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Use of Outcome-Present State Test Model of Clinical Reasoning with Filipino Nursing Students

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by

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Each person whose signature appears below certifies that this dissertation in her opinion is adequate, in scope and quality, as a dissertation for the degree Doctor of Philosophy in Nursing.

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ABBREVIATIONS

AOLIS	Adventist University of the Philippines On-line Information System
AUP	Adventist University of the Philippines
CCTST	California Critical Thinking Skills Test
CINAHL	Cumulative Index to Nursing and Allied Health
CIP	Clinical Integrative Puzzle
CR	Clinical Reasoning
CT	Critical Thinking
DML	Debriefing for Meaningful Learning
fMRI	functional Magnetic Resonance Imaging
GPA	Grade Point Average
HSRT	Health Sciences Reasoning Test
IBM	International Business Machines
IPM	Information Processing Model
IPT	Information Processing Theory
IRB	Institutional Review Board
IRUEPIC	Identify, Relate, Understand, Explain, Predict, Influence, and Control
LLU	Loma Linda University
MANOVA	Multivariate Analysis of Variance
NSW	New South Wales
OPT	Outcome-Present State Test Model

RN	Registered Nurse
SCT	Script Concordance Test
SD	Standard Deviation
SPSS	Statistical Package for the Social Sciences

ABSTRACT OF THE DISSERTATION

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Clinical reasoning is a nursing competency necessary to make the best decision to deliver safe and effective care. A review of the literature shows a link between hazardous errors in patient care and poor clinical reasoning among nurses, and suggests that more study be given to best way to teach clinical reasoning. It is crucial that nurses today and of the future possess the clinical reasoning skills to provide increasingly complex patient care. This study tested the effect of the Outcome-Present State Test (OPT) Model of Clinical Reasoning on Filipino junior nursing students' clinical reasoning scores on the Health Sciences Reasoning Test (HSRT). A two group, pretest and posttest, quasi-experimental design was used with a sample of 58 (28 control and 30 intervention) Filipino Baccalaureate junior nursing students. The intervention group followed the OPT model as an educational program while the control group had the usual nursing process curriculum for their two-week clinical experience in the orthopedic unit. The measure used was the Health Sciences Reasoning Test (HSRT), comprised of five dimensional scores: inferential, analysis, evaluation, induction, and deduction, and a cumulative score. The study findings showed no significant differences between the pretest and posttest within and between groups. The OPT Model of Clinical Reasoning, when used as a two-week intervention program, did not show significant improvement in nursing students' clinical reasoning scores. Moreover, gender, general academic GPA and nursing coursework GPA were not related to the clinical reasoning scores (in the cumulative and across the five dimensions). Though these data may not be generalizable to the whole nursing student population, this study serves as a foundation for additional studies on clinical reasoning education programs. Future studies could benefit by expanding the time period in which the OPT model was used, increasing the sample size, and using measures of clinical reasoning other than the HSRT.

Key words: clinical reasoning, Baccalaureate nursing students, Filipino, OPT Model of Clinical Reasoning, Health Sciences Reasoning Test (HSRT)

CHAPTER ONE

INTRODUCTION TO THE STUDY

The Problem

Clinical reasoning (CR) is a vitally important competency needed for nursing practice in clinical settings (Goudreau, Boyer, & Letourneau, 2014; Victor-Chmill, 2013) and its development must be started early in the nursing program (Elizondo-Omana et al., 2010). Clinical reasoning is a process by which a clinician collects cues and assigns significance to these cues, and processes pertinent information to understand the patient's current and possible future situation. It combines reflective and forward thinking, and is guided by one's knowledge, worldview, values, and beliefs (Kraischsk & Anthony, 2001; Lauri et al., 2001; Scheeffer & Rubenfield, 2000). The process of CR is rarely linear, but is comprised of an ongoing linkage of series of events that can impact outcomes (McCarthy, 2003).

According to neuroscience research, reasoning in general involves a series of complex and sophisticated neural networks of interaction and communication from different parts of the brain, activating the areas involved in cognitive activities. Specifically, these areas integrate and process information, and develop thoughts in response to a specific stimulus, such as a clinical situation (Krawczyk, 2012; Durning et al., 2014; Kiani & Shadlen, 2009).

Clinical reasoning is a thought process nurses use in clinical situations to provide safe, effective patient care (Simmons, 2010; Tanner, 2006; Kautz, Kuiper, Pesut, Knight-Brown, & Daneker, 2005). It is vital for current and future nurses to have well-developed CR skills in order to respond to the complex demands of patient care. Nurses must also be equipped to face the increasingly complex issues they will confront in their practice assignments (American Association of Colleges of Nursing, 2008; Villaneuve & MacDonald, 2006; Task Force on the Essential Patient Safety Competencies for Professional Nursing Care, 2006; Bartels & Bednash, 2005). Problems related to clinical reasoning are observed in the practice of nursing in the clinical area (Fero, Witsberger, Wesmiller, Zullo, & Hoffman, 2009; New South Wales (NSW) Health, 2008; Eisenhauer, Hurley, & Dolan, 2007; del Bueno, 2005; Benner et al., 2002). Benner, Sutphen, Leonard, and Day (2010) noted that nurses increasingly are challenged to make quick decisions based on sound reasoning in acute healthcare situations.

A qualitative study on medication safety involved individual interviews with 20 registered nurses from a university hospital, coming from a variety of different training levels, work tenure, departments, and tertiary care qualifications. In the study, the theme emerged that good clinical reasoning skills were essential to ensure the safe administration of medications to patients (Smeulers, Onderwater, Zwieten, & Vermeulen, 2014).

The relationship between patient mortality and nurses' level of education was explored by Aiken, Clarke, Cheung, and Silber (2003). The authors found lower mortality rates among institutions with higher proportions of more highly educated nurses; conversely, hospitals with lower proportions of more highly educated nurses showed higher rates of patient failure-to-rescue. The authors postulated that higher levels of education among nurses was associated with better clinical reasoning ability.

Newly graduated nurses were observed to have adequate psychomotor skills and good content knowledge (del Bueno, 2005); however, they were found lacking in their ability to use clinical reasoning skills to deliver effective and safe care. In addition, studies recommended that mentoring newly graduated nursing students would help them acquire the level of clinical reasoning skills needed to continue to grow in their professional nursing practice (Standing, 2007; Casey, Fink Krugman, & Propst, 2004).

Nurse educators have a critical role in providing students and graduate nurses with the knowledge needed to make rational decisions, advocate for patient safety, and foster the development of their clinical reasoning skills. Nurse educators must teach and engage students in the clinical reasoning process that is embedded throughout the curriculum. Teaching clinical reasoning remains a challenge for educators in both the classroom and clinical settings. Delany and Golding (2014) posit that clinical reasoning is complex, invisible, and tacit for students; thus, it is not easy to teach or to learn. Generally, clinical instructors identify clinical reasoning skills when the students apply it or manifest it in practice; however, instructors should also consider how best to impart this skill to the next generation (Linn, Khaw, Kildea, & Tonkin, 2012). Since clinical reasoning is a skill that must be learned and developed, it must be taught, and should not be considered as implicit in students' education, a skill that they simply pick up over time, (Linn et al., 2012) or that is acquired through observation of expert nurses in practice (Levett-Jones et al., 2010). Development or acquisition of clinical reasoning may require different approaches or strategies of teaching employed in the learning processes. According to Erickson, Whyte, and Ward (2007), clinical reasoning requires active engagement and a structured educational model that must be deliberately employed. Effective CR training also uses reflection on activities designed to improve performance.

Contemporary teaching and learning styles do not always result in the development of clinical reasoning skills that are needed in nursing professionals (Levett-Jones et al., 2010). There is minimal evidence on what constitutes “best practice” in the teaching of clinical reasoning to students taking up the nursing profession (Bartlett, Rossen, Bland, & Herrick, 2007). Nursing educators devise many strategies to promote and develop clinical reasoning skills, such as making and analyzing care plans, concept mapping, using an integrative curriculum, problem-based learning, articulation, reflective narrative, and interpersonal process recordings. However, nursing educators need a solid foundation of knowledge and tools to support and promote the development of CR among students and practicing nurses alike. It is clear that a conceptual model is needed on how to teach and nurture clinical reasoning skills.

A process called the Outcome-Present State Test (OPT) Model has been developed to offer a framework for teaching clinical reasoning skills to students in nursing programs (Pesut & Herman, 1999). The OPT model requires learners to make use of the whole nursing process and build on previous knowledge in a repetitive manner to hone one’s thinking skills, according to Pesut and Herman (1999). There are a few international studies that utilized and evaluated the OPT model as a teaching strategy in a variety of settings and have shown empirical evidence on the successful development and enhancement of students’ clinical reasoning (Bland et al., 2009; Kuiper, R., Pesut, D., & Kautz, 2009; Bartlett et al., 2008; Kuiper, Keinrich, Matthias, Graham, & Bell-Kotwall, 2008; Kautz et al., 2005; Kuiper, 2002). However, to date no studies that used or evaluated the OPT model as an educational approach or with other educational programs in teaching clinical reasoning have been reported in the Philippines. One research study in the Philippines attempted to measure the clinical reasoning of nursing students but it lacked an intervention component (Tuazon & Valera, 2012).

Purpose and Aims of the Study

Purpose of the Study

The purpose of this study was to evaluate the effect of using the OPT Model of Clinical Reasoning on the development of clinical reasoning skills in Filipino junior nursing students compared to the usual nursing education curriculum. This was accomplished by using a quasi-experimental design with a control and intervention group: the intervention group followed the OPT model of teaching while the control group used the usual nursing process teaching method.

Aims of the Study

To address the purpose, the aims of the study were as follows:

1. To determine the differences between the pretest and posttest scores (five dimensions and overall CR scores) within groups.
2. To determine the differences between the CR gain scores (five dimensions and overall CR scores) between groups.
3. To determine the main effects of gender and group on clinical reasoning scores (five dimensions and overall CR scores) and to determine the interaction effect of both variables (gender and group) on the CR scores (five dimensions and overall).
4. To determine the main effects of overall GPA and group on clinical reasoning scores (five dimensions and overall CR scores) and to determine the interaction effect of both variables (overall GPA and group) on CR scores (five dimensions and overall CR scores).

5. To determine the main effects of professional nursing course GPA and group on clinical reasoning scores (five dimensions and overall CR scores) and to determine the interaction effect of both variables (professional nursing course GPA and group) on CR scores (five dimensions and overall CR scores).

Definition of Major Constructs

The following are the definitions of the constructs used in the study:

Client-in-context—refers to the story of the client, subjective data or information gathered that included history, admitting problem/s, signs and symptoms, diagnostic procedures done and documented through interview and direct observation of the client (Bartlett et al., 2008).

Cue logic—refers to all nursing diagnoses listed that are inferred from the client's information (Bartlett et al., 2008).

Keystone issue—refers to the primary nursing diagnosis that aids in the prioritization of the focus of patient care, that when resolved will lead to the resolution of other cluster diagnosis (Bland, et al., 2009).

Framing—refers to the process of getting the meaning of a client-in-context story and comparing the present status and the outcome to arrive to a picture of the real client condition (Bartlett et al., 2008).

Present state—refers to the present condition of the client made out from the cue logic, keystone issue, and client-in-context story analysis (Bartlett et al., 2008).

Outcome state—refers to the desired health condition as a by-product of the analysis of the present state data (Bartlett et al., 2008).

Decision-making—refers to the process of choosing the nursing interventions and actions to help the client attain the desired outcome (Bartlett et al., 2008).

Testing—is the process of comparing and evaluating the present state and outcome state that should have resulted in the desired outcome condition (Bartlett et al., 2008).

Judgments—refers to the conclusions drawn from comparing the present state and the outcome state (Bartlett et al., 2008).

Clinical Reasoning—refers to a systematic and logical way of thinking by which a nurse collects cues, implements needed processes, and considers the information in order to understand a patient problem, choose the most appropriate course of action and plan to aid the client in achieving a desired outcome state (Bartlett et al., 2008). In this study, the OPT Model of Clinical Reasoning processes and structures was used to promote the enhancement of students' CR and was measured using the Health Sciences Reasoning Test (HSRT) according to five dimensions: inference, analysis, evaluation, inductive, and deductive reasoning.

Outcome-Present State Test Model of Clinical Reasoning—refers to a third generation nursing process model (Pesut & Herman, 1999) promoting clinical reasoning development that provides the structure for linking nursing diagnoses, enhances the organization of patient needs, nursing interventions, and outcomes that surround the keystone issue (Bland et al., 2009). In this study, it was used as a teaching tool (intervention tool) in an attempt to develop or increase nursing students' clinical reasoning skills.

Usual Nursing Process Education—in this study, this refers to the traditional nursing process (assessment, diagnosis, planning, interventions, and evaluation) used by students in the analysis of client's case utilizing the nursing care plan worksheet (see Appendix J), developed by the School of Nursing where the study was conducted. This was taught in the nursing program and learned by the students since their first year in the program.

Significance of the Study

For Nursing Education

Nurse educators have a crucial role in influencing a student's development and application of effective clinical reasoning skills needed for ensuring patient safety and guiding a nursing professional to arrive to rational decisions (Tanner, 2006). Faculty are in strategic roles and positioned to improve teaching and learning through classroom and clinical activities that foster clinical reasoning. Moreover, these nurse educators can be key to students' embrace of clinical reasoning skills as an integral part of their practice (Durning et al., 2013). Nurse educators play an instrumental role in inspiring students to take advantage of every opportunity to experience and learn from the real life circumstances available to them. Thus, it is necessary for nurse educators to use a formal and explicit teaching approach that fosters the development of clinical reasoning skills (Simmons, 2010). Results of this study may serve to help nurse educators improve the learning process, providing information about the OPT Model of Clinical Reasoning which nurse educators can use in both the clinical and classroom settings to facilitate the development of clinical reasoning by nursing students. However, this study did not address how long it would take for clinical reasoning skills to be demonstrated after learning the OPT model.

For Nursing Practice

Progressive development of clinical reasoning skills is critical to all areas of nursing to avoid adverse events or *failure to rescue* situations (Aiken, Clarke, Cheung, & Silber, 2003). Improved clinical reasoning can strengthen nursing practice, evidenced by accurate decision making, quality nursing interventions, reduction of risks, fewer medication errors and improved patient outcomes (Simmons, Lanuza, Fonteyn, Hicks, & Holm, 2003). Findings of this study contribute to nursing literature that emphasizes the importance of clinical reasoning in nursing practice. Teaching and training students to develop of clinical reasoning will contribute to increased student preparedness for professional practice and delivery of safe, quality nursing care to patients (Levett-Jones et al., 2010). Capturing changes in clinical reasoning skills using an educational program will reveal a framework for teaching, learning, and mentoring of students and new graduate nurses as they develop the skills to frame situations and make decisions in the increasingly complex clinical situations seen today.

For Nursing Research

This research study adds to the available yet scarce evidence on the effectiveness of an educational program to promote the development of clinical reasoning in nursing education. Since the research study was the first one that was conducted in nursing education in the Philippines, it may stimulate other researchers to conduct further in-depth and related studies utilizing other groups of students with increased sample size, and in different clinical or classroom settings. Other research may employ additional teaching strategies or educational programs in comparison and/or in combination with the OPT model. Studies on the long term implementation and repetitive application of the

OPT process may provide evidence that such a strategy will contribute to better nursing education. The use of other tools in combination with HSRT to measure clinical reasoning can also be explored.

Overview of the Remaining Chapters

The subsequent parts of the study were organized into four chapters, the bibliography and finally, the appendices.

Chapter 2 undertakes a review of the related literature regarding the OPT model, clinical reasoning, and the various measurements of clinical reasoning.

Chapter 3 describes the research design, assumptions, research aims, research questions, hypotheses, and methodology applied in the study. The same chapter includes a description of the study sample, as well as ethical considerations of participants' rights. Herewith, teaching tools used to gather data, the step-by-step procedures in conducting the study, and the measuring tools used were also included and are discussed in this chapter.

Chapter 4 discusses the analysis of the data and the findings.

Chapter 5 contains the summary of findings, strengths and limitations of the study, implications for theory, nursing education, practice and research, and the conclusion of the study. Last is the list of references and appendices.

CHAPTER TWO

REVIEW OF RELEVANT LITERATURE

Overview of the Chapter

This section presents the review and summary of the related literature of the variables and related concepts included in the study. Educational and health care research over the past 16 years (2000-2016) has become abundant; however, little literature regarding the use of the OPT model has been published. A search was conducted of the databases of Health Resource: Nursing/Academics, Cumulative Index to Nursing, Allied Health (CINAHL), EBSCO, Pubmed, Web of Science, Google Scholar, Hapi, Ovid, Health and Psychosocial Instrument, Psych Books, Psych Articles, and Psych Extra. The search was limited to research written in the English language and articles with the key words: research and measurement with clinical reasoning, clinical reasoning, teaching strategies, and Outcome-Present-State Test (OPT) model. A total of 2,253 papers were retrieved from the online search, of which a majority were decided by the researcher not to be directly related to the purpose of this study. Only full-text articles and research articles that were focused on clinical reasoning concepts and development, research articles that used intervention program/s to develop clinical reasoning and critical thinking, and research articles that used tool/s to measure clinical reasoning and critical thinking were included in the study. The literature search was reduced to 84 articles. Of these, six were nursing research studies on the use of the OPT Model of Clinical Reasoning.

What is Clinical Reasoning?

It the 1980s, the issue of clinical reasoning began to appear in nursing literature, and was referred to as a complex mental process used by healthcare providers to process patient information before making a decision. In a 2010 concept analysis, Simmons described clinical reasoning as a complex process that uses metacognition, cognition, and a discipline that has a specific knowledge to compile and break down patient information, understand its significance, and think carefully of alternative actions. If nursing students were able to collect their data, be involved in decision making, solve patient concerns by providing quality nursing care, and cope with workplace complexities, it is assumed that their nursing education must have employed the teaching of clinical reasoning skills. Knowledge, abilities, and skills rooted in theories and evidence-based practice are requisites for clinical reasoning to be considered efficient and effective (Kautz et al., 2005).

In a 2004 study, Murphy described clinical reasoning as the ability of health practitioners to make judgments about patient needs, and to devise solutions to problems in the setting in which patients are placed. Moreover, Tanner (2006) conceptualizes clinical reasoning as a series of alternative actions nurses select from as they see evidence, in order to arrive at a clinical decision based on recognition and natural intuition.

In the nursing profession, clinical reasoning is the process of making professional judgments, weighing the quality of the data available in order to improve the means by which patients' problems can be solved. The CR process takes this further, by determining if the available data are enough to aid in decision making and to identify diagnosis and management alternatives related to patient care (Banning, 2008). Further, it is also seen as a *recursive* and *multi-dimensional* thought process using decision analysis and experience to compile and analyze patient data and weigh it according to its importance. Therefore, clinical reasoning is an integral part of patient management (Simmons, Lanuza, Fonteyn, Hicks, & Holm, 2003).

It is noted that clinical reasoning has also been considered an important factor in the field of medicine. Some authors believe that it lies at the very core of the medical profession. Clinical reasoning is vital to ensuring correct clinical diagnosis. Different knowledge, evidence, and a significant level of clinical experience are central to the clinical reasoning used by physicians to arrive at a medical diagnosis (Linn et al., 2012). For doctors, clinical reasoning is not only possessing a body of knowledge but gaining a level of experience that makes a distinction between an expert and a novice. According to Audetat et al. (2012), most clinical reasoning errors result from the vulnerability of thinking in complex real-life situations rather than simply a lack of knowledge or incompetence.

In summary, clinical reasoning is the process used by health professionals to solve problems and to make the best decisions for patients in their care.

How is Clinical Reasoning Developed?

Clinical reasoning is a skill that is learned (Higuchi Smith & Donald, 2002; Kamin, O'Sullivan, Deterding, & Younger, 2003). The literature provides several factors or variables that interact and contribute to the formation or development of clinical reasoning. To learn how to work in complex clinical scenarios, nursing students should have a grasp of the steps employed in clinical reasoning, a process which is dependent on gathering patient cues to shape clinical decisions, which in turn can determine outcomes.

The University of New Castle (2009), introduced a clinical reasoning cycle consisting of eight main phases: *look*, *collect, process*, *decide, plan*, *act*, *evaluate and reflect.* Because clinical reasoning is a non-linear, dynamic process, in real-world situations these phases often will merge with no clear-cut distinctions. When a nurse makes a decision, phases may be combined or one phase may move back and forth through the steps so that actions are taken and outcomes are evaluated during the process or its endpoint.

Simmons (2010) further explained that informal and formal thinking schemes combine the analysis of decisions that were made, process the information acquired and consider intuition as well as an evaluation of the patient data value. Facts which at one point may have been considered non-essential could be retrieved later. Nursing actions that could be used are proposed and evaluated for relevance. Clinical reasoning is broad, actively changing, and can be repetitive as data, actions, and alternative actions are checked or discarded at many mental entry points. The cyclical nature of the process gives way for the nurse to revisit and reformulate ideas as more data are gathered, eliminated, or re-evaluated. Having a cognitively pliant quality enables a nurse to assess data, know its relevance, put into practice knowledge and experience, and qualify the value of the information and interventions at the same time (Simmons, 2010).

Higuchi et al. (2002) speak of the clinical reasoning strategy in terms of collection, description, selection, inference, synthesis, and verification. The term "collection" is a group of thinking strategies commonly used and refers to patient data collection. “Description” has to do with nurses describing facts. “Selection” refers to the choice of right information, and making deductions about data is termed “inference.” “Synthesis” refers to combining information and “verification” means testing the accuracy of the information.

Moreover, Levett-Jones et al. (2010) mentioned similar thinking strategies used in the making of a clinical reasoning model. The authors refer to the description of a patient’s situation, collection of patient information, information review, relate information, recall knowledge, give meaning to the information, make deductions, identify irrelevant and relevant data, pair and predict information, combine the information to diagnose a problem, make goals, determine a course of action, and evaluate the whole process.

Clinical reasoning is influenced by one’s critical thinking. For sound clinical reasoning to occur, a nurse should have good critical thinking ability (Benner, Hughes, & Sutphen, 2008; Rochmawati & Wiechula, 2010; University of New Castle, 2009). Critical thinking uses induction, deduction, reflection, analysis, challenging assumptions, and evaluation of data to guide one in making decisions. It is a process where both deductive and inductive cognitive skills are used. Clinical reasoning is a process where experience and knowledge are used in looking at multiple possibilities to reach the desired goals, while weighing the patient’s condition.

Clinical reasoning applicable to the nursing profession is dependent on the progression of critical thinking or cognition and metacognition (Kuiper & Pesut, 2004); both are relevant to the process of clinical reasoning. Metacognition means the thinking process of a higher order that includes the active control of mental processes and its assessment. It considers to what extent cognitive results have been achieved in a learning situation (Banning, 2008). Metacognition is conceptualized as "thinking about thinking," and involves the regulation of metacognitive strategies employed to oversee cognitive activities and desired goals. During this process, nurses will use inductive logic and at the same time assemble and evaluate patient information and supportive evidence before making conclusions about nursing care (Simmons et al., 2003). In the application of clinical reasoning, there is interplay in the individual context, the subject matter, and the understanding of the situation (Banning, 2008). Multiple cognitive processes are employed by nurses in making judgments based on past experience. The same cognitive processes are also used to judge patient condition, application and evaluation of knowledge, generation of hypotheses, reflection, and reasoning of diagnostics.

Declarative and procedural knowledge are two factors on which clinical reasoning relies. The reasoning process is an iterative combination of technical skills and theoretical knowledge, encompassing the *what* and *why* of care, and the *how* to provide care (Benner et al., 2008). Simmons (2010) further adds that whether deductive or inductive reasoning is applied, many variables affect the clinical reasoning of a nurse including life experience, cognitive ability, maturity, and the level of one's skill in the practice. The same author argued that the amount of available data, level of uncertainty, and degree of risk involved may also affect the outcome. Thus, clinical reasoning is domain-specific and dependent on the context that incorporates knowledge unique to the specific practice setting of nursing (Simmons, 2010).

Discipline-specific knowledge, experience, and formal as well as informal thinking strategies in nursing practice must be merged for a nurse to be able to evaluate information in the context of a clinical setting. The use of informal and formal strategies depend on the setting and the experience of the nurse (Simmons, 2010). Clinical reasoning is not a linear process; instead, it is a series of on-going interconnected clinical encounters. Its development and expansion follows a novice-to-expert path over the course of a professional's career (Simmons, 2010).

Inexperienced and experienced nurses apply clinical reasoning processes in decision-making and judgments made in the provision of nursing care to their patients; however, there is a difference between the speed of the thought process between experienced and inexperienced nurses. Simmons et al. (2003) conducted a qualitative descriptive study to describe the cognitive processes of experienced nurses as they assessed the patients in their care. The study was conducted with 15 experienced nurses who were instructed to "think aloud" regarding their findings during these assessments. The study suggested that experienced nurses describe their assessment findings using a conceptual language, relying on their experience to learn, improve, and reason more efficiently. However, it was not determined whether the techniques used resulted in more and better decisions and good patient outcomes. The sample in the study was relatively small and most participants had closer to two years of work experience, which may not have accurately reflected their skill level.

Banning (2008) emphasized that experienced nurses are able to notice immediately important and critical clinical situations. Their use of their own experience, personal knowledge, and intuitive thought formed the basis of their problem-solving. Higgs, Burn, and Jones (2001) also argued that the decisions nurses make about a patient's health care needs can be made easier by combining clinical reasoning and professional judgment, supported by knowledge and intuition, to understand a situation without proof or evidence, based only on their own experience.

Rochmawati and Wiechua (2010) agreed that the individual's capacity to think critically is closely related to clinical reasoning, which can be influenced by external and internal factors. Externally it is influenced by exposure to processes and models of formal education, and internally, by factors affecting brain functions.

A qualitative study was done among 22 medical faculty and 17 interns on how clinical reasoning was developed, maintained, and assessed (Durning et al., 2013). It was observed that the interns focused on activities that promoted the acquisition and use of resources available online, while the faculty gave importance to the development and maintenance of clinical reasoning through the value of teaching and patient care experiences. Both groups struggled with how to measure clinical reasoning. This study revealed a difference in the perceptions of faculty and interns in the maintenance and development of expertise in clinical reasoning. Although the data in this study was from a specific academic institution and specialty, participants' perceptions were assessed, rather than their performance of activities. The results suggest that clinical reasoning can be developed and maintained.

Another qualitative study was conducted by Durning, Artino, Pangaro, Vleuten, and Schuwirth (2011) to explore the influence of contextual factors (patient/doctor setting) on the clinical reasoning of 25 board-certified internists (experts) whose encounters were recorded on videotape. The study results suggested that doctors who were experts in practice identify clinical reasoning based on the situation; in other words, specific patients and different elements of the encounter influenced the doctors' clinical reasoning processes. Moreover, the influence of these factors on the doctors varied, and the existence of more factors may further complicate interactions that could have a significant effect on clinical reasoning. The results of the study may not be generalized to other medical specialties, but the findings contribute to the literature claiming clinical reasoning can be developed.

Likewise, Bartlett, Gay, List, and McKinley (2015) explored the tutor (physicians') perceptions on the impact of teaching clinical reasoning in clinical practice. Eleven tutors with a range of 7-32 years of clinical experience participated. A qualitative process showed that teaching CR had a positive effect on the tutors' own clinical practice. The impact of teaching and learning in a clinical reasoning course was evident in terms of greater use of metacognition, better decision-making, more reflective practice, greater self-awareness, greater job satisfaction and increased confidence. All the tutors were general practitioners, and with the small number of participants, the result may not be generally applicable to clinicians from other specialties.

In nursing, a study conducted by Hunter and Arthur (2016) explored the perceptions of 10 clinical educators with semi-structured interviews on how they taught and evaluated nursing students' clinical reasoning in clinical duty. Content analysis identified four categories: recognition of clinical reasoning, conceptualization of clinical reasoning, facilitation of clinical reasoning, and appraisal of clinical reasoning development. The study found differences in the clinical educators' recognition, conceptualization, and facilitation clinical reasoning among students. Clinical educators conceptualized clinical reasoning as *a process, a reason why, a linking of theory to practice*, and *professional competency*. The authors also reported that clinical reasoning expression by students was influenced by the students' *year of enrollment, timing of placement*, and *clinical environment.* Clinical educators facilitate clinical reasoning in nursing students through the following strategies: *questioning, modeling, seizing the opportunity,* and *making explicit clinical reasoning.* Evaluation of clinical reasoning was categorized as *adequate* and *inadequate,* wherein most of the clinical instructors described the inability to adequately appraise a students' clinical reasoning during clinical duty. Although this study was limited to a small purposive sample of clinical instructors from one undergraduate nursing program, it provided some understanding of how clinical instructors recognize, describe, develop, and appraise clinical reasoning.

Gonzon and Newby's 2013 study evaluated a clinical reasoning model versus nursing process-based skills in the skills laboratory titled, "Identify, Relate, Understand, Explain, Predict, Influence, and Control" (IRUEPIC). The participants were traditional baccalaureate nursing students in the second or third semester of a five-semester program and in the first or second medical-surgical clinical course. Fourteen participants took part in the nursing-process-based skills checklist and 16 in the IRUEPIC reasoning model. Intellectual performance scores in the combined components of the IRUEPIC reasoning model were significantly higher compared to the nursing-process-based skills group. This study confirmed that development of clinical reasoning can be facilitated by nursing instructors.

An action research project on teaching clinical reasoning using a strategy called "making thinking visible" was initiated by Delany and Golding (2014). In this study, 21 experienced allied health educators from three hospitals, attended seven action research sessions. The researchers developed a temporary learning experience based on their own clinical reasoning, implemented it with students, assessed whether it helped students to reason clinically, and then enhanced it so the experience was targeted to develop the reasoning skills of each student. Using content analysis, two overriding themes emerged: the first theme was specifically focused on students' understanding of the reasoning process presented by the participating educators, and the second theme was focused on a heightened awareness of personal teaching styles and approaches to teaching clinical reasoning. This study suggests that the "making thinking visible" approach can be used by educators as a structure to help them to express their expert reasoning for students to access and use.

Clinical reasoning is influenced by one's critical thinking. For sound clinical reasoning to occur, a nurse should have good critical thinking ability (Benner, Hughes, & Sutphen, 2008; Rochmawati & Wiechula, 2010; University of New Castle, 2009). Thus, studies on critical thinking were also cited in this study. Profetto-McGrath (2003) studied the critical thinking of 228 undergraduate baccalaureate nursing students using the California Critical Thinking Skills Test and the California Critical Thinking Disposition Inventory. Results of the study showed increased mean scores in critical thinking in a 3 year period in years 1-4; increases were seen in year 1, year 2, and year 4. However, there was no statistically significant difference among the four groups. Rogal and Young (2008) used a pre-test posttest design to assess the critical thinking of 31 postgraduate nursing students using the California Critical Thinking Skills Test (CCTST). Their study found no significant difference between the pretest and posttest. Moreover, a 2012 study by Pardamean among 98 dental students educated in a problem-based learning method using the HSRT found no significant change in critical thinking skills from the first to the third year of education. In the same line of study, Burns, Mendel, Fisher, Cooper and Fisher (2013), using HSRT as a tool to measure critical thinking, revealed no statistical difference in the critical thinking skills of nurse anesthesia students at two different curricular points, the beginning and end of the first year of didactic instruction.

In clinical practice, nurses are confronted with situations that require them to make decisions. To make informed decisions, nurses need highly developed clinical reasoning skills. Thus, nurse educators must ensure the development and enhancement of clinical reasoning skills among nursing students.

How is Clinical Reasoning Measured?

Clinical reasoning is a highly complex process and assessing it is a challenge. It is inherently difficult to measure internal mental processes since they are not directly observable. However, previous studies revealed that it is possible to assess and measure clinical reasoning.

A quantitative study by Durning et al., (2014) used functional Magnetic Resonance Imaging (fMRI), a neuroimaging method, to assess clinical reasoning by directly observing cognitive processes. The researchers were able to look at the anatomical activation changes taking place during a thinking process. Their study examined the neuroimaging correlates of novices and experts, and how such processes were modulated by sleep and burnout. The authors found that novices appeared to be more susceptible to the effects of burnout (i.e., emotional exhaustion, depersonalization, and a low sense of personal accomplishment) on brain processes associated with cognition. Use of fMRI in assessing clinical reasoning is promising, yet it is not feasible and applicable in most contexts.

The feasibility, reliability, and validity of the Clinical Integrative Puzzle (CIP), a novel assessment method for teaching and assessing clinical reasoning, were described in a 2015 study conducted by Capaldi, Durning, Pangaro, and Ber. The study was a prospective, randomized crossover trial among 36 second-year students taking up a year-long course (The Introduction to Clinical Reasoning) from a single institution. Feasibility was estimated through the time taken to complete a Clinical Integrative Puzzle during a CIP session and through comments from faculty developers. Reliability was addressed by calculating odd-even item reliability (split-half procedure) for grid questions within each CIP. Evidence for content, concurrent, and predictive validity was also measured. The CIP was found to have a high feasibility, acceptable reliability (0.43-0.73) with a mean of 0.60) with a short time for CIP completion. Spearman-Brown correction estimated a reliability of 0.75 with completing two grids (estimated time of 50 minutes) and 0.82 for three grids (estimated time for 75 minutes). Evidence of validity was modest, with the CIP correlated with small group performance ($r = 0.3$, $p < 0.05$). Their data provided good feasibility and reliability evidence for the use of CIP to assess clinical reasoning.

Clinical reasoning has also been measured qualitatively. Anderson, Klang, and Petersson (2012) examined the differences in clinical reasoning among novice pediatric nurses (6 months to 2-3 years of clinical practice), experienced pediatric nurses (more than 3 years of clinical practice) and expert pediatric nurses (specialized education with more than 5 years of clinical practice). The study used six recorded group discussions of a fictitious but realistic pediatric case. Three approaches were identified: an action-oriented approach (novices and experienced), a task-oriented approach (novices and experienced), and hypothesis-oriented approach (expert/specialist). Their study established that the groups with specialist training and long experience reasoned differently than the other groups. Expert nurses were more hypothesis-oriented compared to experienced or novice nurses, who were more task- or action-oriented. No differences were noted between the experienced and novice groups.

The script concordance test (SCT) was a tool used by Ruiz et al., (2010) to measure elements of clinical reasoning among medical students, residents, fellows, and practicing geriatricians. This study revealed that except for the senior fellows, significant differences were found between the mean scores of the geriatricians and all other participants. The Urinary Incontinence script concordance test also demonstrated evidence of construct validity and moderate reliability, discriminating between the non-experienced and the experienced physicians. The SCT in this study was able to assess clinical reasoning skill in geriatric urinary incontinence among medical doctors with different levels of expertise; however by design it measured only one step in clinical reasoning—clinical data interpretation.

A study by Humbert et al., (2011) also confirmed the use of the SCT as a reliable tool to measure clinical reasoning among medical students. In their study, the SCT was able to differentiate fourth-year medical students from pre-clinical medical students, and both cohorts of medical students from expert clinicians across different institutions and geographic areas. Although in this study the SCT was able to measure clinical reasoning, it had limitations in assessing how students addressed interpersonal, psychological, and emotional issues when in clinical settings.

Relevant study on critical thinking was included in this study because according to Benner, Hughes, and Sutphen (2008), clinical reasoning is influenced by one's critical thinking. The 2013 study by Burns et al., used the Health Sciences Reasoning Test (HSRT) to measure quantitatively the critical thinking of two groups of nurse anesthesia students at the beginning and end of the first year of didactic instruction. Using the chi-squared test, the findings revealed no significant difference between the two groups in terms of ethnicity, gender, and number of academic degrees. Further, no significant difference was found between groups in terms of age, years as a registered nurse prior to entering nurse anesthesia training, or years since completion of the last academic degree using the independent t-test. Comparing the overall scores or subscale score in deduction, induction, inference, analysis or evaluation, the result showed no significant difference between groups. Moreover, no significant correlation was found between the number of years as a registered nurse prior to entering nurse anesthesia training and overall HSRT score. The non-significant results may be attributed to the small convenience sample of 47 participants, and no exclusion criteria. Additionally, the study was conducted with two different cohorts rather than one cohort.

Another study using HSRT as a tool to measure clinical reasoning was conducted by Forneris et al., in 2015. The authors used a pretest-posttest research design to determine the effect of a structured debriefing program, the Debriefing for Meaningful Learning (DML), on clinical reasoning scores. Debriefing was done after each of three 20-minute simulation scenarios. The participants were 153 baccalaureate nursing students who were selected through convenience sampling from four different colleges of nursing. The researchers' findings showed that nursing students who participated in the

DML debriefing program scored significantly higher in clinical reasoning than students who had the customary debriefing. In this study, it was noted that an alternate version of the HSRT was used in the posttest, similar but not identical to the HSRT used in the pretest.

The literature offers insight supporting the measurement of clinical reasoning in health disciplines. Many researchers attempted to measure clinical reasoning but a comparison of findings is not possible due to the variety of the instruments used. A number of studies showed a notable increase in clinical reasoning over the length of the program (Rogal & Young, 2008; Drenman, 2010; McMullen & McMullen, 2009). Both quantitative and qualitative assessments were done and revealed as reliable tools to capture an individual's clinical reasoning, yet there were limitations to both. Durning et al. (2013) argued there is no single criterion-standard tool for measuring clinical reasoning skills that is considered valid, feasible, and reliable. Yet it is important that educators assess clinical reasoning to improve our understanding of the clinical reasoning process, to reach a consensus on how clinical reasoning can be best taught, maintained, and advanced.

Currently, the best method or tool in assessing clinical reasoning is under debate. The optimal method to assess or evaluate clinical reasoning remains elusive. While SCT, fMRI, CCTST, and numerous qualitative methods offer ways to describe clinical reasoning, this study used the quantitative HSRT to measure the clinical reasoning skills of respondents. Since the HSRT measures only clinical reasoning and not content knowledge, it is considered appropriate for use in a pretest and posttest design to measure clinical reasoning skills. For this reason, the researcher implemented the study in an attempt to measure the development of clinical reasoning ability in orthopedic nursing after the utilization of OPT Model of Clinical Reasoning in the education program.

Why is Clinical Reasoning Important?

Much of what a student learns about nursing practice later will become obsolete. Clinical reasoning becomes a requisite for nurses to manage the increasing complexity of patient care and to cope with changes in the healthcare system (Raymond & Profetto-McGrath, 2005). Researchers Elbright, Carter Kooken, Moody, and Latif Hassan AL-Ishaq (2006) also stated that a health care professional “needs to manage complexity in the midst of a changing environment” (p. 631). Worldwide, nurses are becoming more responsible, autonomous, and accountable for patient care. Short hospital stays, advances in technology, and rapidly increasing patient acuity require nurses to think quickly, make good judgment calls, and initiate action to resolve problems. Students must learn process-oriented methodologies that foster lifelong learning in order to function successfully in the evolving and dynamic healthcare environment. Clinical reasoning, which focuses on the nurse’s use of thinking strategies, is the precursor to decision making and informed action. Decision-making under conditions of risk, uncertainty, and complexity have become the standard of professional practice (Elbright et al., 2006).

A growing number of patients in hospitals diagnosed with complex health problems are more likely to develop complications that seriously affect their health outcomes (Bright, Walker, & Bion, 2004). Although there are often warning signs before serious adverse events such as cardiac arrest, unplanned admission to intensive care, and unexpected death (Buist, Bernard, Nguyen, Moore, & Anderson, 2004), it is troubling to note evidence that “at risk” patients are not always identified. Even when warning signs are noted, patients may not receive interventions in a timely manner (Thompson et al., 2008).

According to an Australian report, critical care incidents often involved nurses with poor clinical reasoning (NSW Health, 2006). Similarly, it has been observed that nursing students in the Philippines were struggling with clinical reasoning (Tuazon & Valera, 2012). The increasing acuity of patients, the ever-changing healthcare system and environment, and advances in technology all require clinical reasoning in order to deliver effective care and prevent adverse patient outcomes. Therefore, deliberate teaching and monitoring the development of nurses' clinical reasoning in the undergraduate program is essential.

Outcome-Present State Test Model of Clinical Reasoning

The OPT model (Figure I) of reflective clinical reasoning is a third generation nursing process model that highlights outcome specification, reflection, and tests of judgment within the context of individual patient stories (Kautz et al., 2005). OPT provides a structure for clinical reasoning and provides a way for students to capture and put meaning to client information while concurrently considering connections among diagnoses, interventions, and outcomes, paying attention to evidence used to make judgments (Pesut, 2004; Pesut & Herman, 1999). The OPT Model enables consideration of many nursing care problems, and at the same time also shows how nursing care problems interact and affect one another. Such systems thinking helps discern which problem has the most influence and which is most relevant for nursing care planning.

The components of the OPT Model include the client-in-context story, cue logic, keystone issue, framing, present and outcome states, testing, decision making, and judgments. Using a sample case study (see Appendix A), a sample OPT worksheet (see Appendix H) reflected how each component was identified and formulated.

Bartlett et al. (2008) explained in detail the components of the OPT model. *Client-in-context* is the client's story or information, which includes the admitting problem, history, signs and symptoms, and laboratory/diagnostic data. The *keystone issue* is defined as a "central supporting element of the client's story that guides reasoning and care planning based on an analysis and synthesis of diagnostic possibilities" (Pesut & Herman, 1999, p. 238). *Cue logic* includes the list of all other nursing diagnoses taken from the patient's information. *Framing* is the process of getting at the meaning of a client-in-context story. The framing step is unique to the OPT model, and constitutes the difference between the OPT model and the nursing process. Framing of the situation also allows for comparison of the present and outcome states, helping students see the big picture when providing care. The *present state* refers to the client's present condition taken from the cue logic, keystone issue, and client-in-context story. Conversely, *outcome state* is the desired health condition taken from present state data, and is the optimal health states, formulated from the present health states. Clinical reasoning and appropriate selection of interventions when applied will help the client reach a desired state (Pesut & Herman, 1999).

Testing is the process of comparing and evaluating the present condition and outcome state based on the desired outcome condition; for example, tests are used to ensure that actions taken are appropriate. Testing is also used to check whether the major issue was identified correctly, and if the patient is moving toward the desired health outcome. To select nursing interventions, *decision making* is used to help the client attain his desired health outcome. Drawn conclusions are termed *judgments* and used to compare the present condition to the desired outcome condition. These drawn conclusions lead to decisions made in the clinical setting, coupled with reframing and reflection, or a departure from a task out of reasoning (Pesut & Herman, 1999).

The OPT model (Figure 1) requires the identification of the "keystone issue," the main nursing diagnosis and the focus of patient care. Finding solutions to the primary nursing issue will resolve all other related problems (Bland et al., 2009). In order to identify a "keystone issue" in the OPT model, a clinical reasoning web tool is applied.

The picture representation of the relationships that function in the midst of diagnostic hypothesis taken from synthesis thinking best describes clinical web reasoning (Figure 7); which results in a union of identified major issues that need attention (Pesut & Herman, 1999). Bartlett et al. (2008) added that the web promotes clinical reasoning by analyzing the client's story to list the needs and issues the patient reveals. The continuous use of clinical reasoning reveals the relationships of these needs and issues that connect one to the other. The nursing diagnosis with the most arrows pointed toward and away from it is considered the client's keystone issue (Bartlett et al., 2008). Using the sample case study (see Appendix A), a sample "clinical reasoning web" worksheet (see Appendix I) reflects how the keystone issue was identified and formulated.

Bartlett et al. (2008) stated that the OPT model needs students to use all elements of the nursing process, continually building on previous knowledge in a repetitive fashion to develop their nursing thinking skills. The OPT model, considered a simultaneous information-processing model of clinical reasoning, is used as a teaching strategy by a number of professionals. When teaching strategies include clinical reasoning web innovation, dependency on the story related by the patient shows the balance and reinforcement of connections between nursing diagnoses, and the use of a structured OPT model worksheet will help to crystallize reflections and thinking on issues of care for the client (Kautz, Kuiper, Pesut, & Williams, 2006). Pesut and Herman (1999) declare the most significant difference between the care planning methods, OPT model, and other clinical reasoning methods is that the OPT model highlights the framing of the patient's story; this significantly influences the planning and interventions chosen for the client. Framing the patient's story puts the outcomes into focus and helps to move the client from his present health status to the desired health status (Bartlett et al., 2008).

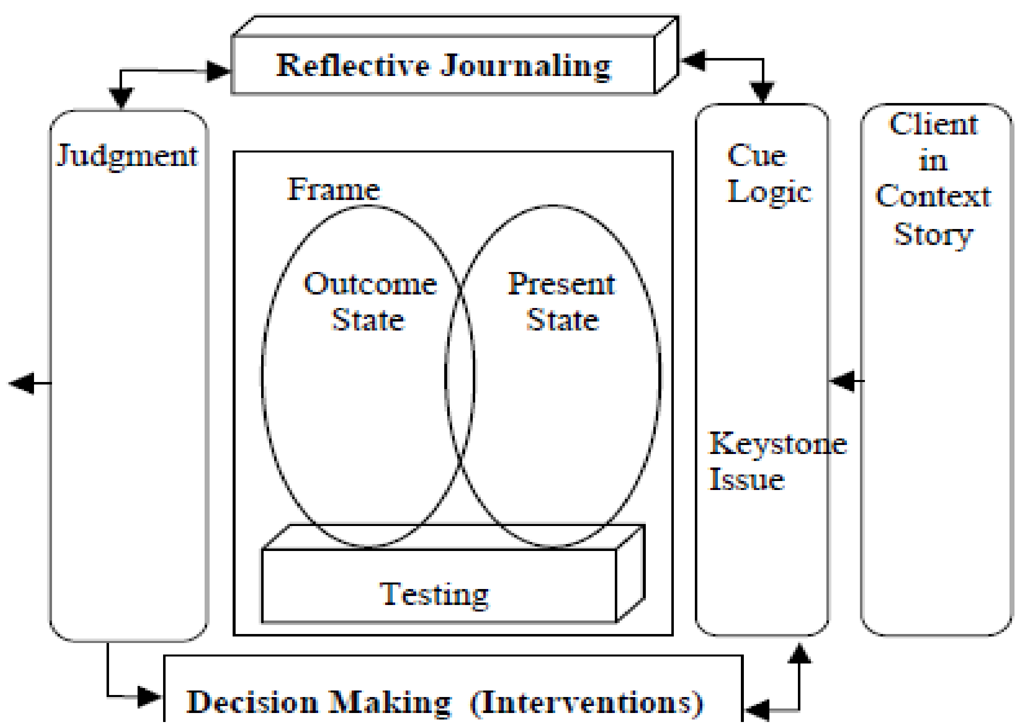

Figure 1. *Outcome Present State Test (OPT) Model; Pesut & Herman, 1999* (From the study of Kautz, D, Kuiper, R., Pesut, D., Knight-Brown, & Daneker, 2005.
(Used with permission)

Outcome Present-State Test Model and Clinical Reasoning Related Studies

A previous study related to the use of the OPT model with senior baccalaureate nursing students was done in the setting of a 7-week-long advanced medical/surgical nursing course. After 2 weeks of OPT practice, nursing students had mastered the model, and after assessment were able to quickly identify the priority nursing diagnoses, interventions, and outcomes for analysis and interpretation (Kuiper as cited in Kautz et al., 2005).

Kautz et al. (2005) also conducted a study involving 23 junior baccalaureate nursing students to evaluate the development of clinical reasoning skills through the use and evaluation of teaching-learning strategies associated with the OPT model. The OPT model was used to structure learning with nursing students enrolled in a medical-surgical course, during 10 weeks of medical-surgical clinical exposure in acute care telemetry units. The sample was selected using purposive sampling design. The findings revealed no significant difference between any of the variables (age, previous years of clinical work experience, hours of work during the current semester, and course load) on any given week. The entire model was completed by the students from the first week and remained unchanged during the 10 week period. Though students learned all sections of the OPT model within the first week, using cross-tabs with a Chi test the weeks were grouped into early (weeks 1-3), mid (weeks 4-6), and late (weeks 7-10). A difference was seen in the students' ability to frame the situation over time (Pearson Chi-Square 6.84, $p = 0.033$), as well as a difference in students' ability to make decisions about appropriate interventions over time (Pearson Chi-square 9.882, $p = 0.007$). Based on data analysis, the students showed improvement in learning associated with the OPT model.

Since there were no developed criteria or metrics for use in evaluating the OPT model tools, the researcher decided to rate each component of the OPT model worksheet as either "evident" with a score of "1," or "not evident," with a score of 0. Using such a rating tool may have caused individual differences and variations among faculty raters, however it is important to use a reliable and valid scale to better evaluate the differences over time and differences between students, and increase validity and reliability of faculty ratings of students' work. The use of student course work was the only measure of clinical reasoning in this study which limited internal validity of the findings.

Although these studies had some limitations, it was established that students can be proficient in using the OPT model process, tool, and structure in 1-2 weeks, providing a basis for the 2-week implementation of the OPT model in the current study.

Some studies indicated a longer implementation period of the OPT. A study done by Bartlett et al. (2008) evaluated how quickly students from an undergraduate level psychiatric-mental health nursing course became highly skilled at using the OPT model. Students in this study made use of the clinical reasoning web and the OPT model worksheets on case studies before and after their clinical experiences in a psychiatric-mental health nursing course. The researchers' findings showed that 29 out of 43 student participants reached the criterion score (a score greater than 65 on 3 or more case studies using the OPT model, completed over 4 weeks), using the OPT model rating tool developed by Kautz and Kuiper (2006). The study also revealed a significant difference (t = -5.439, df = 42, $p < 0.001$) between the pretest (score in the OPT model using a case study before the clinical experience) and the post-test scores (score in the OPT model after the clinical experience using the same case study). This result indicated the students' ability to complete the model improved over time. The measuring tool was designed by the researchers so that completing the OPT model worksheets and clinical reasoning webs measured the students cognitive qualities. No additional tool was used to quantify the students' clinical reasoning abilities in order to determine whether completing the OPT model worksheet and clinical reasoning web was a valid method of quantifying clinical reasoning skills.

Another study done by Bland et al. (2009) used the OPT model as a teaching strategy in an undergraduate psychiatric nursing course in one semester. The study used a one-group pretest, posttest design and revealed that 56% (n =23) of the 43 participants were able to identify the major issue at both pretest and posttest. Thirty-seven percent (n = 16) showed improvement over the two time points, and 9 percent (n = 4) showed a decline in performance. The McNemar test, a test of significance, was used to uncover the point between the pretest and posttest at which students were able to identify the correct keystone nursing diagnosis ($p < .05$). The keystone issue at the time of the posttest was accurately identified by more students. An analysis of the differences in the frames also showed students' growth from the beginning to the end of the course. Seven students who were not able to write and compare the present and outcome states at the beginning of the course all were able to write frames by the end of the course. Since most students improved in their ability to accurately identify the keystone issue at the time of the posttest and framed the situation (compared the present and the outcome states), the researchers believed that the OPT model can be useful to students in assessing, organizing, and evaluating patient data to provide appropriate care. Limitations of this study included a convenience sampling design and a lack of a comparison group; in addition, the OPT model was not used in conjunction with other teaching strategies to promote students' clinical reasoning. The authors recommend the comparison of the standard care plan with the OPT model used in the clinical portion of other nursing courses to allow further insight into students' thinking processes.

A group of researchers (Kuiper et al., 2008) conducted a study on clinical reasoning using a high fidelity patient simulation in comparison with authentic clinical experiences. The study also sought to determine if the OPT model could be used as a debriefing method after a patient simulation. The study involved 44 undergraduate senior baccalaureate nursing students in an adult health medical/surgical course. The students were given an assignment to complete five to six OPT worksheets after authentic clinical experiences. At various points in time throughout the semester, the students spent four hours completing a patient simulation scenario, debriefing with an instructor, and completing another OPT model worksheet related to the scenario. The simulation rotation and related OPT model worksheets were completed at any time during the semester regardless of the number of OPT model worksheets completed for authentic clinical experiences. A comparison of the two groups revealed no significant difference between the mean scores (t = -1.321, p = .194), and a paired sample t-test comparing the students' scores for each section of the model revealed no significant difference between clinical experiences and high fidelity patient simulation (t = -.680, p = .504). Because OPT model worksheet scores for patient simulations were comparable to the authentic clinical experiences, the researchers speculated that the inherent clinical reasoning is occurring during the debriefing following simulation as supported by these activities.

The limitations of the study were a small sample size, the use of purposive sampling, and a descriptive study design.

Previous studies revealed that using the OPT model as a teaching tool in the clinical setting and in a simulation promoted the development of students' clinical reasoning skills. However, no reports were published specifically evaluating the OPT model using other measures of clinical reasoning such as the HSRT or comparing it with other teaching strategies.

The Theoretical Framework/Relevant Theories

The framework of this study was based on the following learning theories: cognitive, self-efficacy, constructivism, information processing and the educational framework (adult learning). The primary focus of learning theories is precisely how people learn; an educational framework, however, focuses on identifying methods that are most likely to achieve the desired learning outcomes (Billings & Halstead, 2012). These theories are essential in the development of clinical reasoning, fostering students' ability to solve problems and exercise sound judgment in clinical settings.

Self-efficacy Learning Theory

Self-efficacy is defined by Albert Bandura as a person's belief in their ability to plan and perform actions that will produce the desired results (Bandura, 1997). An individual may have an inherent degree of skill or talent, but may not see themselves as able to use these skills consistently in a variety of situations. A variety of factors affect an individual's belief about their self-efficacy. Among the factors that affects an individual's self-efficacy include: the amount of effort they put forth, their perseverance and resilience in the face of adversity, their decision-making, their thought patterns (selfaiding or self-hindering) and the levels of depression and stress they experience as they respond to difficulties (Bandura, 1997).

Self-efficacy is considered an important aspect of human performance, attitudinal learning, problem solving, and motivation. Self-efficacy can also be an important stimulus for and byproduct of incidental learning, as opposed to formal or intentional learning. In personal context and workplace settings, Petrovich (2004) considered intentional learning as a dominant type of adult learning.

According to Bandura (1997) self-efficacy sprung from four types of experiences: *vicarious experiences*, in which one observes through valued role models; *enactive mastery,* in which a person successfully practices a skill or behavior; *verbal persuasion*, wherein an individual receives encouragement and support from significant others; and *physiological states,* in which one learns to keep emotions and physiological arousal at a self-supporting, versus harmful, level.

The experience of overcoming obstacles through persistent effort defines enactive mastery (Bandura, 1997), exceeding the impact of modeling or cognitive simulation tutorial instruction. Mastery experience is personally based; that is, self-efficacy comes from the meaning the learner gave to the experience. If an individual sees many of their experiences as failures, which can happen early in the learning process, it undermines self-efficacy. An individual's functioning and self-confidence are improved if the trainer simplifies complex skills and behaviors into easily mastered subskills and arranges them in a hierarchical order. Self-confidence and functioning are enhanced when learners are allowed to acquire skills at their own pace (Bandura, 1997).

When a learner credits failures or difficulties in performance to lack of effort or unfavorable circumstances, self-efficacy is enhanced. In contrast, when learners view poor performance as arising from low ability, self-efficacy is undermined (Bandura, 1997). The ability to competently perform a task takes time and influences the person's interpretation of the mastery experience. If self-efficacy improves, one's developmental progress will continue, even in the face of occasional setbacks. Conversely, when performance levels off or declines after a period of success, the individual might think that further improvement is impossible and stop making an effort. Practicing skills in a repetitive manner has been found to be important in the transfer of knowledge (Bandura, 1997). The theory of self-efficacy should be considered by nurse educators in the teaching of clinical reasoning skills.

According to Bandura (1997) modeling occurs when an individual watches, reads about, or hears about an experience rather than doing it themselves. It is a primary source of information for the learner, especially in areas where competence is complex and difficult to measure. Role models who are relatable or similar to the learner are more persuasive, and when the learner observes a role model performing the skill or task successfully, it typically increases the learner's sense of self-efficacy about performing the task themselves. Conversely, when the learner sees a role model fail at a task, the learner's self-efficacy can be negatively affected. Learners seek inspirational models, persons they look up to and who can help them learn what they want to become. Role models are seen as expert examples of effective coping or teachers of skill and strategy. Learners learn from advanced learners, hoping to become respected teachers and supervisors who manifest the skills and knowledge they teach. Visualizing one's self as mastering skills is an example of self-modeling on the cognitive level, which leads to improved performance (Bandura, 1997).

The OPT model in nursing education was based on Bandura's theory of self-efficacy (Bandura, 1997), which assumes that a nursing student's ability to solve problems improves if their actions bring about the desired outcome to the patients in their care. Clinical reasoning is improved as nursing students understand how diagnoses, interventions, and assessments of the care they provided positively affects their patient's condition. The OPT model uses activities which focus on outcomes and encourages non-linear thinking to achieve the desired outcome (Bartlett, Rossen, & Benfield, 2008).

Bandura (1997) claimed that self-efficacy is enhanced by self-monitoring; that is, an individual shows confidence and proficiency in a task when he/she recalls successful instances of performing the task and attempts to repeat them. In this study, the use of the OPT model as the intervention program will require participants to self-monitor by reflecting on client care issues.

Information Processing Theory

In the healthcare professions, processing of information is the leading theoretical framework of clinical reasoning. Information Processing Theory (IPT), developed by Newell and Simon (1972), was used to explain the process of problem-solving. Billings and Halstead (2012) explained that IPT depicts how information is tracked, the sequence of events of mental processing, and the outcome of the process. The IPT is a descriptive theory of decision-making in which an individual organizes the information, and uses experience, knowledge, and cognitive processes to find solutions to a problem. IPT describes decision-making as a way of gathering data, considering alternatives, and then making a final judgment (Newell & Simon, 1972). The theory is descriptive and centers on how decisions *are* made rather than focusing on how decisions *ought* to be made. IPT presents decision-making as a cyclical, multidimensional, and recursive process that subtracts or easily adds pieces of data for consideration (Simmons, 2010).

IPT is composed of three main memory components: *sensory, working, and long-term memory*. *Working memory* and *sensory memory* enable people to manage limited amounts of incoming data during initial processing. On the other hand, *long-term memory* serves as a permanent storage for knowledge. IPT is used as a device for successful learning because it affords well-articulated ways for describing the main cognitive processes and structure in the cycle of learning (Schraw & McCrudden, 2012).

Sensory memory sifts incoming stimuli, only processing the most relevant stimuli at the present time. An individual's processing of information in the sensory memory happens so fast that they may not realize it or have conscious control over the information that presents itself. In this way, information that is relevant and familiar is processed automatically via sensory memory and then forwarded to the working memory buffer. The highly relevant information may receive some degree of controlled, conscious processing if it is crucial to the task at hand; however, controlled processing in sensory memory would further reduce the limited amount of information that can be processed at any given moment (Schraw & McCrudden, 2012).

The working memory is where essential mental processing occurs, giving information meaning and linking it to other information. Baddeley (2001) developed the three-component model of working memory: *the executive control system, the articulatory loop,* and *the visual-spatial sketch pad*. The role of the executive control system is to select information as it comes in, determining how to process data, assign meaning through inferences and organization, then subsequently transfer the processed data to long-term memory. Another option is to delete the data permanently from the system.

Long-term memory is not limited by capacity or attention span; its function is to provide an unlimited depository of knowledge and facts for long periods. Information in long-term memory is stored in a complex system of nodes interrelated through learning (Billings & Halstead, 2012).

The Information Processing Model (IPM) (Figure 2) is a conceptual model that shows the constraints and functions of human memory, providing an excellent framework for understanding the principles of effective learning. The IPM has four important implications for improving instruction and learning: The first implication is in both working and sensory memory, where stores are extremely limited. Effective learners with limited capacity selectively focus their attention on important information and engage in automated processing as possible. Automaticity makes available limited processing resources that can be used to engage in labor intensive self- regulation (Zimmerman, 2000).

The second implication is that previous relevant knowledge facilitates encoding and retrieval processes. Highly effective learners are known to store a great deal of knowledge that is organized and confined in a particular domain. They also have critical thinking scripts and general problem-solving abilities which enable them to perform well across different domains. This knowledge guides the processing of information in working and sensory memory by providing retrieval structures in memory that are easily accessed. It serves as the basis for the development of expertise (Alexander, 2003; Ericsson, 2003). This explains why helping students use their previous knowledge when learning new information promotes further learning.

A third implication states that automated information processing enhances mental efficiency because it reduces the demands for information processing. There are two reasons why automaticity is considered an important aspect of effective learning: first, automacity selectively allocates limited resources to relevant information needed for the task at hand; second, automacity allows limited resources to be used for other activities and connects new information with existing information stored in memory (Schraw & McCrudden, 2012).

A fourth implication declares that strategies in learning improve the processing of information because learners' efficiency and information is processed at a deeper level (Pressley & Harris, 2006). All effective learners draw from a repertoire of learning strategies in a flexible manner. While some learning strategies can be automatic, others require metacognitive control and controlled processing that puts high demands on limited mental resources.

Information Processing Theory was applicable to this study, proving useful to students as they used the OPT model to gather and organize patient data, consider available options, and arrive at the best, safest decision for the patient.

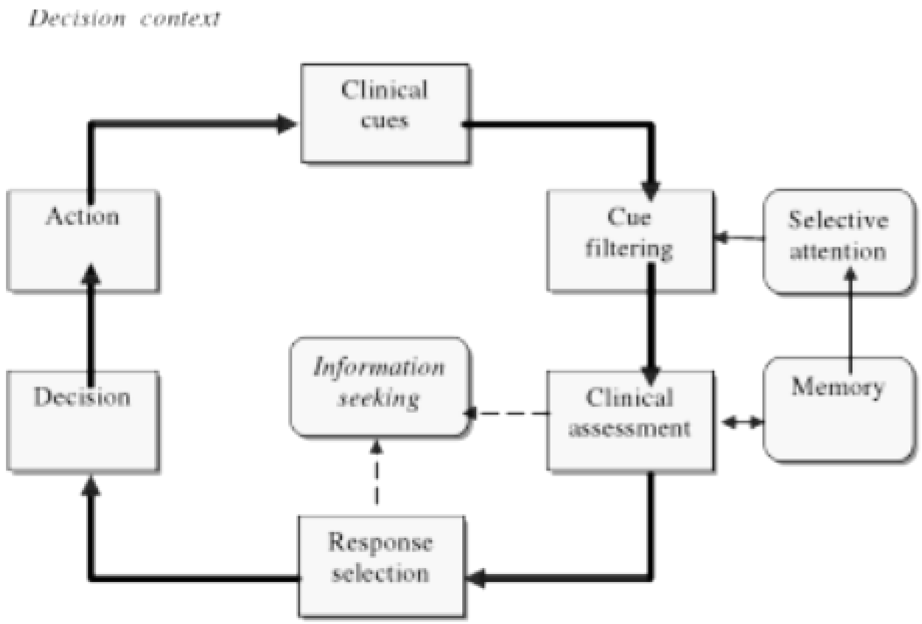

Figure 2. Information-Processing Model of Decision-making (Modified from Wickens & Hollands, 1999).

Constructivism

The learning philosophy of constructivism is based on the work of Jean Piaget and Lev Vygotsky. This philosophy is rooted on the premise that, when a person reflects on his experiences, he constructs his own understanding of the world. Every person generates his own "mental models," and "rules" to make sense of experiences (Billings & Halstead, 2012). Therefore, constructivists believe that learning is simply the process of adjusting mental structures to accommodate new experiences.

The theory of constructivism states that learning has basic operating processes—accommodation, assimilation, and construction—that when applied makes learning a developmental process.

Constructivists' believe that as people build their own knowledge of the world, formed by their experiences and reflections, they must reconcile new encounters with previous experiences and ideas. Through the process of reflection, one potentially changes their beliefs or may opt to discard the new information as irrelevant. Billings and Halstead (2012) concludes that in constructivism theory, a person is an active creator of his own knowledge.

In this study, the student was given opportunities to assimilate and process information, make judgments based on previous situations encountered in the clinical area, and reflect on those experiences to create new ways of thinking and knowledge.

Cognitive Learning Theory

According to Shuell and Wittrock, as cited in Billings and Halstead (2012), cognitive learning is a cumulative, active, and constructive process that is goal oriented and dependent on the mental activities of the learner. Learning is an internal event in which the representation of existing internal knowledge is modified. Learning is processing information: it is experiential and formed by a person's experience of consequences (Billings & Halstead, 2012).

Cognitive theory is focused on mental processes that include perceptions, thinking, memory, and representation of knowledge, with an emphasis on the acquisition of knowledge and understanding, not merely learning to perform a task but acquiring a new behavior (Billings & Halstead, 2012). Moreover, the authors claim that cognitive development occurs in predictable, sequential stages in which aspects of earlier stages are expanded and accessed. Cognitive learning begins with a narrow, absolute, right-versus-wrong view of the world. In cognitive learning, values and knowledge are perceived as relative and contextual, finally reaching a stage in which the individual makes a commitment to establish a personal identity in a pluralistic world.

In cognitive learning theory, students will discover meaning by using memories, information processing strategies, attention, and motivational mechanisms to understand and organize situations. Thus, cognitive learning theory is foundational to the development of clinical reasoning through the utilization of the OPT model.

Adult Learning Theory

Adult learners are described by Knowles as cited in Knowles, Holton, and Swanson (2005) as individuals who do best when asked to use their experience and apply new knowledge to solve real life situations. Adult learners' motivation is more pragmatic compared to younger learners. Mitchell and Courtney (2005) and Petersson (2005) explained that adults learn if information is relevant and valued as personally important. Basic assumptions about adult learners are: they are self-directed; experiences serve as rich resources for learning; readiness to learn develops from life tasks and problems; orientation to learning is task- or problem-centered; and motivation is internal and arises from their curiosity (Knowles et al., 2005).

Billings and Halstead (2012) argued that adults make a commitment to learning when the learning goals are perceived as useful, realistic, and relevant to their personal and professional needs. The learning behaviors of adults are formed by past experiences and maturity, which provide adults with the discernment to see the relationships between past and new experiences.

The premises of adult learning theory served as foundational to the learning process of the respondents in this study not only because they are adults but because they have previous clinical experiences during their early years and exposure in the nursing program that provides ideas on how to solve the clinical problems presented to them in this study. The realization that learning clinical reasoning is useful, relevant, and critical to their chosen profession will further increase students' motivation to learn.

Conceptual Diagram

Figure 3 is a conceptual diagram developed by the researcher incorporating the structures of OPT, concepts of thinking strategies and learning theories, which presents the relationship between the OPT model and clinical reasoning. The bold arrow represents the direct influence of the OPT model structure towards the development of clinical reasoning, and that clinical reasoning will result in the desired student outcomes (increased HSRT, improved decision-making skills, enhanced problem-solving skills, safe/appropriate nursing action, and good patient outcomes). Clinical reasoning *(induction, deduction, analysis, inference,* and *evaluation)* is at the very core of the diagram, significantly influenced by the thinking strategies and embraced by the application of nursing theories. As presented by the two pointed arrows, the thinking strategies (*look, collect, process, interpret, plan, act, evaluate,* and *reflect*) will influence the thinking process and facilitate the development of clinical reasoning. Likewise, an individual's clinical reasoning ability will influence thinking strategies. Each phase is a separate element, with no clear boundaries between them. A person may follow the phases of the clinical reasoning cycle or thinking strategies, or may combine one or more phases or move back and forth between them before reaching a decision, as represented by the arrows in clockwise and counter-clockwise directions. The learning theories (*cognitive, constructivism, self-efficacy, IPT,* and *adult learning)* form the foundation of clinical reasoning development and hold it in place.

The blending and intertwining of these concepts, processes, structures, and strategies, and the recursive nature of cognitive learning, which allows the back and forth movement between them, will impact one's clinical reasoning and result in the desired outcome: nursing competence.

In this study, the students applied the OPT model structures and processes in analyzing patient data. In the process of analyzing a patient's case, the researcher assumed that the students used the different thinking strategies anchored on learning theories to stimulate their clinical reasoning to arrive at a decision appropriate to the patient's clinical situation. The researcher hypothesized that the repetitive use of these processes and the influence of learning theories would promote or enhance the development of clinical reasoning skills among nursing students, as evidenced by increased HSRT scores.

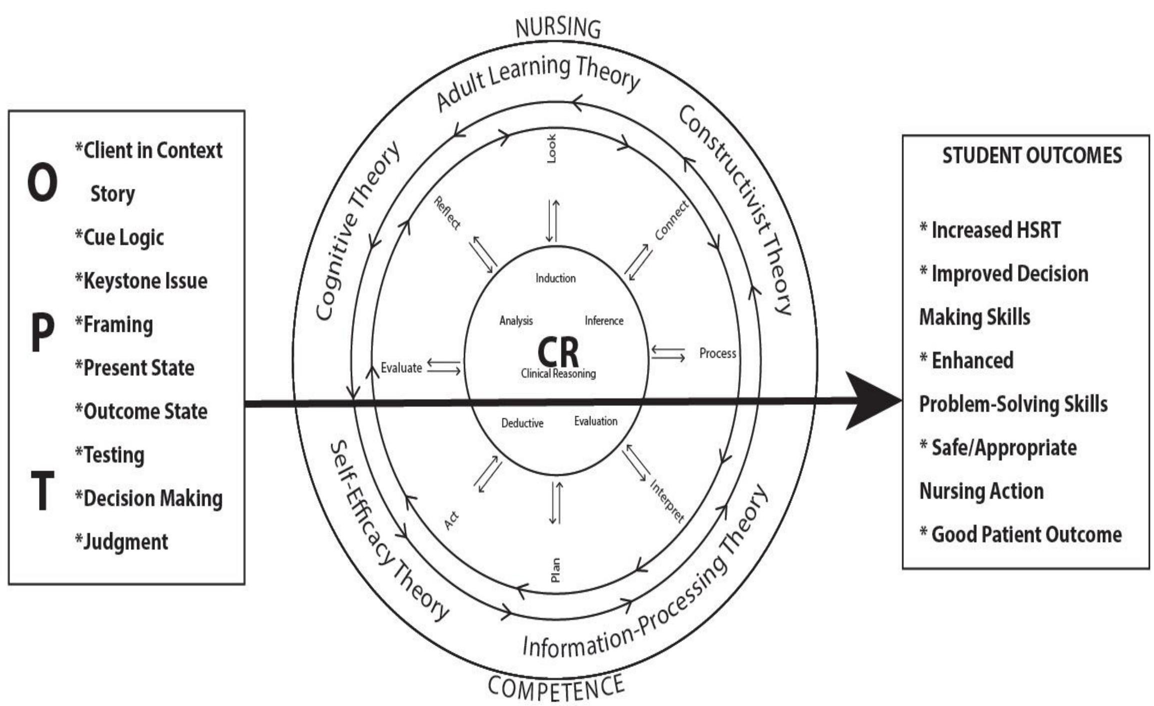

Figure 3. Diagram showing the relationship of OPT Model towards clinical reasoning development to the desired student outcomes as influenced by thinking strategies anchored on learning theories.

CHAPTER THREE

METHODS

This chapter describes the research design, philosophical assumptions, research questions, hypotheses, sample population, sampling design, protection of human subjects, data gathering procedure, and the tools used to measure the variables. It also includes management of data and the statistical treatment used for data analysis.

Research Design

The study used a quasi-experimental comparison group pretest/posttest design. Both the control and intervention groups were given a pretest and posttest using a standardized tool, the Health Sciences Reasoning Test (HSRT). The control group had the usual nursing process education, while the intervention group received the OPT process incorporated into teaching instruction. Differences between groups were evaluated.

The pretest was used to determine whether there were initial group differences (Shadish, Cook, & Campbell, 2002). The OPT model was utilized to teach clinical reasoning to the intervention group. According to Polit and Beck (2008), experimental studies are designed to test causal relationships and to test whether the intervention caused changes in or affected the dependent variable. The joint use of a pretest and a comparison group makes it easier to examine certain threats to validity (Shadish et al., 2002).

Assumptions

This study was based on a post-positivist philosophical assumption. Post-positivists support the idea of *cause and effect*, and believe there are some reasonable relationships among social phenomena that can be imperfectly known (Teddie & Tashakkori, 2009). The major assumption of this study is that the OPT model is a better tool to teach clinical reasoning to nursing students.

Another assumption in this study is that the HSRT, a tool used in the study, is valid and reliable, meaning it is sensitive enough to measure changes in clinical reasoning in a 5 week period between the pretest and the posttest. The HSRT Manual (Insight Assessment, 2015) claims that the HSRT can be used for all health science educational settings and training programs. It is also assumed that changes in clinical reasoning can occur over a short period and can be measured. It is further postulated that clinical reasoning skills do not deteriorate over a short period (Insight Assessment, 2015). The HSRT Manual claims that test/retest reliability is very high. This means if there is no intervening factor after the pretest, test-takers will likely score at within one point with the same test when retested 2 weeks later (Insight assessment, 2015).

Purpose and Aims of the Study

Purpose of the Study

The purpose of this study was to evaluate the effect of using the OPT Model of Clinical Reasoning on the development of clinical reasoning skills in Filipino junior nursing students compared to the usual nursing education curriculum. This was accomplished by using a quasi-experimental design with a control and intervention group: the intervention group followed the OPT model of teaching while the control group used the usual nursing process teaching method.

Aims of the Study

To address the purpose, the aims of the study were as follows:

1. To determine the difference between the pretest and posttest scores (five dimensions and overall CR scores) within groups.
2. To determine the difference in the CR gain scores (five dimensions and overall CR scores) between groups.
3. To determine the main effects of gender and group on the clinical reasoning scores (five dimensions and overall CR scores) and to determine the interaction effect of both variables (gender and group) on the CR scores (five dimensions and overall).
4. To determine the main effects of overall GPA and group on the clinical reasoning scores (five dimensions and overall CR scores) and to determine the interaction effect of both variables (overall GPA and group) on the CR scores (five dimensions and overall CR scores).
5. To determine the main effects of professional nursing course GPA and group on the clinical reasoning scores (five dimensions and overall CR scores) and to determine the interaction effect of both variables (professional nursing course GPA and group) on the CR scores (five dimensions and overall CR scores).

Research Question

The research questions to address the aims were as follows:

1. What is the difference between the pretest and posttest scores (five dimensions and overall CR scores) within groups?
2. What is the difference in the gain scores (five dimensions and overall CR scores) between groups?

3. Do clinical reasoning scores in five dimensions and overall differ by gender and group; and do gender and group interact in the effect on clinical reasoning scores (five dimensions and overall CR scores)?
4. Do clinical reasoning scores in five dimensions and overall differ by overall GPA and group; and do overall GPA and group interact in the effect on clinical reasoning scores (5 dimensions and overall CR scores)?
5. Do clinical reasoning scores in five dimensions and overall differ by professional nursing course GPA and group; and do professional nursing course GPA and group interact in the effect on clinical reasoning scores (five dimensions and overall CR scores)?

Research Hypotheses

The following were the hypotheses of the study:

1. There will be no significant difference between the pretest and posttest scores (five dimensions and overall CR) within groups.
2. There will be no significant difference in the gain scores (five dimensions and overall CR scores) between groups.
3. CR scores (five dimensions and overall) will not differ by gender and group, by overall GPA and group, and by professional nursing course GPA and group. Gender and group, overall GPA and group, professional nursing GPA and group will not interact in the effect on CR scores (five dimensions and overall).

Sample

Fifty-eight participants completed the study, of which 16 were males and 42 females. Twenty-eight were assigned to the control group and 30 were assigned to the intervention group. Convenience sampling was used to gather participants for the study. The participants were recruited from one private nursing school in the Philippines. Inclusion criteria were: age range of 18-24 years; Filipino; single; junior nursing students; assigned to the orthopedic unit for clinical duty; had no previous degree or experience with patients aside from the clinical experience for each nursing course; and provided verbal consent to participate in the study. Exclusion criteria included: foreign students; students repeating professional courses; married; those who were absent during the group administration of pre-test and post-test; and those who were absent during the explanation and discussion of OPT model. Three consecutive groups of students assigned to the orthopedic unit comprised the control group. The succeeding three groups of students assigned to the orthopedic unit comprised the intervention group. This method prevented the cross-over effect from the intervention group to the control group.

Protection of Human Subjects

Approval was secured from the Loma Linda University (LLU) Institutional Review Board (IRB) (see Appendix E) and from the Administrative Committee of the school (see Appendix D) where the study was conducted. The students were given a complete and detailed explanation about the nature and the purpose of the study (see Appendix C). It was emphasized that participation was voluntary, and that they had the freedom to withdraw from the study at any time. Moreover, it was emphasized that participation in the study would have no influence on either their clinical course grade or clinical hours requirement**.** An informed verbal consent was secured and all data sheets were kept confidential by removing students' names and replacing them with code numbers.

Procedure

General Procedure

Since the school had fixed clinical groupings and a clinical rotation plan (a planned 2-week clinical rotation duty in every clinical area and 2 weeks of classroom lectures), the researcher had no freedom to randomly assign students to intervention or control groups. The clinical groupings of students were arranged by the school so that high, average, and low performing students were properly distributed in each group. The first three groups of 8-10 students rotating into the orthopedic unit were assigned to the control group, and the next three groups of students were assigned to the intervention group to prevent cross-over effect.

The pretest was administered by the researcher to both the control and intervention groups 1 week before the orthopedic clinical duty, and the posttest was given by the researcher 2 weeks after the orthopedic clinical duty, providing a 5 week interval between the pretest and the posttest. The timing was chosen to fit into the students' clinical and class schedule. This was at the suggestion of Schultz and Whitney (2004) who recommended a period between test and retest that is short enough not to fatigue participants or allow them to remember their answers, but not so long that changes could influence estimates of reliability.

One clinical instructor with experience supervising students in the orthopedic unit was assigned to supervise the students for the duration of the study, for both the control and intervention groups, to ensure consistency in instruction, and in the use of the usual nursing process and OPT model instruction tool.

Specific Procedure for the Control Group

One week before the students' clinical rotation in the orthopedic unit, the researcher gave the participating students a pretest using the HSRT and demographic questions. The results of the pretest were not shared with the students. During the two week clinical rotation at the orthopedic unit, the students followed the usual nursing process to complete the nursing care plan worksheet developed by the school of nursing where the study was conducted in the analysis of their assigned patients for 2 weeks (see Appendix J). The students had been taught the usual nursing process to complete the worksheet since their first year in the program. Students were given feedback on their weekly nursing care plan worksheets, including ways to improve them. Two weeks after the orthopedic clinical experience, the researcher gave the participating students the posttest. Figure 4 depicts the process for the control group.

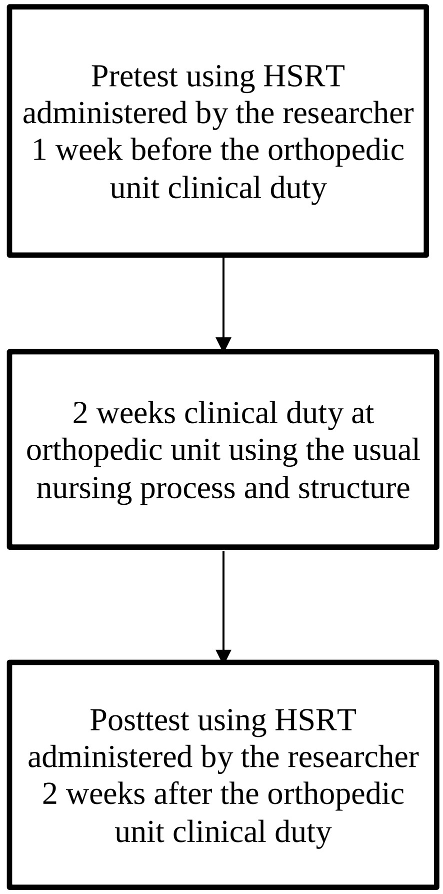

Figure 4. *Flow of procedure for the control group*

Specific Procedure for the Intervention Group

One week before the students' clinical duty in the orthopedic unit, the researcher administered a pretest using the HSRT and demographic questions to the students who consented to participate in the study. The results of the pretest were not shared with students. Two days before clinical duty in orthopedics, the researcher and clinical instructor explained to the students how to use the OPT model. In a separate class session lasting about 3 hours, students were taught the OPT Model of Clinical Reasoning concepts and structures, how to use the OPT model, and how to complete an OPT and clinical reasoning web worksheet. Copies of the OPT model worksheet with instructions for completion were given to students, followed by a case study used as an exercise to complete the clinical reasoning web and the OPT worksheets. The OPT and clinical reasoning web worksheets were distributed and completed by the students during the discussion sessions. Clarifications were provided during the practice exercise.

During the 2 weeks of clinical duty in orthopedics, students completed the OPT worksheets (see Appendix F for sample) and clinical reasoning web (see Appendix G for sample) on assigned patients. Each week, the student completed one OPT worksheet on any of the patients assigned to him/her. Students were given feedback on their models, including guidance on how to improve the models. Two weeks after their orthopedic unit clinical duty, the students completed a posttest administered by the researcher. Figure 5 depicts the process for the intervention group.

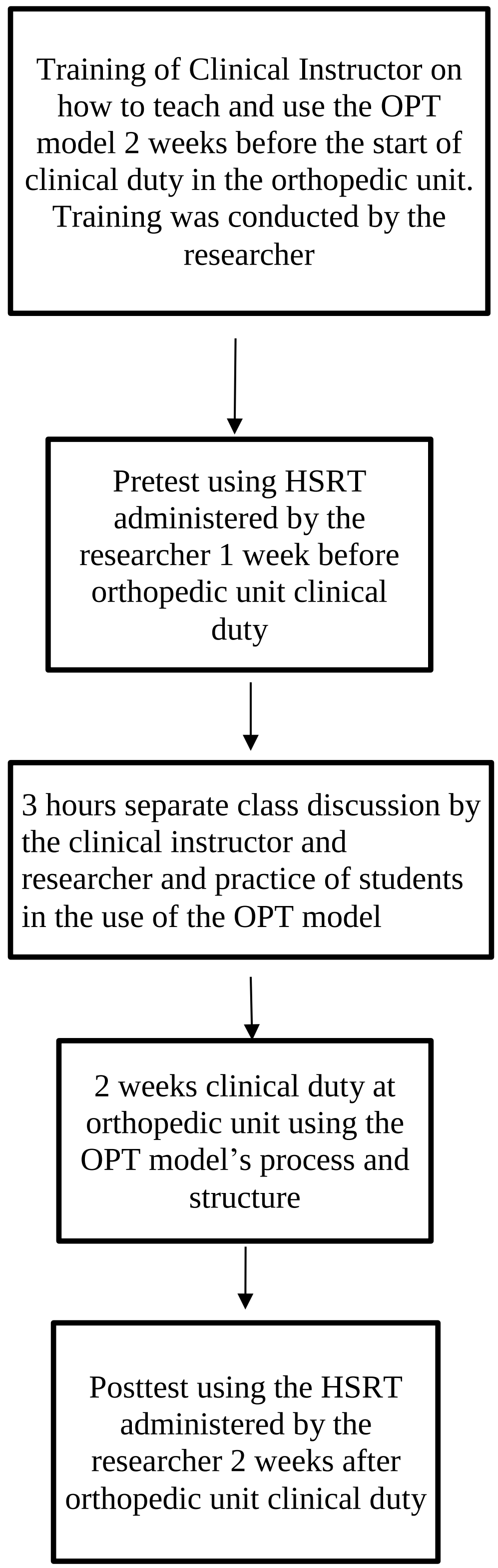

Figure 5. *Flow of procedure for the intervention group*

Training Procedure for the Clinical Instructor

Two weeks before the first intervention group began clinical duty in the orthopedic unit, the researcher conducted an orientation and training program for the clinical instructor. The OPT Model of Clinical Reasoning (Figure 1) was introduced and discussed wherein each component of the model was explained. The OPT Model of Clinical Reasoning Instruction (Figure 6) and the Clinical Reasoning Web Instruction (Figure 7) tools were used to explain how the OPT model would be used in analyzing patient data. Subsequently, the same case study used for the students' practice was used as an exercise to complete the Clinical Reasoning Web and the OPT worksheets. The clinical instructor asked questions and clarified issues during the practice exercise. Instructions regarding the implementation of the usual nursing process to the control group were also given to the clinical instructor to ensure that procedures were carried out consistently during the study.

Teaching Tools used for the Intervention Group

The following teaching tools were used for the intervention group:

1. OPT Model Teaching Tools (Figures 6 & 7) - two teaching tools developed by Barlett et al. (2008) were adapted to help students complete the OPT and the clinical reasoning web worksheets (Pesut & Herman, 1999). These tools include the instructions and criteria that a clinical instructor provided students on how to complete the model and also how to evaluate the students' worksheets.

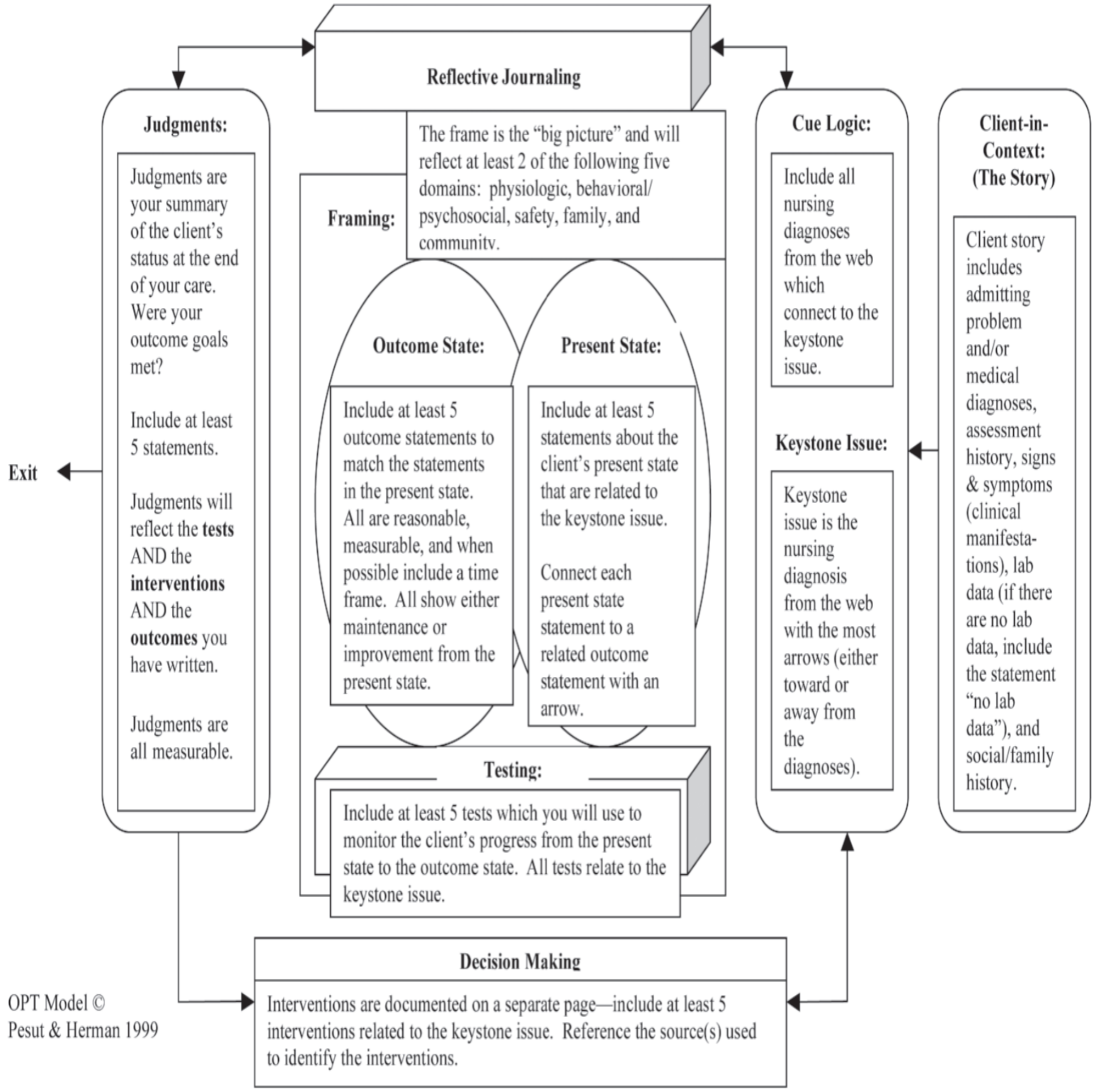

Figure 6. OPT Model of Clinical Reasoning Instructions (From the study of Bartlett et al., 2008; used with permission.)

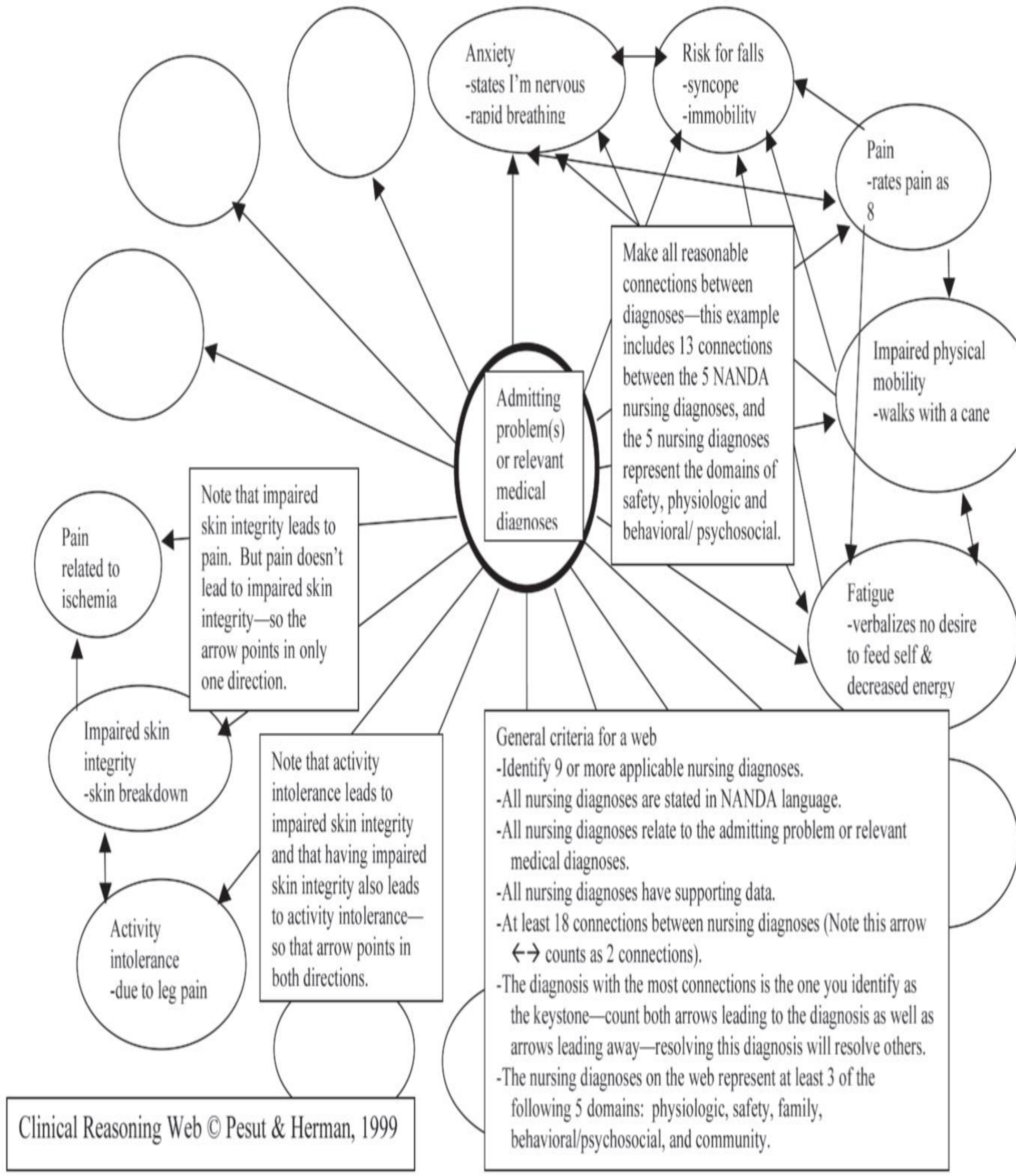

Figure 7. Clinical Reasoning Web Instructions (From the study of Bartlett et al., 2008; used with permission.)

2. One Case Study (see Appendix A) - clinical facts and information in the OPT Model and Clinical Reasoning Web worksheets completed by the students from Kautz et al.'s (2006) study were adapted and formulated as a case study and was

used by the clinical instructor and students to practice using the OPT model and clinical reasoning web.

Test Administration Procedure

The 33-item, multiple-choice-format HSRT was administered by the researcher for 50 minutes as suggested in the instructions, using paper and pencil in a classroom familiar to the students. Instructions on the test format and time allocation for the exam was given, followed by distribution of test papers and answer sheets. At the end of 50 minutes, answer sheets and test papers were collected. The same steps were taken for both the control and intervention groups during the pretest and posttest sessions.

Measurement of Clinical Reasoning

The HSRT was used to measure clinical reasoning, with permission and payment to the publisher. The researcher had contacted the publisher to indicate her interest in using the HSRT in the study. A preview pack of the instrument containing access to the online version of the instrument and its user manual were both requested from the publisher. The researcher reviewed the question items included in the instrument online to make sure they fit the participants and the needs of the study.

The researcher found the HSRT to be a reliable and valid tool to measure changes in clinical reasoning. The test manual also stated that test-retest reliability of the HSRT is high, assuring the researcher that if no other training program was used to improve the students' clinical reasoning skills after the pretest was given, the scores would be within one point 2 weeks later, when retested (Insight Assessment, 2015).

The HSRT is a copyrighted tool that measures clinical reasoning using items framed in a health care context, but not specific to the nursing domain. The questions supply most of what a test-taker needs in order to decide upon a correct answer. Due to copyright issues, the actual test items cannot be included as part of this dissertation; however, a sample question from the Insight Assessment website is included in Appendix B to better understand the nature of the items in the HSRT. The HSRT identifies clinical situations with equivalent clinical responses that contribute to higher thinking in the five areas specified by Facione and Facione (2006): analysis, inductive, deductive, inference, and evaluation reasoning. Although HSRT is not specific to the domain of nursing, it has been used extensively in health sciences education in countries including the U.S., Asia, Europe, and the Middle East (Insight Assessment, 2015). Insight Assessment affirmed the validity and reliability of the instrument, stating that it was developed and tested by a team of experts in the fields of assessment, critical thinking, statistics, psychometrics and measurements, and decision science (Insight Assessment, 2015).

Overall, using the Kuder-Richardson-20 tool to calculate for dichotomous multidimensional scales, the HSRT showed a high level of reliability, estimated at 0.81 (N = 444). According to Facione and Facione (2006), the HSRT has a high level of internal consistency for the following subscales: inductive reasoning (0.76), deductive reasoning (0.71), and evaluation (0.77). However, on two subclasses, analysis (0.54) and inference (0.52), lower internal consistency was shown. Interclass correlation was also performed in the test-retest analysis of the HSRT, resulting in substantial agreement (0.61) to (0.80) in all subscales and strong reliability (0.79) for the overall instrument.

The HSRT, which was derived from the California Critical Thinking Skill Test, was based on the consensus view of the American Philosophical Association's panel of experts and has undergone extensive testing and validation (Insight Assessment, 2015).

The students' improved HSRT test scores after completing an educational program designed to develop clinical reasoning was evidence of the tool's construct validity. Researchers worldwide have used different versions of the HSRT in their work, which has been published in peer-reviewed publications and providing evidence of gains in participants' clinical reasoning skills. In fact, the evidence of its criterion validity was demonstrated by most published studies using HSRT. Its predictive value in measuring higher-order thinking ability has been shown when used to enhance educational programs and to evaluate workplace positions (Insight Assessment, 2015).

As stated earlier, five constructs of clinical reasoning were identified in the development of the HSRT: analysis, induction, deduction, inference, and evaluation. These are further explained below.

Analysis is used to breakdown the data collected from charts, interviews and other sources. In analysis interpretation, a person gives meaning to certain situations or statements that widens the perspectives on matters observed in details, patterns, and elements of certain situations, determining how they interact. This leads to strong analytical processing and application requiring an individual to provide insight on the significance of the collected information (Insight Assessment, 2015).

Inductive reasoning is used to draw inferences about what is thought as probable truth in cited case studies, past experiences, analogies, simulated cases, patterns in events, happenings, actions, and even in people or things. Even if it is not certain, inductive reasoning can be taken as a solid basis upon which to make conclusions and thus may be the basis for an action (Insight Assessment, 2015).

Deductive reasoning follows a clear cut and formal process of thinking with sense and reason. It leaves no space for doubt unless the meaning of words have been altered. Strong deductive reasoning is needed in making decisions in precisely defined contexts in which rules, operating conditions, core beliefs, values, policies, principles, and procedures determine the outcome (Insight Assessment, 2015).

Inference makes it possible to reach a conclusion through a process of reasoning, offering suggestions or probable guesses based on evidence provided in the form of facts or situations. If analysis is flawed, biased or misleading, the wrong decision can be made, even using exemplary inference skills, conclusions, recommendations, and hypotheses (Insight Assessment, 2015).

Evaluation assesses the credibility of the origin of the information and the assertions this information brings. It informs an opinion whether the argument is weak or strong. The quality of analyses, inferences, opinions, proposals or the like can be determined by employing evaluation skills. Good interpretation and explanation can support standard evaluation through presented evidence, reasons, or assumptions behind the drawn conclusions and claims made (Insight Assessment, 2015).

HSRT Scale Interpretation and Descriptions

To determine the strength of the HSRT score in each dimension, the cut scores and interpretation recommended in the test manual were used in this study. The categorical cut scores and interpretation of HSRT scale scores for a 33-item version are as follows:

Table 1. HSRT Dimension scale and interpretations

Dimensions	Not Manifested	Moderate	Strong
Analysis	0-2	3-4	5 or more
Inference	0-2	3-4	5 or more
Evaluation	0-2	3-4	5 or more
Induction	0-4	5-7	8 or more
Deduction	0-4	5-7	8 or more

In analysis, inference, and evaluation dimensions, a score of 0-2 indicates *not manifested,* a 3-4 score indicates *moderate,* and five or more indicates *strong* in the dimension being measured. In the induction and deduction dimensions, a score of 0-4 will be interpreted as *not manifested,* a score of 5-7 will be interpreted as *moderate,* and a score of 8 or more will be interpreted as *strong* in the specific dimension being measured.

To determine the strength of the HSRT overall score, the recommended cut scores and interpretation for a 33-item test (as recommended in the test manual) were also adapted:

Table 2. Overall HSRT scale and Interpretations

Superior	Strong	Moderate	Not Manifested
26 or more	21-25	15-20	0-14

Superior denotes critical thinking skill that is excellent and far above the majority of test-takers. Critical thinking skills at the superior level indicates great potential for more advanced leadership and learning (Insight Assessment, 2015).

Strong denotes potential for career development and educational success (Insight Assessment, 2015).

Moderate denotes the potential for challenges related to skills when reflectively making decisions and finding solutions to problems about employee development or learning (Insight Assessment, 2015).

Not Manifested denotes the possibility of inadequate test-taker effort, mental fatigue, or problems with understanding reading or word use (Insight Assessment, 2015).

The overall reasoning skills describe strength in the use of reason to form opinions and reflective decisions about what to do and what to believe in. To get a good overall score, the test-taker must excel in the overall application of five core reasoning skills that included analysis, inference, evaluation, induction and deduction (Insight Assessment, 2015).

Data Sources and Management

Demographic data collected included gender, overall GPA, and professional nursing course GPA. The HSRT pretest and posttest sheets were sent to the Insight Assessment office in California for scoring, and results were returned to the researcher 2 weeks later. Results include the clinical reasoning scores in the five HSRT dimensions (induction, deduction, inference, analysis, evaluation), and the overall scores. Respondents' GPAs were extracted from the Records and Admission's Office records through the AOLIS (Adventist University of the Philippines On-Line Information System). Grade information was protected according to school policy.

Overall GPA was the average score of all courses taken by the student, computed by adding all the honor points of all courses taken divided by the total number of units taken. Professional nursing course GPA was the average score of all nursing courses taken by the student and was computed by adding all the honor points of all the nursing courses divided by the total number of units of all nursing courses only. Data collection was completed in six months.

Analysis

Data were analyzed using the Statistical Package for the Social Science (SPSS) version 22. Prior to analysis, the data were screened for accuracy and missing values and each variable score was checked for normality and statistical assumptions. Following these preliminary analyses, both descriptive and inferential statistics data were used to address the research questions. Descriptive statistics was used to analyze the demographic data and determine the mean and standard deviation of the pretest and posttest scores. A paired t-test was used to check for significant differences between the means of the pretest and the posttest scores within groups, and an independent t-test to check for significance in the CR scores between groups. Multivariate analysis of variance (MANOVA) was used to determine differences in the CR scores when gender, overall GPA, and professional nursing course GPA were considered.

CHAPTER FOUR

RESULTS

This chapter presents the results of the study. This is divided into four main subsections: data entry, screening, and checking of normality; test of homogeneity; descriptive analysis; and inferential data analysis. It is presented according to research aims and research questions.

Data Entry, Screening, and Checking of Normality

After data collection was completed, the researcher entered the data, and to ensure accuracy, another person not involved in the study reviewed all entries. Data were checked for missing values using "frequency" as a categorical variable and "descriptive statistics" as measurement variables. There was no missing value in either the control or intervention groups.

The "explore" function in SPSS was used to examine the variables for normality of data. The Mean/Median, Kolmogorov-Smirnov, Histogram, Q-Q Plot, and Box and Whisker plots were evaluated and showed moderately skewed data on some variables (pre-deduction, post-analysis, post-induction and post-deduction). There were no significant outliers, so normality of data was assumed. According to Leech, Barrett, and Morgan (2005), when variables are not extremely skewed, it is appropriate to assume normality. Moreover, according to Mertler and Vannatta (2002), t-test and MANOVA, (the statistical tests used to analyze data in this study) are robust to violations of the normality assumption.

Homogeneity Test of CR Scores of the Control and Intervention Group

Table 3 shows the results of the Levene's Test for equality of variance. The variances were not significantly different, which indicates that the assumption of homogeneity had been met, except in pre-deduction and in the pretest of the overall CR scores, where they were significant. Thus the independent t-test for unequal variances values were used in those non-homogeneous variables as suggested by Leech et al. (2005).

Table 3. Test of homogeneity of variance of the control and intervention group for pretest and posttest CR scores

	Levene's Stat	Sig	Interpretation
Pre-Inference	.082	.776	NS
Pre-Analysis	.050	.824	NS
Pre-Evaluation	1.818	.183	NS
Pre-Induction	1.028	.315	NS
Pre-Deduction	8.316	.006	S
Pretest (Overall CR)	7.932	.007	S
Post-Inference	.003	.958	NS
Post-Analysis	.080	.778	NS
Post-Evaluation	.042	.839	NS
Post-Induction	.251	.619	NS
Post-Deduction	.331	.568	NS
Posttest (Overall CR)	2.203	.143	NS

NS- not significant
S-sigificant
Sig. p < . 05

Results of Descriptive Analysis

Demographic Profile of the Sample

A total of 58 students participated in the study. The sample was divided into two groups: a control group (48.28%, *n* = 28) and an intervention group (51.72%, *n* = 30). The intervention group had the OPT Model of Clinical Reasoning as an education program, while the control group had the usual nursing process. The first three groups assigned to the orthopedic area were placed in the control group, and the remaining three groups were placed in the intervention group. This was done to prevent a cross-over effect.

Table 4. Demographic data of the participants

Variables	Control N	%	Intervention N	%
Gender				
Male	8	28.6	8	26.7
Female	20	71.4	22	73.3
Total	28	100.0	30	100.0
Overall GPA				
Low (3.24 and below)	13	46.4	13	43.3
High (3.25 and above)	15	53.6	17	56.7
Total	28	100.0	30	100.0
Professional Nursing GPA				
Low (3.24 and below)	21	75.0	19	63.3
High (3.25 and above)	7	25.0	11	36.7
Total	28	100.0	30	100.0

Of the 28 participants in the control group, 8 (28.6%) were male and 20 (71.4%) were female, while in the intervention group, 8 (26.7%) were males and 22 (73.3%) were female. The lower number of males compared to females may be explained by social perceptions of nursing, traditionally a female-dominated profession. The feminization of nursing work (Evans & Frank, 2003), sexual stereotyping, lack of recruitment strategies, and lack of exposure to male role models in the media (Meadus & Twoney, 2007) were the most common perceived barriers to men entering the nursing profession, continuing the domination of women in the field.

The majority of the participants had a high overall GPA in both groups. Thirteen (46.4%) had a low GPA and 15 (53.6%) had a high overall GPA in the control group, while 13 (43.3%) had a low GPA and 17 (56.7%) had a high overall GPA in the intervention group. On the other hand, a majority of the participants in both groups had low GPAs in their professional nursing courses. In the control group, 21 (75.0%) had a low nursing course GPA and 7 (25.0%) had high GPAs in their professional nursing courses, while in the intervention group, 19 (63.3%) had low nursing course GPAs and 11 (36.7%) had high GPAs in their nursing coursework. GPA is considered an indicator of student performance across the spectrum (Park, Kang, Lee, & Myung, 2015). Overall GPA is the average score of all courses taken by the student, computed by adding all the honor points of all courses taken divided by the total number of units taken. Professional nursing course GPA is the average score of all professional nursing courses taken by the student and was computed by adding all the honor points of all the professional nursing courses divided by the total number of units of all nursing courses taken.

Descriptive Statistics of Pretest and Posttest Scores in Both Groups

Table 5 shows that the pretest mean scores in all dimensions and in the overall CR were all in the same level *(moderate*) for both groups, except for deduction, which was *not manifested* in the control group. The results indicate that the CR pretest scores in both groups were all in the same level (*moderate*), thus the control and intervention groups were comparable.

Table 5. Descriptive statistic of pretest scores (control and intervention group)

	Min.	Max.	Mean	SD	Interpretation
Inference					
Control	1.00	6.00	3.2500	1.35058	Moderate
Intervention	.00	6.00	3.3333	1.56102	Moderate
Analysis					
Control	.00	6.00	3.1071	1.52362	Moderate
Intervention	.00	6.00	3.3000	1.53466	Moderate
Evaluation					
Control	1.00	6.00	3.0714	1.21499	Moderate
Intervention	1.00	6.00	3.5667	1.38174	Moderate
Induction					
Control	2.00	8.00	5.1429	1.45842	Moderate
Intervention	3.00	9.00	5.5333	1.69651	Moderate
Deduction					
Control	1.00	8.00	3.5714	1.89402	Not Manifested
Intervention	1.00	10.00	4.7333	2.83978	Moderate
Overall CR					
Control	6.00	23.00	14.8214	3.74219	Moderate
Intervention	8.00	27.00	16.5667	5.69139	Moderate

The posttest mean scores (Table 6) in all dimensions and in the overall CR were all in the same level (*moderate*) for both groups, except for analysis and deduction, which were *not manifested* in the control group. The results indicate that the CR posttest scores in both groups were all in the same level (*moderate*), thus the control and experimental group were comparable.

Table 6. Descriptive statistic of posttest scores (control and intervention group)

Variables	Min.	Max.	Mean	SD	Interpretation
Inference					
Control	1.00	6.00	3.6786	1.36228	Moderate
Intervention	1.00	6.00	3.9000	1.34805	Moderate
Analysis					
Control	1.00	5.00	2.9643	1.31887	Not Manifested
Intervention	.00	5.00	3.4000	1.24845	Moderate
Evaluation					
Control	1.00	6.00	3.1071	1.34272	Moderate
Intervention	1.00	6.00	3.3000	1.20773	Moderate
Induction					
Control	3.00	8.00	5.1786	1.54089	Moderate
Intervention	3.00	10.00	5.3000	1.53466	Moderate
Deduction					
Control	1.00	8.00	3.8571	2.06764	Not Manifested
Intervention	1.00	10.00	4.9333	2.37709	Moderate
Overall CR					
Control	8.00	23.00	15.2857	3.71042	Moderate
Intervention	8.00	27.00	16.5667	4.72472	Moderate

The inference, evaluation, induction, and overall CR skill of the control and the intervention groups both in the pretest and posttest were in the *moderate* level. The analysis skill of the control and the intervention group in the pretest reflect a *moderate* level, while in the posttest the analysis skill of the control group was *not manifested.* The deduction skill of the respondents in the control group both in the pretest and posttest were at the *not manifested* level. However, the deduction skill in the experimental group reflects *moderate* level.

The *moderate* level result indicates the potential for clinical reasoning skill-related challenges when engaged in reflective problem solving and reflective decision-making associated with learning (Insight Assessment, 2015). The *not manifested* level indicates the possibility that the test-taker did not put much effort into the test, the test-taker was experiencing cognitive fatigue, or the test-taker had reading or language comprehension issues (Insight Assessment, 2015).

Results of Inferential Analysis

The main goal of the study was to describe the effect of using the OPT Model of Clinical Reasoning as a teaching tool in a group of junior nursing students on their clinical reasoning scores (five dimensions and overall) compared to a usual nursing process education.

Research Aim 1

To determine the difference between the pretest and posttest CR scores (five dimensions and overall CR scores) within groups.

Research Question 1

Are there significant differences between the pretest and posttest CR scores (five dimensions and overall CR) within groups?

Paired t-test was used to evaluate the null hypothesis *(Ho*: There will be no significant differences between the pretest and posttest scores (five dimensions and overall CR) within groups.

Table 7. Difference between the pretest and posttest scores in the control group

		Mean	Std. Deviation	t (27)	Sig	Interpretation
Pair 1	Pretest Inference	3.2500	1.35058	-1.890	.069	NS
	Posttest Inference	3.6786	1.36228			
Pair 2	Pretest Analysis	3.1071	1.52362	.548	.588	NS
	Posttest Analysis	2.9643	1.31887			
Pair 3	Pretest Evaluation	3.0714	1.21499	.150	.882	NS
	Posttest Evaluation	3.1071	1.34272			
Pair 4	Pretest Induction	5.1429	1.45842	-.135	.894	NS
	Posttest Induction	5.1786	1.54089			
Pair 5	Pretest Deduction	3.5714	1.89402	-1.072	.293	NS
	Posttest Deduction	3.8571	2.06764			
Pair 6	Pretest Overall CR	14.8214	3.74219	-1.083	.288	NS
	Posttest Overall CR	15.2857	3.71042			

n- 28 (control group)
NS-Not Significant
P $< .05$

There were increases in the means of the control group, except in the analysis dimension, which decreased, as shown in Table 7. However, in all dimensions as well as in the overall, *p* values were greater than .05, therefore the researcher fails to reject the null hypothesis. There were no significant differences between the pretest and posttest scores (five dimensions and overall CR) in the control group.

Table 8. Difference between the pretest and posttest scores in the intervention group

		Mean	Std. Deviation	t(29)	Sig	Verbal Interpretation
Pair 1	Pretest Inference	3.3333	1.56102	-2.036	.051	NS
	Posttest Inference	3.9000	1.34805			
Pair 2	Pretest Analysis	3.3000	1.53466	-.423	.676	NS
	Posttest Analysis	3.4000	1.24845			
Pair 3	Pretest Evaluation	3.5667	1.38174	1.092	.284	NS
	Posttest Evaluation	3.3000	1.20773			
Pair 4	Pretest Induction	5.5333	1.69651	.793	.434	NS
	Posttest Induction	5.3000	1.53466			
Pair 5	Pretest Deduction	4.7333	2.83978	-.633	.532	NS
	Posttest Deduction	4.9333	2.37709			
Pair 6	Pretest Overall CR	16.5667	5.69139	.000	1.000	NS
	Posttest Overall CR	16.5667	4.72472			

n-30 (intervention group)
Sig. Level= $p < .05$
NS- Not Significant
S-Significant

As shown in Table 8, it is noteworthy that there were increases in means in inference, analysis, and deduction; however, the differences were not statistically significant ($p < .05$). On the other hand, a decrease in the means of evaluation and induction were noted, which also were not statistically significant ($p < .05$). Since there were no significant differences between the pretest and posttest scores (five dimensions and overall CR) in the intervention group, the research failed to reject the hypothesis. This means that the pretest and posttest scores in the intervention group were not significantly different.

Research Aim 2

To determine the differences in the CR gain scores between groups.

Research Question 2

Are there significant differences in the gain scores (five dimensions and overall CR) between groups?

Independent t-test was used to evaluate the null hypothesis *(Ho*: There will be no significant differences in the gain scores (five dimensions and overall CR) between groups.

Homogeneity Test of Variance of Gain Scores in the Control and Intervention Groups

Levene's test was checked for equality of variance in the gain scores of the control and intervention group (Table 9). The variances were not significantly different, which indicate that the assumption of homogeneity had been met in all dimensions of CR. However, in the overall CR homogeneity was significant, thus the independent t-test for unequal variance value was used for non-homogenous data, as recommended by Leech et al. (2005).

Table 9. Test of homogeneity of variance of gain scores in the control and intervention group

	Levene's Stat	Sig	Interpretation
Gain Inference	1.942	.169	NS
Gain Analysis	.152	.698	NS
Gain Evaluation	.905	.346	NS
Gain Induction	.992	.323	NS
Gain Deduction	.866	.356	NS
Overall CR	8.019	.006	S

Independent t-test was used to evaluate the null hypothesis *(Ho*: There will be no significant differences in the gain scores (five dimensions and overall CR) between the groups.

Table 10. Difference in the gain scores between the control and the intervention group

	Group	Mean	Std. Deviation	t value	df	Sig I
Inference	Control	.4286	1.19965	-.382	56	.704 NS
	Intervention	.5667	1.52414			
Analysis	Control	-.1429	1.38013	-.691	56	.492 NS
	Intervention	.1000	1.29588			
Evaluation	Control	.0357	1.26146	.884	56	.380 NS
	Intervention	-.2667	1.33735			
Induction	Control	.0357	1.40059	.676	56	.502 NS
	Intervention	-.2333	1.61210			
Deduction	Control	.2857	1.41047	.206	56	.838 NS
	Intervention	.2000	1.73006			
Overall CR	Control	.4643	2.26866	.590	49.259	.558 NS
	Intervention	.0000	3.61033			

n- 28 (control)
n- 30 (intervention)
Sig. Level= $p < .05$
NS- Not Significant

The difference in the gain scores between the control and intervention group of inference (t [56] = -.382, *p*. 704), analysis (t [56] = -.691, *p*. 492), evaluation (t [56] = .884, *p*. 380), induction (t [56] = .676, *p* .502), deduction (t [56] = .206, *p*. 838), and in the over-all CR (t [49.25] = .590, *p* .558), were all not significant. Since *p* values in all dimensions and as well as in the overall were greater than 0.05, the researcher failed to reject the null hypothesis. There were no significant differences in the gain scores between the control and the intervention group. The result indicates that the OPT Model of Clinical Reasoning as intervention program did not make any significant improvement in the CR scores (five dimensions and overall) of the participants.

Checking of Multivariate Assumptions

To answer research questions 3, 4, and 5, data were evaluated for multivariate assumptions. Normality was assumed for all variables since there was no significant outlier noted, although deduction was moderately skewed. Leech et al. (2005) confirmed that normality can be assumed as long as variables are not extremely skewed. Moreover, MANOVA is robust to moderate violations of normality, provided the violation is created by skewness and not by outliers (Mertler & Vannatta, 2002; Tabachnick & Fidel, 2001). To check the linearity between dependent variables, a scatterplot was created and Pearson Correlation Coefficient was calculated. Scatterplots showed a linear relationship for some grouped data, and some plots showed a non-elliptical shape. Correlation coefficients were not significant for inference and analysis, inference and evaluation, analysis and evaluation, analysis and induction, evaluation and inference, evaluation and deduction, induction and deduction; while the correlation coefficient for inference and deduction ($r = .441$, $p = .001$); inference and overall ($r = .588$, $p = .000$); analysis and deduction ($r = .396$, $p = .002$); analysis and overall ($r = .437$, $p = .001$); evaluation and over-all ($r = .365$, $p = .005$); induction and overall ($r = .526$, $p = .000$) were significant, but moderately correlated. According to Leech, Barrett, & Morgan (2005), the dependent variables should be correlated with one another at a low to moderate level. Induction and evaluation ($r = .747$, $p = .000$), and deduction and overall ($r = .632$, $p = .000$) were significant and highly correlated. Transformation of the data was done, however, it did not enhance the linear relationship; thus the researcher opted to conduct the MANOVA using the non-transformed data. The final assumption of homogeneity of variance was tested with the MANOVA procedure.

Research Aim 3

To determine the main effects of gender and group on the CR scores (five dimensions and overall) and the interaction effect of both variables (gender and group) on the CR (five dimensions and overall).

Research Question 3

Do clinical reasoning scores in five dimensions and overall differ by gender and group among the participants, and do gender and group interact in the effect on clinical reasoning scores (five dimensions and overall)?

A two-way multivariate analysis of variance was conducted to assess whether gender and group have differences in the CR scores (analysis, inference, evaluation, induction, deduction, and overall), and whether there was an interaction between gender and group. The Box's Test (Table 11) reveals that equal variances were assumed (F[63, 1924.682] = 1.467, p = .011).

Table 11. Box's test for homogeneity of variance

Box's M	130.602
F	1.467
df1	63
df2	1924.682
Sig.	.011

Table 12 shows the means and standard deviations of the five dimensions and overall CR scores for the groups made up of every combination of the two groups and two kinds of gender. MANOVA results (Table 13) indicate that group (Wilks' Λ = .953, F[6, 49.00] = .401, p = .875, η^2 = .047), and gender (Wilks' Λ = .897, F[6, 49.00] = .935, p = .479, η^2 = .103), both were not significant, and multivariate effect sizes were small according to Cohen (1988). Moreover, the interaction effect was not significant (Wilks' Λ = .963, F[6, 49.00] = .318, p = .925, η^2 = .037). Group and gender did not affect the CR scores in five dimensions and in the overall CR. This means that the CR scores in five dimensions and in the overall CR did not differ for males and females and for those with the OPT Model of Clinical Reasoning and usual nursing process as education program.

Table 12. Means and Standard Deviations for five dimensions and overall CR scores according to gender and group.

Group	N	Inference		Analysis		Evaluation		Induction		Deduction		Over-all	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Control													
Male	8	.1250	1.45774	-.1250	.83452	.3750	1.40789	.2500	1.90863	.2500	1.03510	-.2500	2.37547
Female	20	.5500	1.09904	-.1500	1.56525	-.1000	1.20961	-.0500	1.19097	.3000	1.55935	.7500	2.22131
Intervention													
Male	8	.1250	1.80772	-.2500	.886411	-.1250	.83452	-.5000	1.06904	.5000	1.60357	-1.3750	3.62284
Female	22	.7273	1.42032	.2273	1.41192	-.3182	1.49241	-.1364	1.78073	.4545	1.73829	-.5000	3.55568

Table 13. Multivariate tests for five dimensions and overall CR scores by group and gender

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Group							
	Wilks' Lambda	.953	.401[b]	6.000	49.000	.875	.047
Gender							
	Wilks' Lambda	.897	.935[b]	6.000	49.000	.479	.103
Group *gender							
	Wilks' Lambda	.963	.318[b]	6.000	49.000	.925	.037

a. Design: Intercept + group + gender + group * gender

Research Aim 4

To determine the main effects of overall GPA and group on CR scores (five dimensions and overall) and the interaction effect of both variables (overall GPA and group) on the CR scores (five dimensions and overall).

Research Question 4

Do clinical reasoning scores in five dimensions and overall differ by overall GPA and group among the participants, and do overall GPA and group interact in the effect on clinical reasoning scores (five dimensions and overall)?

Table 14. Box's test for homogeneity of variance

Box's M	83.140
F	1.043
df1	63
df2	6236.744
Sig.	.383

The Box's Test (Table 14) reveals that equal variances were assumed (F[63, 6236.744] = 1.043, p = .383). Means and standard deviations of the five dimensions and overall CR scores for the groups, made up of every combination of the two groups and two levels of overall GPA, are reflected in Table 15. MANOVA results (Table 16) indicate that group (Wilks' Λ = .943, F[6, 49.00] = .494, p = .809, η^2 = .057) and overall GPA (Wilks' Λ = .896, F[6, 49.00] = .952, p = .467, η^2 = .104), both were not significant and multivariate effect sizes were small. Moreover, the interaction effect was not significant (Wilks' Λ = .900, F[6, 49.00] = .909, p = .497, η^2 = .100). Group and overall GPA did not affect the CR scores in five dimensions and in the overall CR. This means that the CR scores in five dimensions and in the overall CR did not differ for those with low or high overall GPA and for those with the OPT Model of Clinical Reasoning or usual nursing process as education program.

Table 15. Means and standard deviations for 5 dimensions and overall CR scores according to overall GPA and group

Group	N	Inference		Analysis		Evaluation		Induction		Deduction		Over-all	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Control													
Low	13	.3077	1.31559	-.0769	1.03775	.4615	1.19829	.3077	1.49358	.1538	1.34450	-.2308	2.55453
High	15	.5333	1.12546	-.2000	1.65616	-.3333	1.23443	-.2000	1.32017	.4000	1.50238	.6667	2.05866
Intervention													
Low	13	.11538	1.77229	.0769	1.25576	-.2308	1.48064	-.0769	1.60528	.6923	1.84321	.7692	4.00320
High	17	.1176	1.16632	.1176	1.36393	-.2941	1.26317	-.4706	1.62472	-.1765	1.59041	-.5882	3.27984

Table 16. Multivariate tests for five dimensions and overall CR scores by group and overall GPA

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Group							
	Wilks' Lambda	.943	.494[b]	6.000	49.000	.809	.057
Overall GPA							
	Wilks' Lambda	.896	.952[b]	6.000	49.000	.467	.104
Group * overall GPA	Wilks' Lambda	.900	.909[b]	6.000	49.000	.497	.100

a. Design: Intercept + group + overall GPA + group * overall GPA

As reflected in Table 16, *p* values in all dimensions of clinical reasoning scores were greater than .05; therefore the researcher fails to reject the null hypothesis. There was no significant difference in the scores (five dimensions and overall CR) when overall GPA and group were considered, and there was no significant interaction effect on CR scores (five dimensions and overall) when overall GPA and group were considered.

Therefore, in this study the CR scores in all five dimensions and overall were not different for those with low or high overall GPA, or if the participant received the OPT Model of Clinical Reasoning or the usual nursing process as education program.

Although statistical analysis revealed no significant difference in the CR scores when overall GPA and group were considered, the raw data indicated that the intervention group had a higher percentage of participants with a high overall GPA than the control group, and with a lower percentage of participants with low CR overall GPA.

Research Aim 5

To determine the main effects of professional nursing course GPA and group on the clinical reasoning scores (five dimensions and overall) and to describe the interaction effect of both variables (professional nursing course GPA and group) on the CR (five dimensions and overall) scores.

Research Question 5

Do clinical reasoning scores in five dimensions and overall differ by professional nursing course GPA and group among the participants, and do professional nursing course GPA and group interact in the effect on clinical reasoning scores (five dimensions and overall)?

Table 17. Box's test for homogeneity of variance

Box's M	109.224
F	1.245
df1	63
df2	1958.798
Sig.	.095

The Box's Test (Table 17) reveals that equal variances were assumed (F[63, 1958.798] = 1.245, p = .095). Means and standard deviations of the five dimensions and overall CR scores for the groups, made up of every combination of the two groups and two levels of professional nursing course GPA, are reflected in Table 18. MANOVA results (Table 19) indicate that group (Wilks' Λ = .900, F[6, 49.00] = .905, p = .499, η^2 = .100) and professional nursing course GPA (Wilks' Λ = .861, F[6, 49.00] = 1.318, p = .267, η^2 = .139), both were not significant and multivariate effect sizes were small. Moreover, the interaction effect was not significant (Wilks' Λ = .893, F[6, 49.00] = .976, p = .451, η^2 = .107). Group and professional nursing course GPA did not affect the CR scores in five dimensions and in the overall CR. This means that the CR scores in five dimensions and in the overall CR did not differ for those with low or high professional nursing course GPA or for those with the OPT Model of Clinical Reasoning or the usual nursing process as education program.

Table 18. Means and standard deviations for 5 dimensions and overall CR scores according to professional nursing course GPA and group

Group	N	Inference		Analysis		Evaluation		Induction		Deduction		Over-all	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Control													
Low	21	.4286	1.20712	-.0952	1.26114	.2857	1.14642	.1429	1.45896	.0952	1.48003	.2857	2.19415
High	7	.4286	1.27242	-.2857	1.79947	-.7143	1.38013	-.2857	1.25357	.8571	1.06904	1.0000	2.58199
Intervention													
Low	19	.7368	1.82093	.2632	1.14708	-.1053	1.32894	-.0000	1.52753	.3684	1.83214	.6316	3.93292
High	11	.2727	.78625	-.1818	1.53741	-.5455	1.36848	-.6364	1.74773	-.0909	1.57826	-1.0909	2.80908

Table 19. Multivariate tests for five dimensions and overall CR scores by group and professional nursing course GPA

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Group	Wilks' Lambda	.900	.905[b]	6.000	49.000	.499	.100
Professional Nursing Course GPA	Wilks' Lambda	.861	1.318[b]	6.000	49.000	.267	.139
Group * professional nursing course GPA	Wilks' Lambda	.893	.976[b]	6.000	49.000	.451	.107

a. Design: Intercept + group + professional nursing course GPA + group * professional nursing course GPA

Since *p* values in all dimensions of clinical reasoning scores were greater than .05, the researcher failed to reject the null hypothesis. There was no significant difference in the CR scores (five dimensions and overall CR) when professional nursing course GPA and group were considered, and there was no significant interaction effect on CR scores (five dimensions and overall) when professional nursing course GPA and group were considered.

Therefore, in this study the CR scores in all five dimensions and in the overall were not different for those with low or high professional nursing course GPA or if the participant received the OPT Model of Clinical Reasoning or the usual nursing process as education program.

Although statistical analysis revealed no significant difference in the CR scores when professional nursing course GPA and group were considered, the raw data revealed that the control group had a higher percentage of participants with a lower professional nursing course GPA when compared to the intervention group, and had a lower percentage of participants with high professional nursing course GPA.

Summary of Results

Descriptive statistics showed that a majority of the participants were female, had high overall GPA, and low professional nursing course GPA. The level of clinical reasoning on both groups is comparable in the overall and all dimensions scores, except deduction in the control group, and deduction and analysis in the intervention group.

Paired t-test showed no significant differences between the pretest and posttest scores (five dimensions and overall CR) within groups.

Independent t-test showed no significant differences in the gain scores (five dimensions and overall CR) between groups.

Multivariate analysis of variance revealed no significant difference in the CR scores (five dimensions and overall CR) when gender, overall and professional nursing course GPA, and group were considered, and there was no significant interaction effect on CR scores (five dimensions and overall) when gender, overall and professional nursing course GPA, and group were considered.

CHAPTER FIVE

DISCUSSION

In this chapter the findings of the study and how it relates to the literature are discussed. Included are the strengths and limitations; implications of the findings to nursing theory, education and practice; recommendations for future research; and finally, the conclusion of the study.

Summary of Findings

The main goal of the study was to evaluate the effect of using the OPT Model of Clinical Reasoning education on the development of clinical reasoning skills among Filipino nursing students using the HSRT as the measuring tool.

The sample of the study consisted of 58 Filipino, third-year undergraduate baccalaureate nursing students. The predominant gender was female. A majority of the participants had a high overall GPA and a low professional nursing course GPA; 75.0% in the control group and 63.3% for participants in the intervention group, respectively.

Both groups' pretest and posttest clinical reasoning scores in all dimensions and in the overall score were the same *moderate* level, except for deduction in the pretest (*not manifested* in the control group and *moderate* in the intervention group), and analysis and deduction in the posttest (*not manifested* in the control group and *moderate* in the intervention group). Deduction skill was consistently *not manifested* in the control group in both pretest and posttest. These results suggest that students need continued development in their deductive reasoning CR skills. Strong deductive reasoning is important for nurses as they make decisions for patient care. Strong deductive reasoning is needed in making decisions in precisely defined contexts in which rules, operating conditions, core beliefs, values, policies, principles, and procedures completely determine the outcome (Insight Assessment, 2015).

It is the basis for decisions made in which policies, core beliefs and values, operating conditions, principles, terminology, procedures, and rules are used to settle issues (Insight Assessment, 2015).

While the raw data implied increases in some mean scores (inference, analysis, and deduction in the intervention group; inference, induction, deduction, and evaluation in the control group), statistical tests demonstrated no significant differences (*p* values in all five dimensions and overall were greater than .05) within the control and intervention groups. The results also indicated no significant differences in the gain scores between groups (*p* values in all five dimensions and in the overall were greater than .05). The result implies that the OPT Model of Clinical Reasoning as an intervention program did not make any significant improvement in the CR scores (five dimensions and overall) of the participants in this study. The results may be confounded by the limited sample size, convenience sampling, the short period of implementation of the OPT model as the intervention program, and the possibility that the HSRT was not sensitive enough to capture and measure changes in the clinical reasoning skill of the students. This study asserts that although the OPT Model of Clinical Reasoning processes and structures can be learned by the students in a 2-week period, this researcher postulates that it may take some time for clinical reasoning skills to develop, thus significant improvement in the clinical reasoning scores was not evident in this study.

Three studies were found with results consistent with the findings of this study, in which an intervention program did not improve the critical thinking skills of students.

Pardamean (2012), using the HSRT as a measuring tool, found no change in critical thinking scores in dental students from the first to the third year of education using the Problem-based Learning (PBL) model. The study of Burns et al. (2013), using HSRT as a tool to measure critical thinking of nurse anesthesia students at two curricular points (at the beginning and end of 12 months of regular didactic instruction), also showed no statistical difference. Rogal and Young (2008) used a pretest post-test design using the California Critical Thinking Skills Test (CCTST) to measure critical thinking in undergraduate nursing students after a critical care nursing education; no statistical significance was found between pretest and posttest. According to Benner, Hughes, and Sutphen (2008), clinical reasoning is influenced by one's critical thinking, thus in this study critical thinking studies were utilized.

In contrast to the findings in this current study, three studies reported improved clinical reasoning skills after an intervention program. Nursing students who had the Debriefing for Meaningful Learning (DML) as an intervention program scored significantly higher in their clinical reasoning than nursing students who were given the usual customary debriefing when measured by the HSRT (Forneris et al., 2015). The 2013 Gonzol and Newby comparing students who were taught with a clinical reasoning model (IRUEPIC) versus the usual nursing process model found that the intellectual performance scores in all components of the IRUEPIC reasoning model were statistically significantly higher when compared to the nursing-process-based skills group. Sullivan-Mann, Perron, and Fellner (2009) using the HSRT as a measure, found that students demonstrated a significant increase in scores for total critical thinking scores and in the analysis and deductive dimensions, after participating in a concept mapping and simulating activity.

In the current study, the studies by Forneris et al. (2015) and Sullivan-Mann et al. (2009), showing an increase in clinical reasoning and critical thinking, provided the basis for using the HSRT as a measure of change in clinical reasoning following an intervention. There were no previous studies done using the OPT model as an educational program using the HSRT as a measuring tool, thus the result of this study had no point of comparison.

The results in this current study demonstrated that clinical reasoning scores (in the overall and in the five dimensions) did not differ by gender. This may be attributed to the small and unequal sample sizes in each gender category. Nursing is a female-dominated profession and this holds true in this study. The following studies support the findings of this research. In the studies of Shinnik and Woo (2013) and Chau et al. (2001) using the CCTST, the researchers found no significant relationship between gender and critical thinking skills. Moreover, a 2014 study by Hunter, Pitt, Croce, and Roche (2014) indicates that gender was not significantly related to any HSRT domains.

In contrast, the following studies found otherwise. A 2003 study by Groves and Alexander among medical students which measured clinical reasoning scores once a year for a period of 3 years, and a study by Freund and Holling (2008) among students attending all levels of the educational system in the Federal Republic of Germany, found that women achieved higher clinical reasoning scores than men.

Moreover, this study indicated found no significant differences in clinical reasoning (overall and in five dimensions) when overall and professional nursing course

GPA were analyzed. This means clinical reasoning scores were the same for those with low and high GPA. Notably, the sample sizes in this study were small and unequal in each level for professional nursing course GPA, which may have confounded the non-significant results. These findings were consistent with a study by Artino, Cleary, Dong, Hemmer, and Durning (2014), which found out that GPA was not significantly correlated with diagnostic reasoning tasks among medical students. In contrast to the findings in this study, the following studies reported that reasoning ability had a strong effect on GPA (Freund & Holling (2008), and GPA was significantly correlated with clinical knowledge and clinical reasoning scores among fourth year medical students (Park et al., 2015).

Strengths and Limitations of the Study

Limitations

This study encountered a number of limitations which likely influenced the results: The sample size was limited and selected through convenience sampling. With two major variables (HSRT scores and demographics) included in the study, based on Stevens' (2002) recommendation of 15 participants per variable, the study could have a total of 30 participants per group. Moreover, the researcher was limited to the available participants who met the inclusion criteria, thus convenience sampling design was used (Creswel, 2003). The study was conducted during a period when nursing enrollment was in a downward trend. The relatively small number could be the reason for the lack of statistical significance, and a larger sample size may produce different results. Randomization of subjects to the control and intervention groups was not possible in the study. Clinical rotation at the university where the study was conducted was scheduled by clinical group cohorts. Moreover, the clinical exposure in the orthopedic unit was designed for only 2 weeks. The researcher had no control over the college's scheduled clinical rotation or the rotation schedule of students in the orthopedic area. This resulted in a 2 week implementation period of the OPT Model of Clinical Reasoning, a limited window for students to use, assimilate, and apply the newly learned OPT model in clinical situations. Kautz et al.'s 2005 study indicated that students could learn the OPT model processes and structures adequately in 1 week of practice. This provided the researcher in the current study some basis and rationale for a 2-week period of implementing the OPT model. However, there was no literature to support the length of time needed to demonstrate improvement in clinical reasoning when the OPT model is used. The researcher acknowledges that this was a limitation in the study design, and the results implied that 2 weeks is not adequate for clinical reasoning skills to develop through the implementation of the OPT model.

Although the researcher oriented the clinical instructor in the use of the OPT Model of Clinical Reasoning, this was the first time that the researcher and clinical instructor applied the process to students which may have influenced the students' learning of the new model. In addition, since both groups, as first-year students, had been informed about the usual nursing process, this may have affected their way of thinking, resulting in the non-significant difference in clinical reasoning scores between the control and the intervention group. Moreover, it was possible there were differences in thinking and learning present in the students assigned to each group, which the study could not control for by randomization.

The decline of some scores may be attributable to the scheduling of the posttest, which was administered after a day-long class. Participants were tired at the end of a long day's course work and may have experienced mental and physical fatigue. In addition, the knowledge that the posttest was not part of their graded coursework may have resulted in students putting less effort into the posttest.

Moreover, reading and language comprehension of the HSRT test items could also have affected the results of the CR scores, since English was not the primary language of the participants. According to the HSRT manual, to perform well on the test, language should not be a barrier to the test-taker (Insight Assessment, 2015).

The number of items per CR dimension, five or six for analysis, inference, and evaluation, and eight or nine for induction and deduction, which makes a total of 33 questions, may not have been sufficient to measure the changes in the participants' clinical reasoning ability. Finally, the HSRT assesses health professionals as a whole and not nurses specifically (Facione & Facione, 2006), and may not be sensitive enough to measure nursing students' clinical reasoning. In future studies, another tool can be investigated to be used instead of or in combination with the HSRT to measure clinical reasoning scores.

Strengths

This study also has a number of strengths. This is the first reported study conducted in the Philippines which evaluated a teaching program to enhance the development of clinical reasoning. This study responds to the goal of Philippine nursing education to discover teaching approaches that will promote early development of clinical reasoning among nursing students.

This study had a 100% participant response rate in both groups, and had completed all data required in the study. Also, a single clinical instructor supervising the participants in both groups decreased the risk of variability. Finally, the tool used to measure the clinical reasoning scores, the HSRT, has been widely used to measure clinical reasoning in a health-clinical context and had a high level of reliability.

Implications

Theory

The study results support and confirm the learning theories—self-efficacy, information processing, constructivism, and adult learning theory—in the following aspects:

The study confirms the "enactive mastery experience" aspect of self-efficacy learning theory, supporting Bandura's claim that repeated practice of skills is necessary to enhance retention and transfer of knowledge. In this study, the participants had a limited opportunity to apply the knowledge and skills of the OPT Model of Clinical Reasoning.

Information Processing Theory was applied in the study by participants organizing information through the use of their knowledge, experience, and cognitive processes to resolve a problem.

The claims of constructivism theory also proved useful in this study, allowing participants to build upon their own understanding and knowledge by using and reflecting upon their experiences to solve problems.

The premise/assumption that adult learners are more likely to succeed if they view the information as important and relevant to their professional, personal, and career needs, was illustrated in the study. With an introduction and orientation on the use of the OPT Model of Clinical Reasoning in solving clinical problems, the students tried to apply the concept of the OPT Model of Clinical Reasoning, albeit with limitations, in their clinical practice.

Education and Practice

Each student is unique in their ways of learning, with students using a variety of processes. Thus it is unlikely that a single tool exists that will be equally useful to each learner in developing their clinical reasoning expertise. This study suggests investigating other pedagogical and assessment approaches to better facilitate clinical reasoning development in nursing education.

This results of this study also suggest that nurse educators consider providing students with the opportunity to practice the OPT Model of Clinical Reasoning process over an extended period and a variety of didactic and clinical settings. Nurse educators should also evaluate the usual nursing process and its effect on clinical reasoning.

Future Research

Since this first such study to be conducted in the Philippines, future research should include replicating it with different population groups, comparing students in different clinical areas or courses, in different nursing schools, with different demographic profiles, and a larger sample size. In future studies, a longer implementation period for the OPT Model of Clinical Reasoning should be considered to ensure more valid results. Future investigations could explore other variables such as IQ and participant learning style as influences upon clinical reasoning. It would also be of interest to conduct a longitudinal study with one cohort of students/RNs (registered nurses). The integration of standard nursing processes should also be explored while using other strategies of teaching/developing clinical reasoning.

Moreover, further experimental studies could focus on different pedagogical approaches and strategies and their impact on the development of clinical reasoning. Qualitative studies, conducted alongside experimental studies to support the quantitative data, could help nurse educators better understand how clinical reasoning can be developed or enhanced.

The use of students' OPT worksheets as a sole measure of clinical reasoning limits the internal validity of the findings. It is suggested that more than one measure of clinical reasoning be applied to analyze each student's performance and the dimensions that are actually being measured. Researchers should incorporate other measures of clinical reasoning in addition to HSRT, which, although created to assess health care professionals and students, is not specific to the discipline of nursing. As a result, the items in the instrument may not adequately measure the clinical reasoning used by student nurses. Clearly, as clinical reasoning in nurses continues to be a topic of interest, there is a need for a measurement tool specific to nursing.

Conclusion

As an intervention program, the OPT Model of Clinical Reasoning did not have a significant impact on the development of clinical reasoning in all dimensions (e.g., inference, analysis, evaluation, induction, deduction, and overall) of third-year Filipino nursing students completing an orthopedic rotation, using the Health Sciences Reasoning Test as a measure of clinical reasoning. Group, gender, overall GPA, and professional nursing course GPA showed no significant differences in the students' overall clinical reasoning scores and was consistent with other five dimensions. Moreover, gender, overall GPA, professional nursing course GPA, and group interaction did not show any significant effect on clinical reasoning scores in all dimensions and overall. It is also noteworthy that deductive reasoning skill consistently was *not manifested* in the control group in both pretest and posttest. These data may not be generalizable to the whole nursing students' population.

Clinical reasoning is central to excellence in nursing education, practice, and research. However, the challenge of assessing and developing clinical reasoning skills remains an elusive goal for nursing education. More research is needed in this field to better establish and quantify the efficacy of assessment and development tools used for improving clinical reasoning in nursing education today. Specifically, this study suggests that more research be undertaken to determine an effective length of time in which to implement an educational program such as the OPT model as well as the most appropriate tool to measure clinical reasoning.

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APPENDIX A

CASE STUDY

Instructions:

Apply the OPT Model of Clinical Reasoning to this case study. Using the facts below, use cue logic, framing, testing, decision-making, and judgment to determine nursing care in this situation. Use the Clinical Reasoning Web worksheet to organize your reasoning.

An 85-year-old man was admitted with abdominal pain and with a diagnosis of necrotic gallbladder. Cholecystectomy was performed immediately and he has the following clinical manifestations and status post-operatively: Glasgow coma scale of 12, drowsy, BP of 68/32, respiratory rate of 8-10/minute, thready pulses with a rate of >115, with heart murmurs, skin cool to touch and pallor with capillary refill of 3-4 seconds, with CVP reading of 12, lung crackles, garbled speech, incision site with intact staples, oxygen per nasal cannula, intact JP drain, and foley catheter draining 20cc /hour. Abdominal examination revealed absent bowel sounds and was on NPO status. The patient would moan whenever he is moved and turned. Laboratory evaluation showed a Red Blood Cell Count of 4.33m/ul, Hematocrit of 39%, and Platelets of 64k/ul. The patient receives 2 units of plasma and packed RBCs and total parenteral nutrition at 50cc/hour. The medications include vancomycin and morphine at 1 mg every 10 minutes via patient-controlled analgesia (adapted from Kautz, Kuiper, Pesut, & Williams, 2006).

APPENDIX B

SAMPLE HSRT TEST QUESTION

(Retrieved from www.insightassessment)

A scientific study compared two matched groups of college women. The women in both groups were presented with information about the benefits of a healthy diet and regular exercise. The women in one group were paired with one another and encouraged to work as two-person teams to help each other stick with the recommended healthy regimen of smart eating and regular vigorous exercise. The women in the other group were encouraged to the same recommended regimen, but they were also advised to work at it individually, rather than with a partner or teammate. After 50 days the physical health and the well-being of all the women in both groups were evaluated. On the average the women in the first group (with teammates) showed a 26 point improvement in measures of cardiopulmonary capacity, body strength, body fat reduction, and sense of well-being. On average the women in the other group (encouraged to work as individuals) showed a 17 point improvement on those same measures. Using statistical analyses the researchers determined that the probability that a difference of this size had occurred by chance was less than one in 1000.

If true, these research findings would tend to support which of the following assertions?

A= A college woman cannot achieve optimal health functioning without a teammate.

B= Universities should require all students living in campus residence halls to participate in a healthy regime of smart eating and regular vigorous exercise.

C= A healthy diet will cause one to have a better mental health and physical strength.

D= This research study was funded by a corporation that makes exercise apparel.

E= A regimen of smart eating and regular exercise is related to better health.

APPENDIX C

INFORMATION LETTER TO NURSING STUDENTS

As part of nursing curriculum evaluation, the College of Nursing is going to evaluate a way of teaching clinical reasoning to nursing students. We will compare use of our traditional Nursing Process Model and use of a newer model, the Outcome-Present State Test Model (OPT) of Clinical Reasoning, on student development of clinical reasoning skills and measure it with a Health Sciences Reasoning Test. The goal is to evaluate the best way to help students develop clinical reasoning skills. We shall be collecting information to evaluate outcomes.

You will be part of this evaluation because you are going to be assigned to the orthopedic unit for clinical experience. Students assigned to the orthopedic unit will be assigned to one of two groups. All students will take a test called the *"Health Sciences Reasoning Test"* before and after the orthopedic unit clinical rotation. The test will take about 50 minutes and it will not affect your course grade.

Group 1 will have their clinical experience and will fill out the usual Nursing Care Plan form currently used during the 2-week clinical rotation. Group 2 will attend a classroom explanation/discussion and practice the *OPT Model of Clinical Reasoning* worksheets during the 2-week rotation.

The Health Sciences Reasoning Test will be used to evaluate whether there is any difference in clinical reasoning skills. All students will take the test, but it will not be a part of the course grade and the results will not affect your grade in anyway. Your information will be carefully protected and no identifying information will be shared.

We hope that we will learn something about ways to enhance clinical reasoning skills in nursing education. In the future what is learned may be published, but it will be done in a way that protects student identity. If you have questions about the process and evaluation please ask your Clinical Instructor or me.

Susy Jael, PhD (c), RN

APPENDIX D

UNIVERSITY APPROVAL LETTER

Adventist University of the Philippines

Office of the President
Puting Kahoy, Silang 4118 Cavite
P.O. BOX 1834, Manila1099 Philippines
Tel No. (049) 541-12-11 to 25 loc. 202
(02) 888-58-67
Fax No: (049) 541-12-28
E-mail: president@aup.edu.ph
aupprexy@yahoo.com

July 7, 2014

International Review Board
Loma Linda University
Office of the Vice President of Research Affairs
24887 Taylor Street, Suite 202
Loma Linda, California 92350

Dear Sirs/Mesdames:

Greetings from the Adventist University of the Philippines.

This is to officially inform you that the administration has approved **Mrs. Susy Jael** to collect research data on AUP nursing students for her study entitled "The Effect of Using the OPT Model of Clinical Reasoning on Clinical Reasoning Development of Filipino Senior Nursing Students."

Mrs. Jael has the support of the administration in her data gathering and other other related activities to fulfill her requirements towards the degree Doctor of Philisophy in Nursing.

Thank you.

Sincerely,

Francisco D. Gayoba, DTheol
President

/ltm

APPENDIX E

IRB LETTER OF APPROVAL FOR EXEMPTION

LOMA LINDA UNIVERSITY

INSTITUTIONAL REVIEW BOARD

RESEARCH PROTECTION PROGRAMS

24887 Taylor Street • Suite 202 • Loma Linda, CA 92350

(909) 558-4531 (voice) • (909) 558-0131 (fax)

Exempt Notice ***IRB# 5140199***

To: **Pothier, Patricia K**

Department: **Nursing Graduate Programs**

Protocol: **The effects of using the OPT model of clinical reasoning education on clinical reasoning development of Filipino nursing students**

Your application for the research protocol indicated above was reviewed administratively on behalf of the IRB. This protocol is determined to be exempt from IRB approval as outlined in federal regulations for protection of human subjects, 45 CFR Part 46.101 (b)(1).

Stipulations of approval:

Please note the PI's name and the IRB number assigned to this IRB protocol (as indicated above) on any future communications with the IRB. Direct all communications to the IRB c/o Research Protection Programs.

Although this protocol is exempt from further IRB review as submitted, it is understood that all research conducted under the auspices of Loma Linda University will be guided by the highest standards of ethical conduct.

Signature of IRB Chair/Designee: R L Rigsby Date: 9/4/14

Loma Linda University Adventist Health Sciences Center holds Federalwide Assurance (FWA) No. 00006447 with the U.S. Office for Human Research Protections, and the IRB registration no. is IORG0000226. This Assurance applies to the following institutions: Loma Linda University, Loma Linda University Medical Center (including Loma Linda University Children's Hospital, LLU Community Medical Center), Loma Linda University Behavioral Medicine, and affiliated medical practices groups.

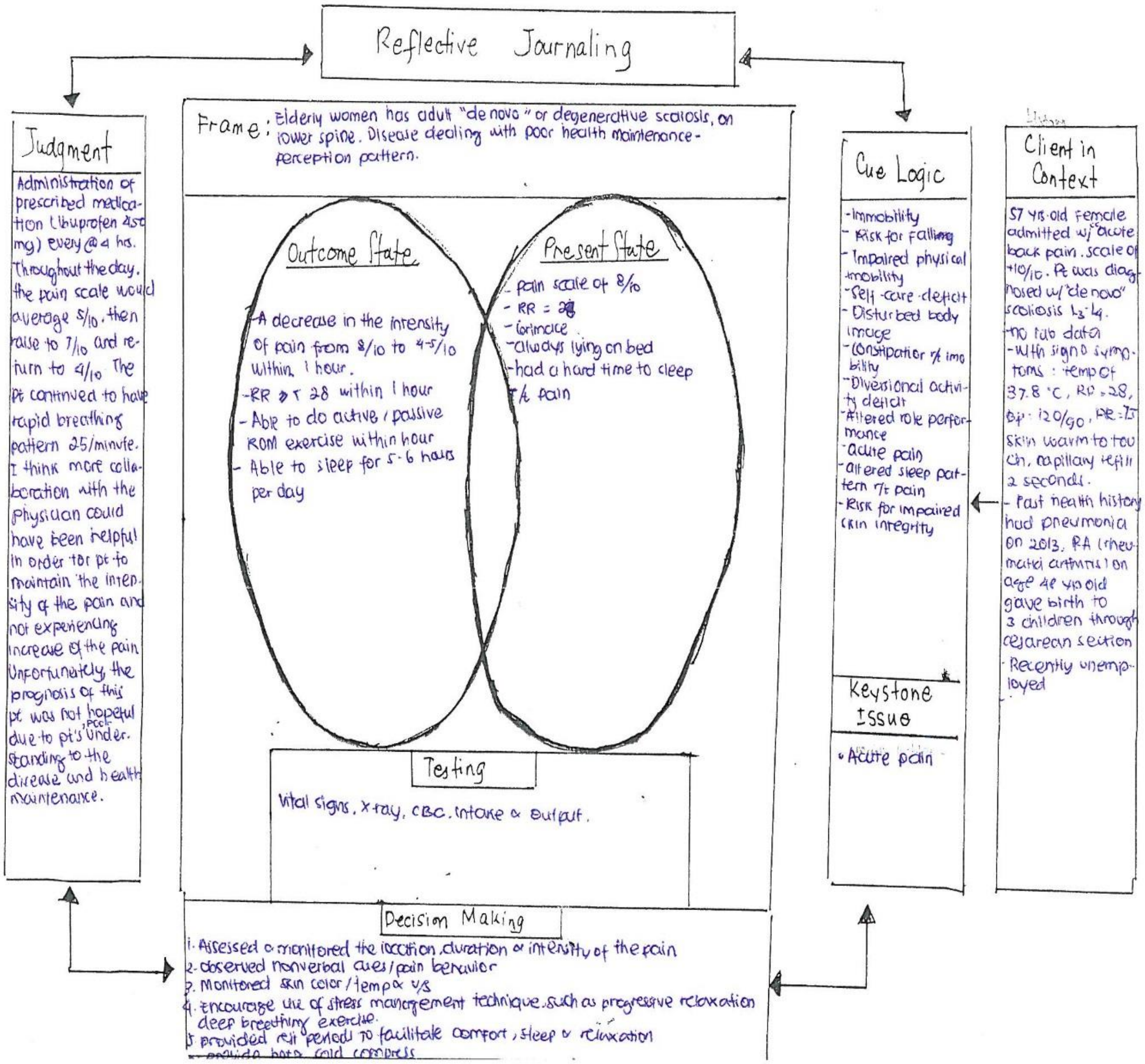
IRB Chair:
Rhodes L. Rigsby, MD, MBA
Department of Medicine
(909) 558-2341, rrigsby@llu.edu>

IRB Administrator:
Linda G. Halstead, MA, Director
Research Protection Programs
Ext 43570, Fax 80131, lhalstead@llu.edu

IRB Analyst:
Anuradha Diekmann, MPH, CCRP
Research Protection Programs
Ext 86215, Fax 80131, adiekmann@llu.edu

APPENDIX F

SAMPLE OF STUDENTS' OPT WORKSHEET



APPENDIX G

SAMPLE OF STUDENTS' CLINICAL REASONING WEB WORKSHEET

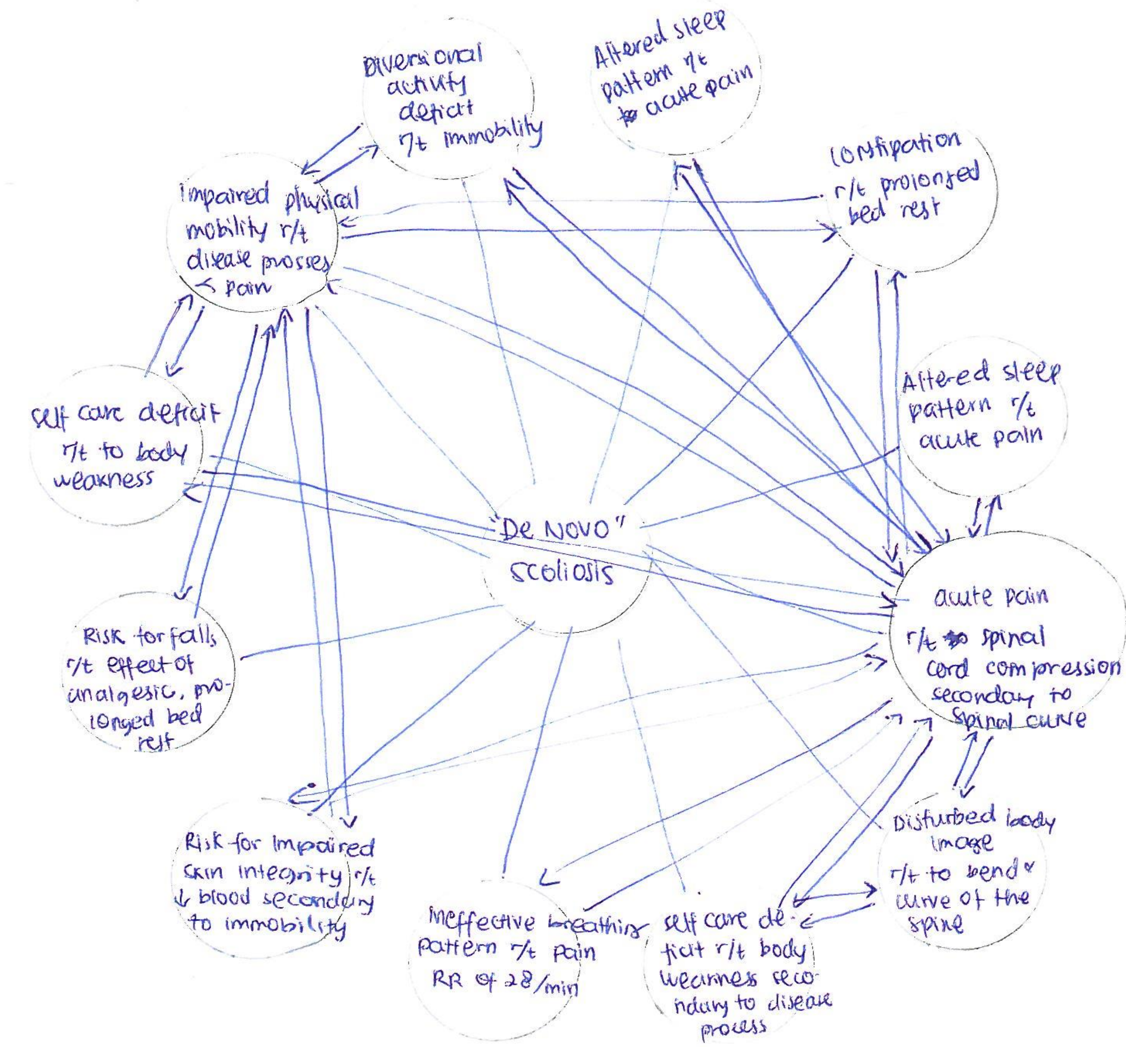
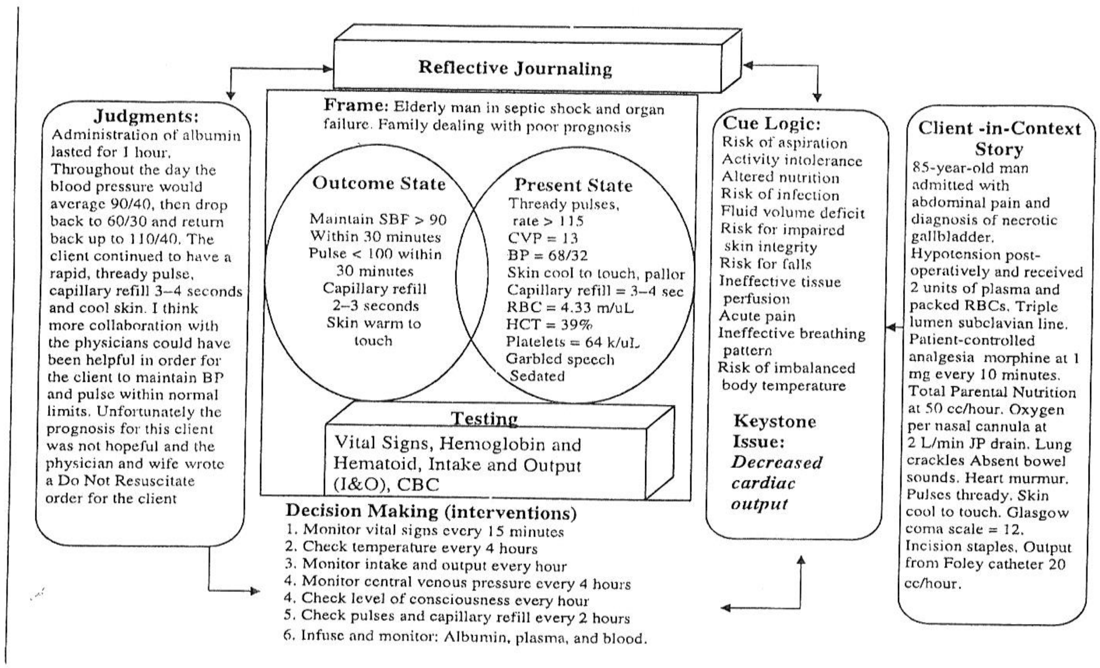


figure 1. sample of one student's Clinical Reasoning web.

APPENDIX H

SAMPLE OF OPT WORKSHEET BASED ON CASE STUDY IN APPENDIX A

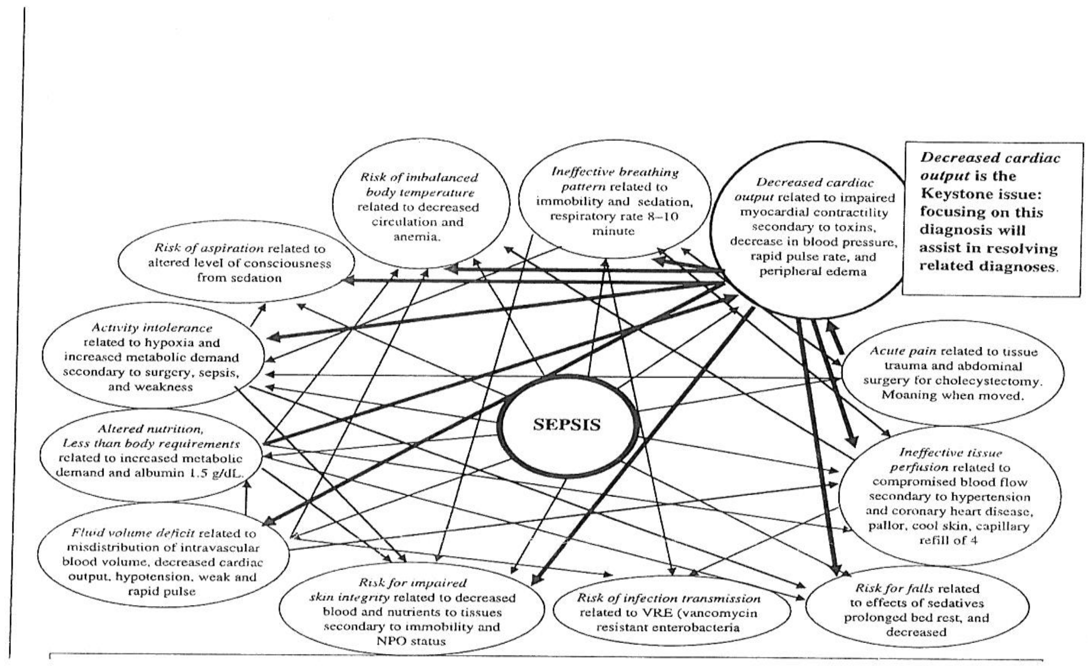
(From the study of Kautz, D, Kuiper, R., Pesut, D., Pesut & Williams, 2006)



APPENDIX I

SAMPLE OF CLINICAL REASONING WEB WORKSHEET BASED ON CASE STUDY IN APPENDIX A

(From the study of Kautz, D, Kuiper, R., Pesut, D., Pesut & Williams, 2006)



APPENDIX J

SAMPLE OF THE NURSING CARE PLAN WORKSHEET USED IN THE USUAL NURSING PROCESS EDUCATION

ADVENTIST UNIVERSITY OF THE PHILIPPINES
COLLEGE OF NURSING - CLINICAL DIVISION

NURSING CARE PLAN

Student's Name: ____________
Supervising Clinical Instructor: ____________
Clinical Area / Blocking: ____________

Date of Actual Patient Care: ____________
Agency: ____________
Shift: AM ☐ PM ☐ NOC ☐

Name of Patient: ____________
Sex: Male ☐ Female ☐ Age: ____

Address: ____________
Civil Status: Single ☐ Married ☐ Divorced ☐ Annulled ☐ Widowed ☐ N/A ☐

Educational Attainment: ____________

Occupation: ____________

Chief Complaints ____________
Impression / Diagnosis ____________

Date of Admission: ____________
Attending Physician: ____________

History of Present Illness:

Past Medical and / or OB History:

Family Medical History:

For Pediatric Clients

Delivery History:

Feeding History:

Immunization History:

HEALTH ASSESSMENT BASED ON GORDON'S FUNCTIONAL HEALTH PATTERN

I. Health Maintenance - Perception Pattern

Cigarette	☐ No	☐ Yes	☐ Quit	Date: ________
	☐ <1 pk/day	☐ 1-2 pks/day	☐ >2 pks/day	
Alcohol:	☐ No	☐ Yes	☐ Quit	Date: ________
	☐ Beer	☐ Hard Liquor	☐ Other type	Specify: ________
	☐ 1-2 bottles/session	☐ >2 bottles/session	☐ Other amount	Specify: ________
Drugs:	☐ No	☐ Yes	Type of Drug: ________	Purpose: ________
Allergies:	☐ Drugs	☐ Food	☐ Dyes ☐ Others	Specify: ________

II. Nutritional - Metabolic Pattern

Special Diet:	☐ No	☐ Yes	Specify: ________	
Dietary Supplements / Vitamins:		☐ No	☐ Yes	
Appetite:	☐ Normal	☐ Increased	☐ Decreased	☐ Decreased taste sensation
	☐ Nausea	☐ Vomiting	☐ Stomatitis	☐ Weight loss / gain ________ lbs.
Swallowing:	☐ Normal	☐ With Difficulty	☐ With NGT	
Dentures:	☐ Upper (___ Partial ___ Full)		☐ Lower (___ Partial ___ Full)	

III. Elimination Pattern

Bowel Habits:	☐ Constipation	☐ Diarrhea	# of BM's / day: ________	Date of Last BM: ________
	☐ with Ostomy	☐ Appliance	☐ Self Care	
Bladder Habits:	☐ Frequency	☐ Dysuria	☐ Burning	☐ Urgency
	☐ Hematuria	☐ Dribbling	☐ Nocturia	
Incontinency:	☐ Yes	☐ No	☐ Daytime	☐ Nighttime
	☐ Occassional	☐ Difficulty delaying voiding		☐ Difficulty reaching toilet
Catheterization:	☐ Retention / Indwelling / Foley		☐ Straight	☐ Condom / Weebag
	☐ Cystoclysis	Urine Output / shift: ________cc/ml		Urine Color: ________

IV. Activity and Exercise

Self Care Ability: 0 = Independent 1 = Assistive device 2 = Assistance from others
3 = Assistance from person and equipment 4 = Dependent / Unable

	0	1	2	3	4	
Eating / Drinking						
Bathing						
Dressing / Grooming						
Toileting						
Bed Mobility						
Transferring						
Ambulating						
Stair Climbing						
Shopping						
Cooking						
Home Maintenance						

V. Sleep / Rest Pattern

Sleeping Habits:	☐ Regular	☐ Irregular	☐ with AM Nap	☐ with PM Nap
	Time of Sleep: ______	Time of arising: ______	Total hours of sleep night: ______	
	☐ Feeling rested after sleep		☐ Feeling inadequately rested after sleep	
Problems:	☐ None	☐ Early waking	☐ Insomnia	☐ Nightmares

VI. Cognitive - Perceptual Pattern

Mental Status:	☐ Alert	☐ Oriented	☐ Confused	☐ Combative
	☐ Unresponsive	☐ Receptive Aphasia		
Speech:	☐ Normal	☐ Slurred	☐ Garbled	☐ Expressive Aphasia
	Spoken language: ______________		Interpreter: ______________________	
Level of Anxiety:	☐ Mild	☐ Moderate	☐ Severe	☐ Panic
Hearing:	☐ Normal	☐ Impaired (___ Right ___ Left)		☐ Deaf (___ Right ___ Left)
	☐ Hearing Aid	☐ Tinnitus		
Vision:	☐ Normal	☐ Eyeglasses	☐ Contact lens	☐ Vertigo
	☐ Impaired (____ Right ____ Left)		☐ Blind (____ Right ____ Left)	
Discomfort / Pain:	☐ None	☐ Acute	☐ Chronic	Description: ______________
	Pain Management: ______________________________________			

VII. Role - Relationship Pattern

Marital Status:	______________	Occupation: ______________		
Employment:	☐ Employed	☐ Unemployed	☐ Short-term / long-term disability	
Support System:	☐ Spouse	☐ Neighbors / Friends	☐ None	☐ Other / Specify: ________
Family concerns regarding hospitalization: ______________________________________				

VIII. Sexuality - Reproductive Pattern

LMP: ________	Gravida: __________	Para: __________	
Menstrual / Hormonal Problems:	☐ Yes	☐ No	Last Pap Smear: ______________
Monthly Self-Breast/Testicular Exam:	☐ Yes	☐ No	Sexual concerns: ______________

IX. Coping - Stress Tolerance / Self - Perception / Self - Concept Pattern

Major Concerns regarding hospitalization or illness (financial, self care): ______________________________			
Major loss / crisis / change in past year/s:	☐ Yes	☐ No	Specify: ______________
Fear of Violence:	☐ Yes	☐ No	Who / Specify: ______________
Outlook on Future: ________	(rate 1-poor to 10-very optimistic)		Describe: ______________

X. Value - Belief Pattern

NURSING CARE PLAN

Problem	Cues	Nursing Diagnosis and Rationale	Goals and Objectives	Nursing Interventions	NI Rationale (with references	Evaluatio
# ______	Subjective Data:	Nrsg Dx:		Independent		
		Rationale:				
	Objective Data:	Reference:		Dependent:		