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Cognitive Preference and Skill Acquisition: The Relationship Between Student Nurse Anesthetists and Certified Registered Nurse Anesthetists Thinking Styles

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by

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ABSTRACT

Cognitive Preference and Skill Acquisition: The Relationship between Student Nurse Anesthetists and Certified Registered Nurse Anesthetists Thinking Styles

by

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Decision-making in healthcare is a complex and, at times, uncertain process. In the United States Certified Registered Nurse Anesthetists (CRNA) administer the majority of anesthesia. Nurse Anesthetists must draw on their educational background, clinical experience, and cognitive processes to make sound clinical judgments. To avoid errors understanding the relationship between cognitive preference and skill acquisition is critical. This study was designed to describe the cognitive preferences of Student Nurse Anesthetists (SRNAs) and CRNAs in the United States. The 2 cognitive preferences explored are rational (analytical) and experiential (intuitive) decision-making.

The researcher used a quantitative, cross-sectional, descriptive correlational design. The researcher administered the *Rational Experiential Inventory* (*REI-40*) via electronic survey to enrolled SRNAs and practicing CRNAs. The *REI-40* is a validated psychometric tool involving 40 questions. Twenty questions evaluate each decision-making style. Ten questions assess engagement (e.g., enjoyment and reliance), and 10 questions assess the ability (e.g., capability and use) of each style. The demographics (e.g., age, gender, clinical experience, setting, and education) were collected and compared with the cognitive preference.

This study revealed that SRNAs' and CRNAs' dominant cognitive preference was rational thinking and experiential thinking was greater than mid-scale. There was no statistical difference in how SRNAs and CRNAs scored on the *REI-40 Inventory*. Furthermore, there were no strong correlations between years of experience and cognitive preferences. However, there was a statistically significant difference in experiential cognitive ability and engagement when compared by gender identity.

Ideally how one feels, and thinks should be aligned when making clinical decisions. This is the art and science of the profession. Research has revealed that human factors such as cognitive biases, heuristics, personal experience, and emotions play a role in decision-making. The development and integration of experiential decision-making is essential to aligning clinical judgment and safe patient care. This study describes SRNAs' and CRNAs' cognitive preferences and the relationship to the level of skill acquisition. This knowledge contributes to the understanding of CRNAs' decision-making processes. Furthermore, there are ramifications for developing continuing education and clinical support tools for the profession.

DEDICATION

This research is dedicated to the Nurse Anesthesia profession, which has given the author numerous opportunities and a fulfilling career. Nursing and the Nurse Anesthesia profession has taught this provider patient advocacy, high quality, and safe care and what it means to be vigilant.

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Chapter 1. Introduction

The landmark report by Kohn and colleagues (2000), "*To Err is Human: Building a Safer Health System*," brought to light medical errors, cognitive processes in decision-making, and the concept of evidence-based practice. The researchers assert that as many as 98,000 people die each year from medical errors in United States hospitals (Kohn et al., 2000). The cost of these medical errors to the healthcare system were estimated to be between $17 billion and $29 billion per year (Kohn et al., 2000). It is approximated that more people die each year from healthcare errors than from motor vehicle accidents or breast cancer (Kohn et al., 2000). Kohn and colleagues (2000) recommended that healthcare professionals recognize and learn from their errors to improve systems and safety. Therefore, understanding the cognitive processes used in decision-making and influencing factors is critical.

Cognitive processes include how providers think, know, remember, judge, and solve problems (Stiegler & Tung, 2014). Studies have suggested that this process is inundated with errors, wide variability in practices, multiple influences, and noncompliance to evidence-based guidelines (Aronson et al., 2003; Kohn et al., 2000; Kremer et al., 2019; Stiegler & Ruskin, 2012). Clinical decision-making is how a healthcare provider employs prior knowledge, reason, and the clinical situation to formulate a diagnosis and action plan (Croskerry, 2002; Fomberstein & Ruskin, 2015; Tanner, 2006). In principle, clinical decisions should be straightforward, consistent, and sound. However, people commonly experience differences between what they think (e.g., rational and analytical thinking) and how they feel (e.g., experiential and intuitive thinking) (Pacini & Epstein, 1999).

Clinical experience is the catalyst for developing pattern recognition and intuitive cognitive processes by putting evidence-based guidelines to practice (Benner, 2001; Traynor et

al., 2010). Benner (2001) describes the levels of skill acquisition as a progression from a novice who uses primarily analytical guidelines to an expert nurse who integrates experiential cognitive processes. This integration enables the nurse to align the heart, "how they feel," and head, "how they think," to make clinical decisions in a rapid, automatic, and holistic manner (Benner, 2001).

This study was focused on the nurse anesthesia population. Certified Registered Nurse Anesthetists (CRNA) administer more than 50 million anesthetics each year to patients in the United States (American Association of Nurse Anesthetists [AANA], 2021a). CRNAs have provided anesthesia for more than 150 years and were the first nursing specialty accorded direct reimbursement rights from Medicare (AANA, 2021a). Moreover, CRNAs comprise more than 80% of anesthesia providers in rural counties (AANA, 2021a). A fundamental component to providing safe and effective anesthesia care is appropriate clinical decision-making. In healthcare decision-making is a complex system involving educational background, clinical experience, judgment, and cognitive processes (Krishnan, 2018; Lee et al., 2017; Thompson et al., 2004).

CRNAs make clinical decisions in a highly volatile, dynamic, and uncertain environment. These decisions rely on cognitive processes that employ analytical knowledge, pattern recognition, and experiential learning. Many CRNAs are unaware of their cognitive preferences, abilities, or biases, the ramifications of which are not fully appreciated. The study of cognitive processes and associated influences is critical to providing competent, consistent nurse anesthesia care. Therefore, understanding the implications of cognitive preferences and abilities on clinical decision-making can cultivate and improve patient care habits.

Background

This study was focused on nurse anesthetists' cognitive processes related to decision-making. The two processes of interest are rational, also called analytical, and experiential, also

called intuitive. Clinical guidelines are an analytical approach to communicate evidence-based practice (Sladek et al., 2008a). The *AANA Guidelines and Standards for Nurse Anesthesia Practice* (2021b) define optimal decision-making as clinical decisions congruent with evidence-based guidelines and standards of practice. The AANA developed evidence-based guidelines to assist CRNAs' decision-making (AANA, 2021b). The essential components to evidence-based practice are patient preference and values, clinical expertise, and best research evidence (AANA, 2021b).

Patient care experience is an intuitive approach to developing clinical decision-making. The clinical experience and educational requirements to become a CRNA are rigorous. There is a minimum of 7 to 8 calendar years of education and experience to prepare for practice (AANA, 2021a). The minimum education requirement to enter a Nurse Anesthesia program is a baccalaureate or graduate degree in nursing. As of 2022, all accredited Nurse Anesthesia program graduates will hold a doctorate in Nursing Practice degree. Nurse anesthesia programs average 2,604 hours of clinical experience (AANA, 2021a). In addition, nurse anesthesia programs admission requirements include a minimum of 1 year of full-time critical care experience. Upon completion of a CRNA program, a graduate completes a total of 9,369 hours of clinical experience through their baccalaureate program, critical care experience, and nurse anesthesia curriculum. Therefore, analytical education and clinical experience are vital in developing this advanced practice nursing specialty.

The science of human factors and critical thinking has not been fully explored in healthcare but can profoundly impact the profession (Eltoria, 2018; Thompson & Stapley, 2011). Clinical decision-making is a dynamic process that affects patient outcomes (Johansen & O'Brien, 2016). Nurses employ multiple factors and cognitive processes in decision-making

(Melin-Johansson et al., 2017; Nibbelink & Brewer, 2018). Unfortunately, medical errors and patient complications are a reality of the hospital clinical setting (Kohn et al., 2000). Specifically, Kremer et al. (2019) revealed that violations of practice standards and lapse in judgment attributed to anesthesia-related perioperative complications.

Concepts of Decision-Making, Intuition, and Expertise

The importance and value of intuitive decision-making are foundational to the nursing experience (Benner et al., 2009). Johansen and O'Brien's (2016) concept analysis of decision-making in nursing identified attributes of intuition and analysis, heuristics, experience, knowledge, clinical reasoning, and critical thinking. The primary antecedent to decision-making is situation awareness. In other words, situation awareness prompts the nurse to decide a course of action (Johansen & O'Brien, 2016). Therefore, nurses achieve sound clinical judgment by integrating evidence-based knowledge and intuitive thinking, prioritizing patient needs, and continually assessing and evaluating outcomes (Manetti, 2019).

Johansen and O'Brien (2016) asserted that decision-making in nursing practice is a complex process. This process involves gathering subjective and objective patient data, evaluating that information, and implementing actions to achieve outcome goals (Johansen & O'Brien, 2016). Furthermore, factors such as experience, knowledge, and the ability to cope with rapidly changing situations influence the process significantly (Johansen & O'Brien, 2016). Limitations to this concept analysis were contextual factors (e.g., level of experience, values, education, stress, and clinical setting). Johansen and O'Brien (2016) posit that further research on the effects of contextual factors is required to understand the phenomenon thoroughly.

Integral to decision-making in nursing practice is the role of experience and intuition. The defining attributes of intuition are centered around knowledge that is holistic, immediate, not

preceded by inference, and a knowledge that is drawn from synthesis rather than analysis (Chilcote, 2017; Robert et al., 2014). For intuition to occur knowledge and experience must precede (Robert et al., 2014). Effken (2001) posits that intuition is part of an intrinsic quality resulting from direct perception acquired through education and experience. Furthermore, intuition is related to enhanced clinical judgment, effective decision-making, and crisis aversion (Robert et al., 2014).

Lastly, Hutchinson and colleagues (2016) conducted a concept analysis of nursing expertise. The researchers differentiated the concepts of competence and expertise. Competence suggests the acquisition and satisfactory performance of routine skills (Hutchinson et al., 2016). Competence refers to knowledge and skills in a familiar problem setting. In contrast nursing expertise is a skilled form of adaptive mastery, in which nurses solve problems in unfamiliar situations through high-order reasoning and performance (Hutchinson et al., 2016). Therefore, an expert is a nurse who possesses tacit knowledge and mastery of a domain (Hutchinson et al., 2016).

The central construct to nursing expertise is intuition (Hutchinson et al., 2016). Experienced nurses frequently use intuition in their clinical decision-making (Payne, 2015; Pearson, 2013). Intuition encompasses situational awareness and understanding of the practice context. Attributes associated with nursing expertise include superior practice, holistic care, and the integration of practical and theoretical knowledge (Bonner, 2003; Christensen & Hewitt-Taylor, 2006; Hutchinson et al., 2016). The antecedents to nursing expertise are time, experience, and knowledge (Hutchinson et al., 2016). These antecedents enable an expert nurse to demonstrate sustained perception, advanced reasoning, and complex clinical performance. Hutchinson et al. (2016) describe expertise as linking the multiple attributes of knowledge in a

proficient, rapid, and context-sensitive manner. This perspective of an expert's understanding and reasoning is identified as nursing intuition (Hutchinson et al., 2016).

Lyneham and colleagues (2008) support and further describe intuition and experiential thinking in the expert nurses' decision-making. Lyneham et al. (2008) posit that expert emergency room nurses exhibit three distinct phases of intuition. These phases are cognitive intuition, where a patient assessment is processed subconsciously and can be rationalized afterward; transitional intuition is when a physical sensation or other behaviors enter the nurse's awareness; and embodied intuition, when the nurse trusts their intuitive thoughts (Lyneham et al., 2008). Pretz and Folse (2011) assert that experienced nurses, as compared to new graduates, preferred their intuition. These findings support the assertion that expert nurses use intuitive thinking in their decision-making process.

Research Problem

The foundation to making clinical decisions are cognitive processes. Rational cognitive process is a conscious and relatively slow processing system (Pacini & Epstein, 1996). Experiential cognitive process is a preconscious and rapid processing system (Pacini & Epstein, 1996). Understanding the relationship between these cognitive processes and the level of skill acquisition provides insight that can improve clinical decision-making, patient safety, and reduce adverse events.

A review of the *AANA Malpractice Foundation* database of closed claims revealed that many errors were preventable and were related to communication failures, violation of practice standards, and flaws in judgment (Jordan & Quraishi, 2015; Kremer et al., 2019; Larson & Jordan, 2001). This study will be a catalyst for understanding cognitive preferences in the student nurse anesthetist (SRNA) and CRNA population. Furthermore, there are ramifications for

developing continuing education and clinical support tools for SRNAs' and CRNAs' education, training, and practice.

The specific aims of this study were to:

1. Describe SRNAs' and CRNAs' cognitive preferences.
2. Describe the relationship between cognitive preferences and clinical experience in SRNAs and CRNAs.
3. Describe the relationship between the cognitive preferences and anesthesia practice setting and models in CRNAs.
4. Describe the differences in cognitive preference of a SRNA compared to a CRNA.

Purpose

This study's purpose was to describe the cognitive preferences of SRNAs and CRNAs. Because there is limited research on this topic, the purpose was written as a declarative statement (Wood & Ross-Kerr, 2011). The assumptions of this study were that clinical experience and the level of skill acquisition influence SRNAs' and CRNAs' cognitive preferences.

Research Questions

The research questions guiding this study were:

1. What are the cognitive preferences and abilities of SRNAs and CRNAs?
2. What is the relationship between cognitive preference and clinical experience (e.g., years of experience, practice setting, and Critical Care certification (CCRN) in SRNAs?
3. What is the relationship between cognitive preference and clinical experience (e.g., years of experience, anesthesia practice model, and practice setting) in CRNAs?

4. What are the differences in cognitive preference of an enrolled SRNA compared to a practicing CRNA?

Limitations

This study was limited to actively enrolled SRNAs and practicing CRNAs in the United States. The survey response rate determines the strength of generalizability and interpretation of the results. The reliability and validity of the instrument addressing rational and experiential cognitive preference have been established. However, this was the first use of this instrument to a SRNA and CRNA sample. Further evaluation will be required to confirm findings. Lastly, the results were self-reported by volunteer participants. Therefore, self-reporting instruments may lead to greater participation from participants interested in and knowledgeable in the research area.

Delimitations

Cognitive preference was measured using the *Rational Experiential Inventory* (*REI-40)*. The cognitive process instrument is based on preference, ability, and engagement of the *Dual Processing Model of Reasoning* (e.g., rational and experiential). Each variable was examined statistically. The reliability and validity of this instrument have been determined. This study did not examine factors such as personality traits, motivation, recent continuing education, and problem-solving styles. There may be other instruments that measure these variables.

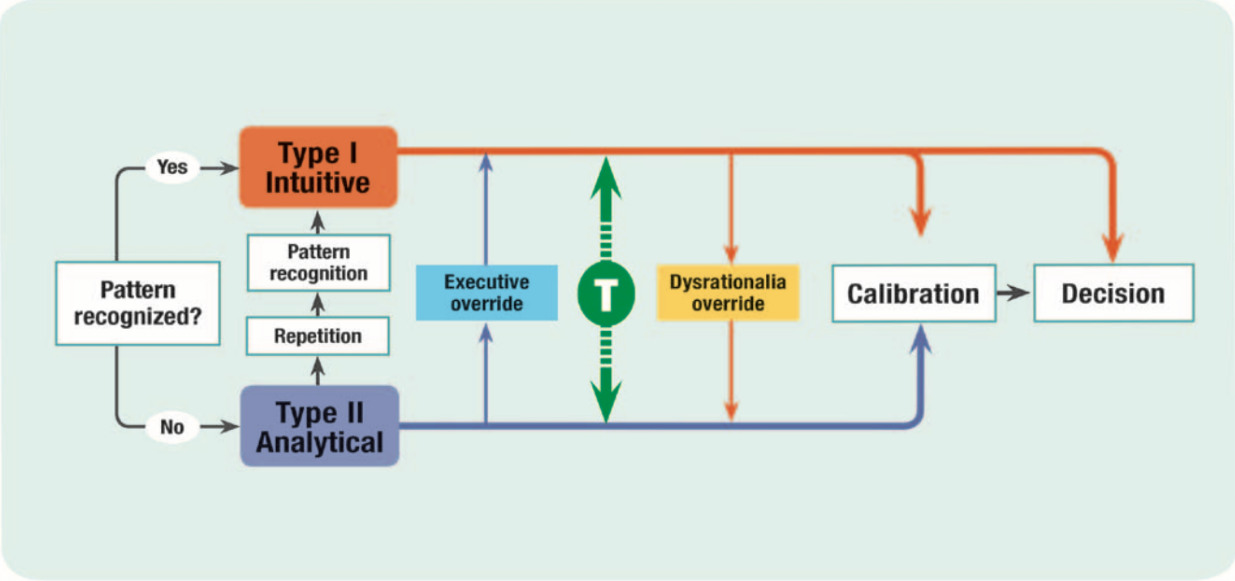
Theoretical Framework

Benner's *Model of Skill Acquisition in Nursing* (1984; 2001) is a framework to guide the evaluation of nurses' skill development and decision-making in the clinical setting. *The Dual Processing Model of Reasoning* and *Cognitive Experiential Theory* (CET) provides a framework for understanding this decision-making process (Kahneman, 2011; Pacini & Epstein, 1999) (see

Figure 1). This study overlays Benner's (2001) *Model of Skill Acquisition in Nursing* and CET to provide a practical theoretical framework for studying CRNAs' clinical decision development and evolution (see Figure 2). The research model outlines the five skill acquisition stages: novice, advanced beginner, competent, proficient, and expert overlayed with the development of experiential decision making through repetition and pattern recognition (see Figure 2).

Figure 1

Dual Processing Model of Reasoning



Benner's Model of Skill Acquisition in Nursing

Benner's *Model of Skill Acquisition in Nursing* (2001) is a framework that evaluates nurses' clinical reasoning and development in the profession. Benner (2001) cites the *Dreyfus Model of Skill Acquisition* (1980) as a valuable tool to be generalized to nursing. Benner's model outlines five stages to skill acquisition: novice, advanced beginner, competent, proficient, and expert (Benner, 2001; Dreyfus & Dreyfus, 1980). These five stages have been the foundation for nursing theory education (McEwen & Wills, 2019). Benner's model reflects a philosophy of science that is intuitive and humanistic in the approach to decision-making (Benner, 2001;

Thompson, 1999). Moreover, this model has been used to evaluate critical care and Advanced Practice Nurses (Dale et al., 2013; Stinson, 2017).

Benner's (2001) model describes the stages as follows. A novice nurse is a beginner with no experience (e.g., new graduate or less than 6 months experience) (Benner, 2001). Because there is no situational experience, objective attributes are taught concerning a patient's condition (e.g., vital signs and symptoms). The novice nurse also learns guidelines or standards that steer nursing interventions and actions (Benner, 2001). The novice nurses' challenge is the inability to use discretionary judgment due to a lack of experience (Benner, 2001).

The next stage in development is an advanced beginner (e.g., 7 months to 1 year experience). An advanced beginner nurse can perform at an acceptable level (Benner, 2001). Due to sufficient experience, recurrent situations or aspects are identifiable. As Benner (2001) describes, recurrent situations are global characteristics that require prior situational experience to recognize. The challenge of the advanced beginner nurse is prioritizing clinical aspects to determine which are most relevant and need immediate attention.

The next stage in Benner's model is the competent nurse. Benner (2001) predicts this stage will occur after 2 to 3 years of experience. The competent nurse can situate their interventions in the patient's long-term goals (Benner, 2001). The nurse's interventions and care plan are based on conscious, abstract, and analytical decision-making processes (Benner, 2001). The competent nurse can view the patient holistically and rendering decision-making less difficult.

The next progression is a proficient nurse. Benner (2001) describes a proficient nurse as one who perceives the situation holistically, and principles guide decisions. Experience-based knowledge facilitates the proficient nurse in understanding the situation and recognizing what is

expected and unexpected (Benner, 2001). This holistic understanding improves the decision-making process. Benner (2001) describes the decision-making process as less labored. Furthermore, case studies and contextual learning effectively educated the proficient nurse.

The last stage is an expert. In the expert stage nurses no longer depend on analytical principles (e.g., rules, guidelines, standards) to connect meaning to a clinical situation (Benner, 2001). Instead, expert nurses have a background of experience that enables an intuitive understanding of clinical situations. The expert nurse also collects a broader range of patient cues in making decisions (Hoffman et al., 2009). However, Benner (2001) clarifies that an expert nurse still uses analytical tools for decision-making. Analytical tools are still necessary because of healthcare's ever-changing and dynamic nature. However, expert nurses can recognize patterns, act rapidly, and provide holistic care due to their vast clinical experience (Benner, 2001).

Benner's (2001) model describes the evolution from novice nurses to an expert. This progression occurs by applying analytical knowledge to nursing practice and developing intuitive judgment through clinical experience. The core concepts of Benner's model are competence, skill acquisition, experience, clinical knowledge, and practice knowledge (Benner, 2001). Benner (2001) posits that expert-level nursing and clinical decision-making result from experiential and intuitive cognitive processing.

Dual Processing Model of Reasoning and the Cognitive Experiential Theory

A leading psychological model on how individuals manage information is the *Dual Process Model of Reasoning* (see Figure 1). The *Dual Process Model of Reasoning* describes the role of Type 1 (e.g., intuitive) and Type 2 (e.g., analytical) cognitive processes in decision-making (Croskerry, 2009; Fomberstein & Ruskin, 2015; Kahneman, 2011; Stiegler & Tung,

2014). This model suggests that people toggle between Type 1 and Type 2, and each system helps recalibrate or override in a particular scenario (Kahneman, 2011). This model does not suggest that one system is superior to the other. Both types of cognitive systems can produce errors in decision-making (Croskerry, 2009; Stiegler & Tung, 2014).

Cognitive Experiential Theory (CET) is a refinement of the *Dual Process Model of Reasoning* (Pacini & Epstein, 1999). CET posits that people understand a situation by Type 1 (e.g., intuitive or experiential) and Type 2 (e.g., analytical or rational) information-processing systems. The Type 1 system is preconscious, rapid, holistic, automatic, and primarily nonverbal. Type 2 is inferential, operates through cultural rules of reasoning, is conscious, and is relatively slow. The rational system is an analytical, affect-free system and relies primarily on verbal interaction (Pacini & Epstein, 1999).

CET places the *Dual Process Model of Reasoning* in the context of behavior (Pacini & Epstein, 1996). The contribution of each information-processing system varies from situation to situation. Under most circumstances rational-experiential systems operate simultaneously, and individuals are unaware of the two processes (Pacini & Epstein, 1999). However, if a situation causes a conflict between how individuals know versus how they feel, their dominant quality becomes apparent (Pacini & Epstein, 1999). Therefore, understanding a CRNA's cognitive preference and ability is vital to understanding their clinical decision-making process.

Furthermore, the experiential system can influence rational thought processes. Experiential processing is emotionally driven, highly compelling, and can override the rational system (Epstein, 2003). This phenomenon leads to decision-making described as "against their better judgment" (Epstein, 2003). The implications for the healthcare environment are implementing strategies that develop and train the rational system to correct and guide the

experiential system. An example of this strategy is practicing and evaluating each step of a clinical guideline or treatment pathway. This process allows for self-awareness and reflection on decisions that appear to conflict with the individuals' clinical experience (Epstein, 2003).

Pacini and Epstein (1999) developed the *Rational Experiential Inventory* (*REI-40*) that employs the CET framework. CET and *REI-40* have been used to explore physician's, nurse's, paramedic's, and pharmacist's cognitive preferences and decision-making (Alba, 2018; Alshaalan et al., 2019; Burbach et al., 2015; Calder et al., 2012; McLaughlin et al., 2014; Williams et al., 2016). CET and *REI-40* have not been studied in the CRNA population. Applying this theory and instrument to nurse anesthesia will fill a knowledge gap in this area.

The strength of the *Dual Process Model of Reasoning*, CET, and the *REI-40* instrument is that they aid in identifying cognitive preference, ability, and engagement of each information processing system. Self-awareness is vital before effective situational awareness and decision-making. CRNAs must be knowledgeable in analytical guidelines and clinical experience to fully appreciate a patient's status. Equally vital is how CRNAs process data and the influence of personal experience. Self-awareness is essential to developing consistent, safe, and quality clinical decision-making.

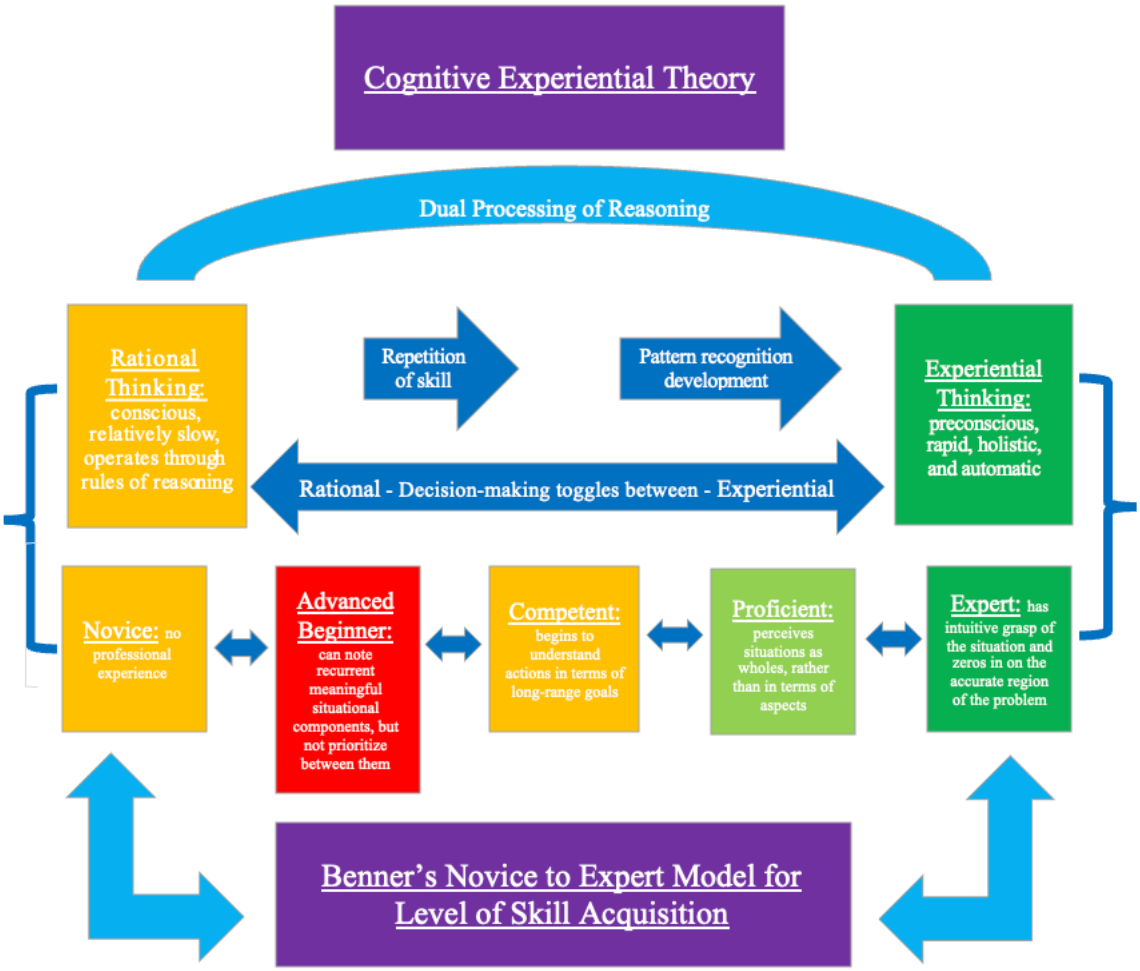
Research Theoretical Framework

This study's theoretical framework (Figure 2) overlays Benner's (2001) *Model of Skill Acquisition in Nursing* and Pacini and Epstein's (1999) *Cognitive Experiential Theory* to guide the exploration of the relationship between cognitive preference and skill acquisition in both SRNAs and CRNAs. Benner's (2001) model asserts that expert nurses will use pattern recognition from clinical experience to develop intuitive decision-making. CET also asserts that Type 1 cognitive process (e.g., experiential thinking) is developed through repetition and pattern

recognition. Therefore, this study will examine the relationship between skill acquisition and cognitive preference from student nurse anesthetists to expert CRNA.

Figure 2

Research Theoretical Framework



Significance

CRNAs are required to make decisions in a highly volatile, dynamic, and uncertain environment. In this high-stakes, rapidly changing environment, it is vital to understand how cognitive preference and the level of skill acquisition may influence CRNAs. There are limited studies that explore nurse anesthetists' cognitive processes related to clinical experience and the

level of skill acquisition. This study was designed to determine the dominant cognitive preference of SRNAs and CRNAs and to describe the relationship between cognitive preference and the level of skill acquisition. These findings will provide insight that will improve education, patient care, safety, satisfaction, and outcomes. Furthermore, this research will serve as a catalyst for future studies and quality improvement initiatives to improve SRNAs' education and CRNAs' decision-making development and evaluation.

Conclusion

CRNAs' decision-making processes incorporate analytical and experiential cognitive activities. A vital attribute to the skill acquisition process is integrating experiential and intuitive knowledge. The hallmark characteristic of an expert nurse is situational awareness, clinical intuition, and ease and speed of reasoning. Nursing researchers posit that intuitive, experiential knowledge will develop with time and clinical experience (Benner, 2001; Hutchinson et al., 2016). This study was designed to describe the relationship between cognitive preference and the level of skill acquisition in SRNAs and CRNAs.

Chapter 2. Literature Review

The first theme identified is a discussion of the leading models, theories, and decision-making frameworks. The descriptions of these models are framed in the context of the anesthesia environment. The purpose of understanding this phenomenon is to provide insight into why healthcare decision-making is beset with variability. The models discussed are *Expected Utility*, *Bayesian Probability*, formalized pattern-matching, heuristics, *Dual Process Model of Reasoning*, *Cognitive Experiential Self-Theory*, and *Sensemaking Theory*.

Expected Utility (EU) was developed in the 17th century and posited that a particular decision is made by calculating the expected benefit and expected value (EV) of each choice (Stiegler & Tung, 2014). The option with the highest yield, therefore, is chosen. This theory assumes the person making the decision understands all the probabilities, payoffs, and effort involved in all the options (Stiegler & Tung, 2014). This assumption is rarely valid in real-world healthcare decisions. Patient data is often incomplete, and all parties involved (e.g., physician, nurse, and patient) may not agree on outcome priorities (Stiegler & Tung, 2014).

Bayesian Probability adapts EU Theory to allow new data to change probabilities (Stiegler & Tung, 2014). This adaptation is more in line with the healthcare setting. An initial decision can be made with the available information and predicted benefits, but the choices and EV can be revised as new data is obtained. This type of clinical decision-making is recognized as "evidence-based" and widely taught in healthcare (Stiegler & Tung, 2014). As with EU Theory, this model is limited to known knowledge and it is thus difficult to predict the response to a given therapy.

Formalized pattern-matching groups clinical observations to reduce the number of options (Stiegler & Tung, 2014). The next step in this process is to identify a pivot point in

pattern-matching. This type of process is most often used in case study evaluation. If a patient presents with inadequate end-organ perfusion (e.g., hypotension, lactic acidosis) but not all organ systems are involved, the pivot point would be determining why particular systems are affected versus others (Stiegler & Tung, 2014). The process requires extensive knowledge of potential patterns, and frequency of occurrence can affect pattern recognition (Stiegler & Tung, 2014).

Kahneman (2011) defines heuristics as the cognitive process of using shortcuts or simple procedures to answer difficult questions. Heuristics are often used in healthcare to make quick and efficient decisions (Buckingham & Adams, 2000: Stiegler & Dhillon, 2014; Stiegler & Ruskin, 2012). An example of this type of decision-making is a set protocol for treatment for a particular patient population (e.g., Diabetic slide scale for insulin). Kahneman (2011) describes three limitations to heuristics. The first is representative heuristics, which is based on the probability of an occurrence (Kremer et al., 2002). Representative heuristics leaves out other probable causes and, therefore, an appropriate diagnosis could be missed. Availability heuristic is when the most memorable event outweighs the probability of occurrence (Kremer et al., 2002; Stiegler & Tung, 2014). In availability heuristics, the emotion and memory of an event affect the decision. Lastly, anchoring heuristic is when the initial estimation of the situation affects the subsequent decision, even after new data is acquired (Kremer et al., 2002; Stiegler & Tung, 2014).

The Dual Process Model of Reasoning, of particular interest in this study, is the use of Type 1 (e.g., intuitive) and Type 2 (e.g., analytical) cognitive processing in decision-making (Fomberstein & Ruskin, 2015; Stiegler & Tung, 2014). This model suggests an individual toggles between Type 1 and Type 2, and each system helps recalibrate the decision or overrides

in a particular scenario. This model does not suggest that one system is superior to the other. Errors in a decision can be made from either type (Stiegler & Tung, 2014).

Cognitive Experiential Theory (CET), also of significant interest in this study, is a refinement of the *Dual Process Model of Reasoning.* CET places Dual Process Model in the context of behavior. The contribution of each system (e.g., analytical and intuitive) varies from situation to situation. Under most circumstances rational-experiential systems operate simultaneously, and individuals are unaware of the two processes (Pacini & Epstein, 1999). However, if a situation causes a conflict between how individuals know versus how they feel, their dominant quality becomes apparent (Pacini & Epstein, 1999). Therefore, understanding cognitive preference and ability is vital to understanding the decision-making process.

Lastly, *Sensemaking Theory* posits that decision-making requires making sense of the situation (Stiegler & Tung, 2014). This process involves initial impressions, feedback, identifying, and understanding information. Therefore, early impressions and biases can affect later decisions. *Sensemaking Theory* attempts to understand the context and why a particular event is occurring.

Review of Human Factors and Cognitive Errors in Anesthesia

The consideration of human factors and cognitive errors is vital to understanding the CRNA's decision-making environment. Cognitive errors are not knowledge gaps but faulty thought processes (Stiegler & Dhillon, 2014; Stiegler & Ruskin, 2012). Cognitive errors included in this review are influences noted in anesthesia-related research and literature, such as bias, overconfidence, heuristics, framing, loss aversion, and emotions.

Cognitive bias is a systematic preference to ignore a particular perspective on decision options or possibilities (Stiegler & Dhillon, 2014; Stiegler & Tung, 2014). Several types of

cognitive biases can come into play in decision-making. Confirmation bias is the tendency only to seek or recognize only information that supports a diagnosis (Fomberstein & Ruskin, 2015; Stiegler & Ruskin, 2012; Stiegler & Tung, 2014). Data that refutes the decision is ignored or not weighted as significant. Anchoring or fixating on one feature is closely related to this process (Stiegler & Ruskin, 2012). Visceral bias is the negative or positive feelings about a patient population that influences decisions (Stiegler & Tung, 2014). For example, a very important person or VIP may receive different treatment than a person who presents as homeless. Lastly, omission bias is inaction over action even though an intervention will improve the situation (Stiegler & Ruskin, 2012; Stiegler & Tung, 2014). An example of omission bias is failure to speak up when noticing a safety concern, especially when speaking up can prevent or mitigate a potential adverse event (Stiegler & Gaba, 2015).

Overconfidence is an inaccurately high self-assessment of one's skills, knowledge, and ability in an area (Stiegler & Dhillon, 2014; Stiegler & Ruskin, 2012; Stiegler & Tung, 2014). Overconfidence can impact decision-making by ignoring other possibilities or potential diagnoses, preventing or delaying appropriate treatment. Furthermore, overconfidence can prevent an individual from adopting appropriate safety measures and standards of care developed by others (Stiegler & Tung, 2014). Type 1 decision-making is prone to this cognitive error (Fomberstein & Ruskin, 2015). Closely related to overconfidence and confirmation bias is premature closure (Fomberstein & Ruskin, 2015; Stiegler & Dhillon, 2014; Stiegler & Ruskin, 2012). Premature closure occurs when the provider accepts the first plausible diagnosis before complete verification (Stiegler & Dhillon, 2014).

Heuristics, or organizational short-cuts, are often used in healthcare to make quick and efficient decisions (Stiegler & Dhillon, 2014; Stiegler & Ruskin, 2012). However, there are

limitations to heuristics. A representative heuristic is based on the probability of an occurrence (Kremer et al., 2002). Representative heuristic leaves out other probable causes and, therefore, an appropriate diagnosis could be missed. Availability heuristic is when the most memorable event outweighs the probability of occurrence (Kremer et al., 2002; Stiegler & Tung, 2014). In availability heuristic, the emotion and memory of an event affect the decision. Lastly, anchoring heuristic is when the initial estimation of the situation affects the subsequent decision, even after new data is acquired (Kremer et al., 2002; Stiegler & Tung, 2014).

Framing and loss aversion is the influence of a perceived loss or gains on the decision-making process (Stiegler & Dhillon, 2014; Stiegler & Ruskin, 2012; Stiegler & Tung, 2014). Research supports that a participant will be more likely to choose an option if there is a perceived gain. However, if the situation is framed as a loss, participants are more likely to choose a riskier option (Stiegler & Tung, 2014). Therefore, healthcare providers can influence decision-making by framing the options as a gain or as a loss (Kremer et al., 2002). Furthermore, an increased risk option may be chosen if the decision is framed as preventing a loss.

Lastly, emotions such as anger and regret play a role in decision-making. Anger prevents effective communication, disrupts behavior, and strains teamwork (Stiegler & Tung, 2014). Healthy work environments are critical for safe, effective care. Regret is the phenomenon of wishing that one had chosen differently or blaming oneself for the decision made (Stiegler & Tung, 2014). A decision that resulted in a bad outcome will influence future decisions that are similar in nature. This response is nonrational but has a powerful influence on decision-making (Stiegler & Tung, 2014).

Review of Cognitive Processes and Decision-Making in CRNAs

Research evaluating CRNAs' cognitive processes and decision-making comes primarily from malpractice closed-claim databases. Kremer et al. (2002) studied over 300 closed malpractice claims to determine clinical decision-making processes. The study used a cognitive psychology framework of information-processing theory. The expert panel discovered that incomplete pre-anesthetic assessment, cognitive biases, and inaccurate probability estimations were associated with adverse outcomes (Kremer et al., 2002).

Another study by Kremer and colleagues (2019) involved a qualitative thematic review of malpractice closed claims to discover preventable variables or events. Results revealed that communication failures, violations of the *American Association of Nurse Anesthetists* (AANA) *Standards of Nurse Anesthesia Practice*, and judgment errors were associated with the adverse event (Kremer et al., 2019). The researchers posited that emphasizing human factors that influenced clinical decision-making should occur in training and continuing education courses.

Golinski and Hranchook (2018) studied malpractice closed claims in cosmetic surgery cases. The identified themes related to CRNA decision-making were the normalization of deviance, ineffective communication patterns, and nonadherence to *AANA Standards of Nurse Anesthesia Practice* (Golinski & Hranchook, 2018). Geisz-Everson et al. (2019) examined cardiac events in noncardiac surgery through closed claims analysis and identified themes in adverse outcomes as pre-anesthetic evaluation, normalization of deviance, medications, hemorrhage, knowledge deficit, and failed clinical reasoning.

Lastly, Larson et al. (2018) studied characteristics and patterns of respiratory events in malpractice closed claims. The researchers posited that failure to monitor patient's ventilation optimally (e.g., normalization of deviance) and violation of *AANA Standard of Nurse Practice*

were significant variables in respiratory events. Hirsh and colleagues (2019) thematic analysis of regional anesthesia closed claims identified errors in cognitive decision-making, ineffective communication patterns, and production pressure as components of adverse events.

Variable Decision-Making in Anesthesia

Kahneman and colleagues (2021) refer to the variability in healthcare decision-making as noise. The researchers assert that noise can be reduced by adherence to evidence-based clinical guidelines. Evidence-based guidelines assist the decision-making process and standardized care across institutions. However, it is not clear that these guidelines are always strictly adhered to in clinical practice (Greig et al., 2017). Greig and colleagues (2017) discovered variability in anesthesia providers' decision-making related to risk.

A foundational clinical guideline in anesthesia that influences decision-making is the preoperative assessment using the American Society of Anesthesiology (ASA) Physical Status (PS) Classification. Saklad (1941) described this six-degree grading of a patient's physical status in May of 1941. Saklad asserted that the patient's physical state could be helpful for statistical analysis (e.g., tracking types of patients receiving anesthesia/surgery). The ASA revised and adopted this six-degree physical status classification in 1961 (Dripps et al., 1963). Many anesthesia providers report the ASA PS Classification as an essential indicator for deciding anesthesia risk (Aronson et al., 2003).

The guidelines set for this classification method is both praised and criticized for its simplicity, subjectivity, and nonspecificity (Sweitzer, 2016). The simplicity enables the classification to be easily remembered, quickly applied, and frequently predictive of patient outcomes (Sweitzer, 2016). However, the guideline designation to patients is beset with variability, or noise, from one anesthesia provider to the next (Mak et al., 2002).

Several studies have explored the inconsistent decision-making related to the ASA PS Classification. Aronson et al. (2003) surveyed 70 anesthesia providers (e.g., 39 CRNAs and 31 physician anesthesiologists) to determine the interrater reliability of ASA PS designation and the variability among anesthesia providers. The survey consisted of 10 scenarios for which the respondent gave an ASA PS classification and rationale. Aronson et al. participants demonstrated agreement ranging from 1–84% with the correct classification, depending on the case, suggesting poor interrater reliability. In addition, the sources of variability were the nature of the surgery, potential difficult airway, smoking history, acute injury, and pregnancy (Aronson et al., 2003).

Riley et al. (2014) studied anesthetists in Australia to determine if the level of training, gender, or type of practice was associated with ASA PS assignment. The results demonstrated that ASA PS I had the most frequently correct assigned classification and the most variation with ASA PS II (Riley et al., 2014). Overall, the study demonstrated a fair agreement among anesthesia providers in assigning ASA PS class, which is consistent with previous studies (Riley et al., 2014). Lastly, correct identification and over or underscoring was not related to age, level of training, gender, or training location (Riley et al., 2014).

Interrater reliability is a historical concern for the ASA PS classification. Haynes and Lawler (1995) surveyed 97 anesthesiologists in the United Kingdom, asking them to give ASA PS classifications to 10 hypothetical patient scenarios. While no case demonstrated complete agreement, the variation among ASA PS classifications differed significantly depending on the presenting case. A similar study by Ranta et al. (1997) in Finland describes marked variations in ASA PS classification. In their study of 10 hypothetical patient scenarios, one case had the classification of all five possible grades. Therefore, Ranta et al. (1997) posit that significant variation is present even in a smaller, culturally homogeneous country like Finland. Hurwitz et

al. (2017) demonstrated that adding examples improves the correct assignment of patients by anesthesia providers and non-anesthesia clinicians.

The ASA PS Classification is just one example of a decision-making point a CRNA will encounter. There are numerous decision-making points in an anesthetic case with potential risks to the patient (e.g., risk of nausea, pain, difficult airway, awareness, bleeding, infection). The CRNA's responsibility is to know the indications, potential risks, anesthesia requirements, and postoperative complications of any surgery in which they provide anesthesia. Once the patient and associated surgery are thoroughly assessed, the next step is deciding on a plan of care. Evidence-based guidelines, protocols, and best practices in the clinical field are tools designed to assist CRNAs in developing an anesthetic plan. Another skill set in decision-making is the clinical experience and expertise with a particular patient population and surgical procedure. Understanding and exploring these influences on decision-making is vital to enhancing nurse anesthesia excellence.

Measurement of Cognitive Preferences

The fields of psychology and economics have researched and developed measurement of cognitive processes related to decision-making (Johansen & O'Brien, 2016). These disciplines have examined personality traits (e.g., Myers Briggs or Big Five personality traits), environmental cues, and risk to benefit influence on decisions (Epstein & Pacini, 1999). The *REI-40* Instrument was chosen for this study due to its construction included parallel testing using categorical thinking, emotional expressivity, ego and ideology, and the Big Five personality scales (Pacini & Epstein, 1999). Therefore, the revised *REI-40* instrument is a comprehensive measurement that adds to the existing knowledge in this field of study.

The reliability and validity scores of the *REI-40* resulted in a rationality scale of $\alpha = .90$ and an experiential scale $\alpha = .87$ (Pacini & Epstein, 1999). This result is an improvement from the initial instrument. A two-factor solution confirmed that rational and experientiality are independent and orthogonal (Pacini & Epstein, 1999). Additional factor analysis of the subscales determined rational and experiential subscales could be divided into ability and engagement factors. Ability is associated with self-esteem related variables and engagement with attitudes and value related variables (Pacini & Epstein, 1999).

The revised *REI-40* demonstrated improvement over the older version (Pacini & Epstein, 1999). The scale is balanced with 20 items per scale and equality of positively to negatively worded items. The revised *REI-40* confirmed previous reliability and validity findings and suggested a relationship between thinking styles and personality traits (Pacini & Epstein, 1999). The weakness of the initial study of this instrument was the homogeneity of the sample population (e.g., heavily biased to gender and race). However, the *REI-40* has been validated in other studies and populations (Bjorklund & Backstrom, 2008; Monacis et al., 2016).

The *REI-40* instrument has been used in multiple healthcare related research. Sladek and colleagues (2008a) studied the relationship between cognitive preference as measured by the *REI-40* instrument to physicians' knowledge and behaviors relating to acute coronary syndrome guidelines. The researchers discovered guideline-discordant practice was associated with an experiential thinking-style (Sladek et al., 2008a). Moreover, guideline-concordant practice was associated with a higher rational thinking style scoring. However, when a behavioral action such as hand hygiene was examined, compliance was significantly positively correlated with experiential thinking style (Sladek et al., 2008b). The researchers posited that hand hygiene behavior is learned from an experiential style than a rational one (Sladek et al., 2008b).

Sladek and colleagues (2010a) also explored cognitive preferences and styles (e.g., Myers-Briggs Type Indicator) in consultant physicians, senior registered nurses (RNs), and health managers. Health managers reported higher rational reasoning than RNs, while consultant physicians reported lower experiential reasoning than both managers and RNs. The cognitive style was largely homogenous. Sladek et al. (2010b) compiled the results of cognitive preferences in previous studies to explore the relationship between age and gender. The researchers concluded that a convergence of rational and experiential systems occurs in adulthood, although the timing of this convergence differs in women and men (Sladek et al., 2010b). Therefore, health care leaders must implement change initiatives with two versions, each targeting a different cognitive processes mode to be successful.

Burbach and colleagues (2015) examined thinking style preference related to symptom recognition in nurses. The researchers concluded a significant relationship of $p < .05$ between a rational thinking style and symptom recognition (Burbach et al., 2015). Therefore, students with a stronger preference for rational thinking demonstrated greater accuracy in cue recognition (Burbach et al., 2015). Alba (2018) studied the relationship between intuition, years of work experience in nursing, and perceived ethical decision-making ability. Alba's (2018) findings support a relationship between intuition and perceived ethical decision-making ability with a Pearson's r of .252 and $p = .0001$. These results contribute to a broader understanding of how thought processes influence ethical decision-making.

Physician research has also employed the *REI-40* instrument. Calder and colleagues (2012) concluded that emergency (ER) physicians prefer rational decision-making over experiential. However, female ER physicians scored higher on experiential scores than their male counterparts (Calder et al., 2012). Aldamir and colleagues (2018) asserted a link between years of experience and higher scores for experiential thinking style in ER physicians. The researchers

posited that this finding supports the assertion that decision-making is often based on acquired knowledge. Lastly, Alshaalan and colleagues (2019) examined physician anesthesiologists. The researchers concluded that male consultants, physicians with more than 10 years of experience, and board certification outside the country preferred rational decision-making style.

Jensen et al. (2016) explored the cognitive preferences of students versus working paramedics. Both groups reported significantly higher rational thinking styles to experiential. Paramedics who were male, younger, advanced care paramedics, and fewer years' work experience reported higher rational thinking scores. These findings are critical in developing continuing education and clinical support tools.

Lastly, the *REI-40* was implemented in research with pharmacists. McLaughlin and colleagues (2014) determined that pharmacy students scored higher in rational scores than in experiential. Rational scores were higher the younger the student (e.g., age less than 30 years old), and there was no significant difference based on gender, race, or presence of a prior degree (McLaughlin et al., 2014). Williams and colleagues (2016) asserted that thinking styles remain consistent across pharmacy practice experience and were independent of grades and performance. Therefore, the researchers posit that pedagogical approaches do not require strategies towards specific decision-making styles (Williams et al., 2016).

Review of Cognitive Aids in Clinical Decision-Making

The study of cognitive preferences has led to the development of cognitive aids in clinical decision-making. These cognitive aids and educational strategies assist providers in navigating the complex and uncertain healthcare environment. The previously discussed cognitive influences, biases, and errors only increase the difficulty of making quality decisions. Therefore, providers must develop techniques and habits to aid in decision-making.

Metacognition is the practice of self-reflection (Stiegler & Tung, 2014). Reflective practices allow the anesthesia provider to process decisions made and improve awareness. This improved awareness allows the provider to identify departures and influences that swayed the decision. Examples anesthesia providers can use to engage in metacognition are slowing down, pursuing alternative answers, and accepting uncertainty (Stiegler & Tung, 2014).

Anderson et al. (2019) posit that reflective activities related to clinical decision-making expose strengths, weaknesses, and unrecognized bias. Moreover, receiving timely feedback is most likely to improve behavior (Stiegler & Dhillon, 2014). Stiegler and colleagues (2017) discovered that self-reflecting tools primed resident physician anesthesiologists to direct their learning behaviors to match their learning needs.

Cognitive self-monitoring strategies seek to limit influences by developing guidelines for decision-making (Stiegler & Tung, 2014). Strategies described include the rule of three tactic, which requires the anesthesia provider to consider at least three other reasons for the diagnosis (Stiegler & Dhillon, 2014; Stiegler & Tung, 2014). The next step is prospective hindsight and imagining if the decision is made. Lastly, the rule out worse case technique asks to consider the rare but significant cause before moving on with the decision (Stiegler & Dhillon, 2014; Stiegler & Tung, 2014).

Cognitive aids adapted from the Federal Aviation Association (FAA) and applied to anesthesia are 3 Ps, DECIDE, and PAVE risk assessment. The 3 Ps are perceive, process, and perform. DECIDE stands for detect, estimate, choose, identify, do, and evaluate (Stiegler & Ruskin, 2014). Lastly, PAVE is patient, anesthesia provider, environment, and external pressure. These aids adapted from the FAA assume closed-loop communication and risk avoidance.

Lastly, decision supports are external tools to reduce nonrational cognitive factors (Stiegler & Tung, 2014). These cognitive aids attempt to improve decision-making, particularly Type 1, by decreasing omission of actions, improve task performance, and mitigating influences on the process (Fomberstein & Ruskin, 2015; Stiegler & Tung, 2014). Standard tools are checklists, algorithms, electronic medical record prompts, and standards of care or protocols (Stiegler & Ruskin, 2012).

These decision supports are developed from evidence-based research and best practice strategies. Neily et al. (2007) discovered that cognitive aids such as printed guidelines on an anesthesia machine are clinically helpful for rare emergencies situations. Coopmans and Biddle (2008) posited that handheld computer-assisted decision-making devices could improve the time to correct diagnosis and treatment during scenarios. Silva and Arnaud (2019) posit that cognitive aids can improve the intraoperative handoff process and improve communication.

Lastly, developing cognitive aids and testing for cognitive errors can be performed in simulation labs. There are limitations to what can be inferred solely from observed behaviors and actions (Stiegler & Gaba, 2015). Understanding the reasoning processes and other contributing factors is critical. Furthermore, feedback bias can occur when a lack of feedback is processed as positive feedback (Fomberstein & Ruskin, 2015). Shields and Gentry (2020) discovered that both online simulation and in-person simulation training can significantly improve students' clinical knowledge. High-fidelity simulation training improves knowledge and skill acquisition in crisis event management. Simulation learning has been reproduced in high-stakes clinical situations, such as a malignant hyperthermia, fire in the operating room, postpartum hemorrhage, and advance lifesaving (Gabbard & Smith-Steinert, 2021; Lutgendorf et al., 2017; Parsons et al., 2019; Wunder et al., 2020).

Conclusion

Ideally, each anesthesia provider would use the patient data and current evidence to make similar, consistent decisions. The review of the literature demonstrates that this is often not the case. Human factors such as cognitive biases, heuristics, personal experience, and emotions all play a role in decision-making. A gap in the literature is an understanding of CRNAs' cognitive preference and relationship to experience and the level of skill acquisition. It is critical that anesthesia providers understand cognitive processes and decision-making dynamics. Self-awareness is a vital component and strategy to understanding and developing safe, quality care. This study aims to describe the relationship between cognitive preferences and skill acquisition to close the knowledge gap in this area.

Chapter 3. Methodology

This chapter describes the research design, target population, sampling strategy, protection of human subjects, and data analysis plan. A detailed description of the instrument and reliability and validity is provided. The purpose of this study is to describe SRNAs' and CRNAs' cognitive preferences. This study assumes that variability in SRNAs' and CRNAs' cognitive preferences is influenced by clinical experience and the level of skill acquisition in anesthesia.

Conceptual Definition of Terms

The following is a list of conceptual definitions for this study:

1. A CRNA is defined as an advanced practice registered nurse who administers anesthesia and other medications (AANA, 2021a). CRNAs also monitor patients who are receiving and recovering from anesthesia. CRNAs participating in this study must be actively practicing and board-certified providers.
2. A SRNA is defined as a registered nurse enrolled in an accredited nurse anesthesia program (AANA, 2022c).
3. Decision-making is defined as the process of using knowledge and experience in implementing actions to achieve the desired outcome (Benner, 2001; Johansen & O'Brien, 2016).
4. Rational cognitive preference is defined in CET as being inferential, operating through cultural rules of reasoning, conscious, and a relatively slow processing system (Pacini & Epstein, 1996). In the *Dual Process Model of Reasoning*, rational cognitive preference is also referred to as Type II system and analytical (Kahneman, 2011; Stanovich & West, 2000; Stiegler & Tung, 2014).

5. Experiential cognitive preference is defined in CET as a preconscious, rapid, holistic, automatic, and primarily nonverbal processing system (Pacini & Epstein, 1996). In the *Dual Process Model of Reasoning,* experiential cognitive preference is also referred to as Type I system and intuitive (Kahneman, 2011; Stanovich & West, 2000; Stiegler & Tung, 2014).
6. Experience is the use of intuition and cue learning (e.g., recognizing patterns from past experiences) to formulate a plan (Benner, 2001; Hutchinson et al., 2016; Patterson & Eggleston, 2017).
7. The concept of level of skill acquisition is described in Benner's (2001) *Model of Skill Acquisition*. Benner's model illustrates the development from the novice to expert nurse. This development is influenced by analytical knowledge and the integration of experiential thinking.
8. Sociodemographic data are defined as SRNAs' and CRNAs' characteristics such as gender identity, educational background, and the number of years of clinical experience.
9. Environmental data are defined as SRNAs and CRNAs characteristics such as practice setting, anesthesia model, and patient population.

Operational Definition of Terms

The following is a list of operational definitions for this study (see Table 1).

Table 1

Measurement Table

Construct	**Theoretical Definition**	**Operational Definition**	**Sub-scale**	**Measure Definition**
Cognitive Process/ Preference	Rational cognitive preference is defined as is inferential, operates through cultural rules of reasoning, is conscious, and relatively slow processing system (Pacini & Epstein, 1996). Experiential cognitive preference is defined as a preconscious, rapid, holistic, automatic, and primarily non-verbal processing system (Pacini & Epstein, 1996).	Cognitive processes as measured by the *Rational Experiential Inventory* (*REI-40*) (Pacini & Epstein, 1999).	Rational - Ability: capability and use. - Engagement: reliance on and enjoyment Experiential - Ability: capability and use. - Engagement: reliance on and enjoyment	The SRNA & CRNA will identify with either Rational or Experiential Cognitive process.
Experience	Providers uses intuition and cue learning (e.g., recognizing patterns from past experiences) to formulate a plan (Benner, 2001; Patterson & Eggleston, 2017).	Number of active clinical experience years and practicing with a current board certification.	Sub-scale: - Years of clinical experience - Practice model - Practice location	The SRNA & CRNA has numerous patient, surgical, and anesthesia experiences to draw upon for decision-making.
Level of skill acquisition	The concept of level of skill acquisition is described by Benner (2001) Model of Skill Acquisition. This model illustrates the development from novice to expert nurse. This development is influenced by analytical knowledge and the integration of experiential thinking.	Number of years of clinical experience and level of skill acquisition in nurse anesthesia.	Sub-scale: - Novice - Expert	Novice skill acquisition is a SRNA. Expert skill acquisition is a practicing CRNA

Dependent Variable

Cognitive preference is measured by using the *Rational Experiential Inventory* (*REI-40*) (Pacini & Epstein, 1999). Cognitive preferences are classified as rational or experiential and subscale into ability and engagement for each. Ability refers to the self-reported level of capability and use of the cognitive type (Pacini & Epstein, 1999). Engagement refers to the self-reported level of reliance on and enjoyment of thinking using a particular cognitive type (Pacini & Epstein, 1999).

Independent Variables

The independent variables for this study are as follows:

1. Social and environmental demographic factors are age, gender, educational background, practice setting, and model.
2. The SRNA's and CRNA's clinical experience will be measured by:
    a. years of active practice
    b. anesthesia practice model (e.g., anesthesia care model or independent)
    c. anesthesia practice location (e.g., teaching hospital, community, outpatient center, office-based practice, and endoscopy or pain clinic).
    d. SRNA background, years of experience as RN, and CCRN certification.
3. The level of skill acquisition is measured by the stage of SRNA education and the level of experience as a CRNA.

Assumptions

The assumptions for this study are as follows:

1. Decision-making is a vital component for CRNAs to provide effective, safe, and competent care to their patients.

2. Cognitive preferences of rational and experiential thinking-styles play a crucial role in decision-making.
3. SRNAs and CRNAs engage in both rational and experiential decision-making in the clinical setting.
4. Cognitive preference will be measured using the *REI-40* inventory scale.
5. SRNAs and CRNAs experience a novice-to-expert skill acquisition process that relies on analytical knowledge and experience, repetition, and pattern recognition.

Research Design

The research design is a quantitative, cross-sectional, descriptive correlational design. This study describes the relationship between variables and does not determine causality (Polit & Beck, 2021). The research goal is to describe the cognitive preferences in SRNAs and CRNAs and the relationship of these preferences to the level of skill acquisition. The following research questions and hypotheses guide the study.

Research Questions

This investigation explores these primary research questions:

1. What are the cognitive preferences of SRNAs and CRNAs?
2. What is the relationship between cognitive preference and clinical experience (e.g., years of experience, practice setting, and CCRN certification) in SRNAs?
3. What is the relationship between cognitive preference and clinical experience (e.g., years of experience, anesthesia practice model, and practice setting) in CRNAs?
4. What are the differences in cognitive preference of an enrolled SRNA as compared to a practicing CRNA?

Hypotheses

The following research hypotheses were tested:

1. H_1 (research hypothesis): SRNAs and CRNAs will have a dominant cognitive preference. H_0 (null hypothesis) SRNAs and CRNAs do not have a dominant cognitive preference.
2. H_2: An increased level of skill acquisition (e.g., years of clinical experience) results in a higher cognitive preference (e.g., *REI-40* score) to experiential thinking-style. The H_0 is that there is no relationship between years of experience and cognitive preference.
3. H_3: A CRNA with an increased clinical experience and level of skill acquisition has developed a higher experiential ability and engagement as compared to a SRNA. The H_0 is that there is no significant difference between SRNA and CRNA experiential cognitive preference, ability, and engagement.

Target Population

The target population includes students enrolled in an accredited Nurse Anesthesia program and board-certified CRNAs who are actively practicing either full-time or part-time. The goal is to obtain a varied sample of SRNA educational levels, and CRNAs practicing in different practice models, locations, and experience levels. Anesthesia practice models include Anesthesia Care Teams (ACT), which entail CRNAs working with physician anesthesiologists, and independent practice CRNAs, which are CRNAs practicing without a physician anesthesiologist present. Anesthesia practice location is defined as either a teaching hospital, community hospital, urban hospital, outpatient surgery center, endoscopy center, office-based

practice, or pain clinic. Anesthesia experience level is defined as the number of years in active practice.

Sampling Eligibility Criteria

The inclusion criteria for this study include:

1. Actively enrolled student nurse anesthetists in an accredited Nurse Anesthesia program in the United States.
2. Actively practicing CRNAs in either a hospital, ambulatory surgery center, office-based practice, endoscopy center, or pain clinic.
3. CRNAs that provide either full-time or part-time anesthesia services as part of their work duties.

The exclusion criteria include:

1. Students who no longer attended nurse anesthesia school.
2. Nonclinically practicing CRNAs.
3. CRNAs with expired board certifications.

Sampling Strategy

A convenience sample with a network technique was used for this study. This sampling approach is commonly used in nursing research and is popular due to its low cost and quick attainment of sample size (Polit & Beck, 2021). The weakness of this technique is the risk of sampling bias (e.g., over or under representation of a population subgroup) (Polit & Beck, 2021). This risk of sampling bias limits the study's efforts to generalize to the broader population (Polit & Beck, 2021).

The SRNA population was recruited by contacting directors of Nurse Anesthesia programs and requesting permission to send the survey to their students. In addition, a Facebook SRNA and CRNA social medial group was used. The CRNA population was recruited by contacting directors of anesthesia practices and requesting permission to send the survey to their CRNAs. The same Facebook SRNA and CRNA social medial group was also used. This strategy promptly reached the target population, allowed for quick response times, lowered costs compared with databased generated email requests, and possibly increased participation.

Power Analysis

The significance criterion establishes the statistical probability of committing a Type I and Type II error. Type I error is rejecting the null hypothesis (H_0) when in fact it is true (Cohen, 1992). Type II error is failure to reject the null hypothesis (H_0) when in fact it is false (Cohen, 1992). Therefore, α is the significance for Type I error, ß is the power for Type II error, *N* is the sample size, and *ES* is the population effect size (Cohen, 1992).

This study's power and effect size calculation is based on *t*-test and analysis of variance (ANOVA) data analysis. The values entered are those commonly used in social science research of an α of .05, a power ß level of .80, and a medium *ES* of .15 (Cohen, 1992: Creswell & Creswell, 2018). To detect a medium difference between two independent sample means ($df = 2(N - 1)$) at $\alpha = 0.05$ requires $N = 64$ in each group or 128 total participants (Cohen, 1992).

Sample size calculation was confirmed using *G*Power3 Software*©. A two-tail *t*-test with an effect size *d* of 0.5, α of 0.05, power ß level of 0.95 results in a Df of 208, sample size group 1 of 105, group 2 of 105, and total sample size of $N = 210$. Faul et al. (2007) outlined the improvements and utility of *G*Power3 Software*© in social, behavioral, and biomedical sciences.

The *REI-40* is a 40-question instrument that measures four variables (rational and experiential ability and engagement). The research groups will be SRNAs and CRNAs, the cognitive preference results (e.g., *REI-40* scores), and clinical experience. The study includes the additional measurement of demographics, practice setting, and clinical experience of SRNAs and CRNAs.

Research Instrument

Several instruments can be used to assess nurses' critical thinking and cognitive processes (e.g., rational versus experiential and intuitive thinking-style). This study's instrument selection is based on overall appropriateness for intended study variables, the instrument's psychometric and measurement properties, reliability and validity, length of time to complete, and availability. Investigating this study's aim requires a review of existing instruments and the development of a demographic questionnaire that collects descriptive information such as age, gender identity, clinical experience, practice setting, and educational level.

Survey Development

The development of the survey consisted of these stages.

1. Literature review and analysis of existing instruments assessing medical professionals' cognitive processes, knowledge, attitudes, and decision-making.
2. Literature review and analysis of existing instruments measuring medical professionals' cognitive preference.
3. Literature review and analysis of Benner's (2001) novice to expert skill acquisition model in advanced practice nurses.
4. Survey review, edit, and finalization. The dissertation committee reviewed the survey instrument and provided appropriate edits for final development in *REDCap*©.

5. Survey implementation through web-based survey distribution.

Description of Survey Sections

The preliminary survey consists of two sections: demographics and the *REI-40* instrument. The survey consists of 52 items and took approximately 20 minutes to complete when pilot tested.

Demographics

The demographics sections included 12 items assessing age, gender identity, race and ethnicity, and level of education for all participants. If the participant was a SRNA, additional demographic section included the year in Nurse Anesthesia program, clinical experience before anesthesia school, and certification as a Critical Care Registered Nurse (CCRN). If the participant was a CRNA, additional demographics included questions concerning their clinical experience, practice setting, patient population, and anesthesia practice model.

Rational Experiential Inventory (REI-40)

The *REI-40* is a validated psychometric tool that includes 40 questions measuring the different information-processing systems (e.g., rational and experiential) used in decision-making (Pacini & Epstein, 1999). The reliability and validity scores of *REI-40* resulted in a rationality scale of $\alpha = .90$ and experiential scale $\alpha = .87$ (Pacini & Epstein, 1999). A two-factor structure was confirmed by entering the instrument items into a principal component factor analysis with varimax rotation confirming that rational and experientiality are independent and orthogonal (Pacini & Epstein, 1999). Additional factor analysis determined that the rational and experiential subscale could be divided into ability and engagement factors. Each subscale was divided into positively and negatively worded items. Permission was granted to use the instrument by referencing the authors.

Protection of Human Subjects

The following actions are recommended by East Tennessee State University (ETSU) Institutional Review Board (IRB) and were followed to ensure the protection of confidentiality, privacy and minimize risks to the participants (IRB, n.d.). Data collection was secured on a password-protected computer and secure cloud account behind a firewall protection program. The data are accessible only to the primary investigator. Faculty advisors and IRB may gain access upon request. The participants could withdraw from the study by clicking exit from the survey at any moment. No personal identifying data was collected (e.g., name, address, contact information). Consent was noted electronically by clicking next to complete the survey and submit to release the data. This action indicated acceptance to participate in the study.

The research proposal, protocols, invitation letter, and informed consent documents were submitted to the ETSU IRB for review and approval (see Appendix A & B). The invitation letter consisted of information regarding voluntary participation, the anonymity of responses, and untraceable responses. Furthermore, the invitation letter provided contact information for the primary investigator, the dissertation chair, and the university representative for the IRB if there were any questions or concerns regarding the study.

Data Collection, Preparation, and Analysis

The researcher obtained the participant's data for this study through an online survey company, *REDCap*© (see Appendix C). This software package allows the researcher to develop a web-based version and create an email link to access the survey. An academic membership allows for unlimited questions per survey, unlimited responses, advanced data exports to statistical software programs, custom variables, multilingual surveys, and unlimited filters for comparing data trends.

REDCap© Internet software guarantees the security of participants' data with firewalls that prevent unauthorized access. Furthermore, access to the platform is password protected. The internet protocol (IP) address was not restricted. The unrestricted IP address permitted multiple CRNAs to complete the survey at their workplace if so desired.

An invitation e-mail was sent through these methods:

1.) Emailing directors of anesthesia practices in the United States.

2.) Emailing directors of SRNA programs in the United States.

3.) Posting an invitation letter on anesthesia social media.

A follow-up reminder email was sent the beginning of the week after the initial contact with participants. The letter provided a brief description of the study and a web link. The survey enrollment was open for 4 weeks.

When the participants selected the web-link, they were connected to the survey hosted by *REDCap*©. Once on the survey site, additional information was provided concerning the study, assurance of privacy and confidentiality, and the researcher's contact information. The participant was given information on the importance of SRNA and CRNA participation, to increase the likelihood of survey completion.

After the summary information, the participant was directed to click the continue link to complete the informed consent and agreement to participate. Once consent was given, the participant was given access to the survey. The survey was divided into two sections. The first section was basic demographics such as age, gender identity, clinical work experience, and education (see Appendix C). Section two consisted of the *REI-40* instrument (Pacini & Epstein, 1999).

Data Preparation

Participants' responses were classified into two groups: completed versus partially completed surveys. Each section was reviewed for completion of the items. The inclusion and exclusion criteria were examined, and ineligible participants removed. The researcher decided if partially completed surveys were added to the data analysis based on the response rate. No partially completed *REI-40* inventories were allowed.

Data Analysis

Data analysis and management were performed using *IBM Statistical Package for the Social Science Statistics*© (SPSS) Grad Pack Standard V28.0 for Mac. The *REI-40* was scored based on a coding manual provided by the instrument developer, which provides reverse coding for some of the questions (Pacini & Epstein, 1999) (see Appendix D). Categorical variables were calculated using frequencies and percentages, while continuous variables were calculated as mean + or – standard deviation (SD). A confidence interval of 95% was calculated for the mean difference between rational and experiential scores. An independent *t*-test was used to analyze the differences between means. The values entered were those commonly used in social science research of a α of .05, a ß level of .80, and a medium *ES* of .15 (Cohen, 1992: Creswell & Creswell, 2018).

Section one analysis consists of descriptive statistics to determine the sample characteristics from the data collected. Demographic characteristics include gender, age, nursing education, years of clinical experience, practice model, location, and population. The nominal and ordinal items in this section had percentages and median scores calculated.

Section two consisted of cognitive preference measurement with the *REI-40* questionnaire. The *REI-40* consists of 20 questions that evaluate each thinking-style. Raw scores

determine the SRNAs' and CRNAs' rational or experiential thinking-style preference. Ten questions assess preference, and 10 questions assess the ability to use each style. The participants responded on a five-point Likert scale with higher scores indicating a preference for the style. This *REI-40* scoring analysis addressed the first research question of identifying and describing SRNAs' and CRNAs' cognitive preferences.

Correlational and comparison analysis were performed to address the second research question of the relationship between the SRNAs' and CRNAs' clinical experience to the cognitive preference. A bivariate correlations analysis was performed to determine the relationship between years of experience and cognitive preference (Polit & Beck, 2021). This analysis described the relationship between the level of skill acquisition and cognitive preference.

Comparison analysis was performed to examine the third research question of the relationship between SRNAs and CRNAs' cognitive preference. This research question explores the relationship between experiential cognitive preference and the level of skill acquisition. A comparison analysis was performed with and independent *t*-tests to determine if there were significant differences in the mean scores between groups (Polit & Beck, 2021). This analysis describes the changes in cognitive preference between the groups.

Conclusion

Aligning how one feels and how one thinks results in rapid but thoughtful decisions. The CRNAs' educational background, experience, and cognitive preference play a role in developing clinical judgment and reasoning. Understanding the role of experience and cognitive preference is critical to making consistent, quality decisions. This study describes the cognitive preferences and explores the relationship to skill acquisition. By exploring these variables, CRNAs and

educators can better understand the process, ability, and impact these factors have on decision-making. Furthermore, this information can assist CRNAs in developing, refining, and evaluating decision-making processes.

Chapter 4. Results

This chapter describes the results of the study examining SRNAs' and practicing CRNAs' cognitive preferences. Descriptive, correlational, and comparison statistics were used to evaluate the two groups. The *REI-40 Inventory* measures participants' preference for rational cognitive style (e.g., "I have a logical mind") and experiential cognitive style (e.g., "I like to rely on my intuitive impressions"). The *REI-40* was scored according to the author's instructions (Pacini & Epstein, 1999). Each cognitive preference is scored out of 5 in the subsets of ability and engagement. Therefore, a higher sum score indicates a higher rational or experiential cognitive style. This chapter describes the sample, summarizes the results, describes the data analysis, and details the sampling process.

Sample Characteristics

A total of 285 surveys were submitted for this study. Response rate was not calculated due to the exact number of received invitation letters is unknown. Thirty-four participants were removed due to incomplete *REI-40* inventories, and 2 participants were removed due to not meeting inclusion criteria (e.g., eligibility requirements). Continuous variables were screened for outliers via z-score calculations and N = 0 outliers were identified. A total of N = 249 participants met eligibility criteria and completed the survey. Of the 249 participants, 98 were SRNAs, and 151 were CRNAs (see Figure 3). Of the 249 participants, 162 were female, and 87 were male. The racial/ethnicity of the sample was reported primarily as white (See Tables 2 & 3). A total of N = 110 (44.2%) of the sample held a master's degree, N = 99 (39.8%) held a baccalaureate degree, N = 32 (12.9%) held Doctor of Nursing Practice, N = 7 (2.8%) held a Ph.D., and N = 1 Certificate degree.

Figure 3

Sample Inclusion and Exclusion Diagram

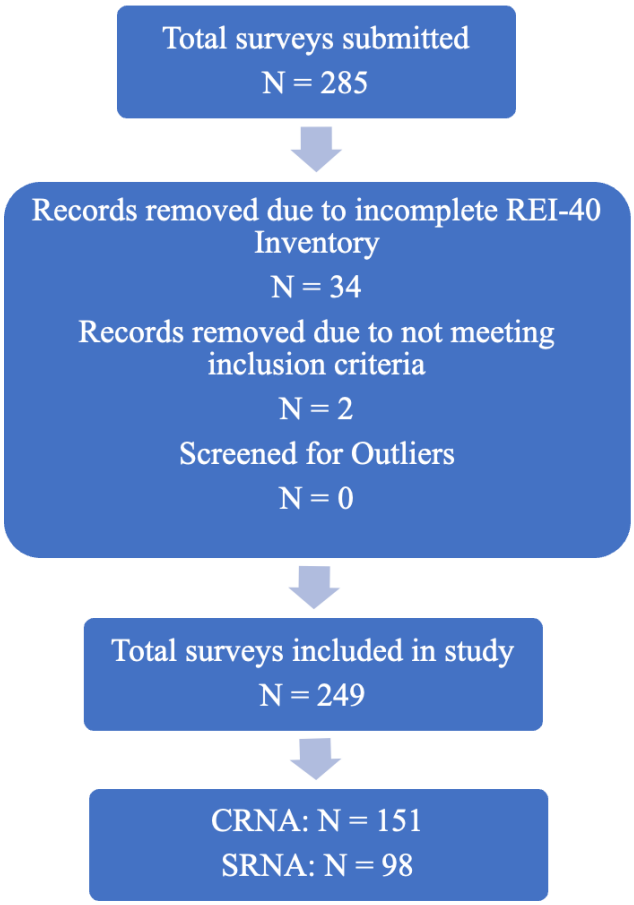


Table 2

Demographics: Age and Years of Clinical Experience

Variables	**Mean ± SD**	**Min ~ Max**
Age		
Total Sample	39.39 ± 11.25	24 ~ 65
SRNA	30.49 ± 4.64	24 ~ 45
CRNA	45.36 ± 10.40	28 ~ 65
SRNAs' Years of Experience as RN before Anesthesia School		
SRNA	4.96 ± 2.77	2 ~ 14
CRNA	NA	NA
CRNAs' Years of Experience in Anesthesia		
SRNA	NA	NA
CRNA	13.09 ± 9.21	1 ~ 36

Table 3

Demographics: Gender, Race/Ethnicity, and Education

Variable	SRNA	CRNA	Total Sample	*CRNAs Nationally*
Gender:				
Female	62 (63%)	100 (66%)	162 (65.1%)	*60.6%*
Male	36 (37%)	51 (34%)	87 (34.9%)	*40.3%*
Race:				
Black or African American	4 (4.1%)	0 (0%)	4 (1.6%)	*4.76%*
Asian	2 (2%)	2 (1.3%)	4 (1.6%)	*4.39%*
White	85 (86.7%)	140 (92.7%)	225 (90.4%)	*87.2%*
Hispanic, Latino, or Spanish origin	5 (5.1%)	4 (2.6%)	9 (3.6%)	
Native Hawaiian, or other Pacific Islander	0 (0%)	1 (0.7%)	1 (0.4%)	*.175%*
Some other race, ethnicity, or origin	0 (0%)	1 (0.7%)	1 (0.4%)	*4.73%*
Prefer not to say	1 (1%)	2 (1.3%)	3 (1.2%)	
Education:				
Certificate	0 (0%)	1 (0.7%)	1 (0.4%)	
Baccalaureate	93 (95%)	6 (4%)	99 (39.8%)	
Masters	3 (3.1%)	107 (70.9%)	110 (44.2%)	
Doctor of Nursing Practice	2 (2%)	30 (19.9%)	32 (12.9%)	
Ph.D.	0 (0%)	7 (4.6%)	7 (2.8%)	

- *National CRNA data* (DataUSA, 2022).

The data collection took place over 4 weeks in March, 2022. An invitation email letter was sent out to CRNA practice administrators and SRNA program chairs, encouraging participation and sharing among their organization. The researcher observed delayed responses and out-of-office notifications in mid-March, most likely due to spring break schedules. Nevertheless, an adequate sample size was obtained to power the data analysis.

SRNA Population

The SRNA population had a mean age of 30.5, with 62 females and 36 males. The educational level comprised 93 (95%) baccalaureate, 3 (3.1%) masters, and 2 (2%) doctorate

level SRNAs. The mean years of experience as an RN before anesthesia school were 4.96, with the least number of years of 2 and a maximum of 12 years. The year in Nurse Anesthesia Program were 47 (48%) first year, 27 (27.5%) second year, 23 (23.5%) third year, and 1 (1%) other.

Previous clinical experience included 40 in Cardiovascular Intensive Care Unit (ICU), 29 Medical ICU, 19 in Surgical ICU, 18 in Neuro ICU, 17 in Trauma ICU, 17 Combined Med/Surgical ICU, 15 in CCU, 12 in Emergency Room, 6 in Post Anesthesia Care Unit, 4 Pediatric ICU, 1 in Burn ICU, 0 in Neonatal ICU and 0 in Flight RN. Participants were allowed to choose more than one ICU experience. SRNAs sampled with Critical Care RN Certification were 93 (95%). The mean scores on the *REI-40* included a rational ability of 4.13, rational engagement of 3.99, experiential ability of 3.67, and experiential engagement of 3.41.

CRNA Population

The CRNA population consisted of a mean age of 45.4 with a minimum age of 28 and maximum age of 65. There were 100 female (66%) and 51 (34%) male CRNAs with the race/ethnicity of white at 140 (92.7%). The educational level consisted of 1 Certificate, 6 baccalaureate, 107 masters, 30 Doctor of Nursing Practice, and 7 Ph.D. educated. The mean years of experience were 13.1, with a minimum number of years of 2 and a maximum of 36 years. These results correspond with national averages of CRNAs of 44.6 years old, 87.2% white, and 60.6% female (DataUSA, 2022).

The clinical experience consisted of 127 (84.1%) in Anesthesia Care Team, 14 (9.3%) in Independent CRNA Practice, and 10 (6.6%) in other environments. The CRNA Practice Location consisted of 129 (85%) hospital-based, 6 (4%) Outpatient Surgery Center, 3 (2%) Endoscopy/Gastroenterology Center, 1 (1%) Office based, 1 (1%) Pain Clinic, 9 (6%) Academia,

and 1(1%) other. Of the hospital based CRNAs sampled, 47 practice in Urban hospitals, 48 Community hospitals, 31 Academic, and 3 in other environments. Participants responded that their primary patient population was Adult, with 137 (90.7%), Pediatric, with 4 (2.6%), Obstetrics, with 5 (3.3%), and other, with 5 (3.3%) responses. The mean scores on the *REI-40* included a rational ability of 4.23, rational engagement of 3.99, experiential ability of 3.74, and experiential engagement of 3.38.

Reliability and Validity

A Cronbach Alpha analysis of the *REI-40* was performed to determine the reliability and validity of the instrument. The *REI-40* consists of 4 subscales that contain 10 items each and items that require reverse coding. Rational ability subscale resulted in a Cronbach Alpha α = .754, rational engagement of α = .734, experiential ability of α = .881, and experiential engagement of α = .831, which demonstrate a high internal consistency and reliability. These findings are consistent with the instrument's developer's results of rationality scale α = .90 and experiential scale α = .87 (Pacini & Epstein, 1999). *REI-40* results were screened for outliers using z score calculations, and no outliers were identified.

Cognitive Preference of SRNAs and CRNAs

Hypothesis One (H_1) is that SRNAs and CRNAs have a dominant cognitive preference. The *REI-40* scores of SRNAs were rational ability of 4.13, rational engagement of 3.99, experiential ability of 3.67, and experiential engagement of 3.51. These results give an overall rational cognitive preference of 8.12 and an experiential cognitive preference of 7.18 (See Table 4). Therefore, SRNAs have a dominant cognitive preference for rational thinking style.

The *REI-40* scores of CRNAs were rational ability of 4.23, rational engagement of 3.99, experiential ability of 3.74, and experiential engagement of 3.52. These results give an overall

rational cognitive preference of 8.22 and an experiential cognitive preference of 7.26 (see Table 4). Therefore, CRNAs also have a dominant cognitive preference for rational thinking-style.

Table 4

SRNA and CRNA REI-40 Inventory Results

Variables	Mean ± SD	Min ~ Max
Rational Ability:		
SRNA (N = 98)	4.13 ± .36	3.2 ~ 5.0
CRNA (N = 151)	4.23 ± .49	2.8 ~ 5.0
Rational Engagement:		
SRNA (N = 98)	3.99 ± .42	2.8 ~ 4.9
CRNA (N = 151)	3.99 ± .55	2.5 ~ 5.0
Experiential Ability:		
SRNA (N = 98)	3.67 ± .57	2.0 ~ 4.9
CRNA (N = 151)	3.74 ± .68	2.0 ~ 5.0
Experiential Engagement:		
SRNA (N = 98)	3.51 ± .61	2.0 ~ 5.0
CRNA (N = 151)	3.52 ± .61	2.1 ~ 4.7

Note: SD = standard deviation, Min = minimum score, Max = maximum score

Cognitive Preference and Experience Level

Hypothesis Two (H_2) is that an increased level of skill acquisition (e.g., years of clinical experience) results in a higher cognitive preference (e.g., *REI-40* score) for experiential thinking style. A bivariate Pearson Correlation analysis was performed between the SRNA's years of experience as a Registered Nurse (RN) before anesthesia school and rational ability, rational engagement, experiential ability, and experiential engagement scores. There was not a significant relationship between the number of years of experience as an RN and the *REI-40* scores with a Pearson Correlation Coefficient of $r(98) = < 1$ and $p = > 0.05$ for all variables (see Table 5). Therefore, the research hypothesis was rejected.

A bivariate Pearson Correlation analysis was performed between CRNAs' years of experience and *REI-40* scores. There was not a significant relationship between the number of years of experience practicing anesthesia and the *REI-40* scores with a Pearson Correlation

Coefficient of $r(151) = < 1$ and $p = > 0.05$ for all variables (see Table 4). Therefore, the research hypothesis was rejected.

Table 5

Bivariate Correlation of Experience to Cognitive Ability and Engagement

Variables	SRNAs' Years of Practicing as RN before Anesthesia School (N = 98)	CRNAs' Years of Clinical Practice in Anesthesia (N = 151)
Rational Ability Score:		
Pearson Correlation	-.155	.063
Sig. (2-tailed)	.128	.440
Rational Engagement Score:		
Pearson Correlation	-.009	.050
Sig. (2-tailed)	.927	.544
Experiential Ability Score:		
Pearson Correlation	.108	.027
Sig. (2-tailed)	.288	.742
Experiential Engagement Score		
Pearson Correlation	.090	.024
Sig. (2-tailed)	.380	.769

Note: Sig. (2-tailed) = significance level < .05

Cognitive Preference Differences between SRNAs and CRNAs

Hypothesis Three (H_3) is that a CRNA with an increased clinical experience, due to the higher level of skill acquisition, has a higher experiential ability and engagement scores as compared to a SRNA. An independent *t*-test (two-tailed significance) was performed to compare mean scores on cognitive preference. The Levene's Test for Equality of Variances was significant for rational ability, rational engagement, and experiential ability. Of the 151 CRNAs rational ability score ($M = 4.23$) compared to the 98 SRNAs ($M = 4.13$), was not statistically significant, $t(247) = 1.72$, $p = .068$. Rational engagement of CRNAs ($M = 3.99$) compared to SRNAs ($M = 3.99$) was not statistically significant with a $t(247) = -.01$, $p = .992$. Experiential ability of CRNAs ($M = 3.74$) compared to SRNAs ($M = 3.67$) was not statistically significant with a $t(247) = .755$, $p = .434$. Lastly, the experiential engagement scores of CRNAs ($M = 3.52$)

compared to SRNAs (M = 3.51) was not statistically significant with a $t(247) = .042$, $p = .967$ (see Table 6). Therefore, the research hypothesis is rejected that CRNAs develop higher experiential thinking compared to SRNAs.

Table 6

Independent t-test: SRNA and CRNA Cognitive Ability and Engagement

Variables	Mean±SD		t-value	p-value
	SRNA	CRNA		
Rational Ability	4.13 ± .36	4.23 ± .49	1.718	.068
Rational Engagement	3.99 ± .42	3.99 ± .55	-.010	.992
Experiential Ability	3.67 ± .57	3.74 ± .68	.755	.434
Experiential Engagement	3.51 ± .61	3.52 ± .61	.042	.967

Note: SD = standard deviation, p-value = < .05

Additional data analysis revealed a statistically significant difference in experiential cognitive preference between identified genders (see Table 7 & 8). An independent *t*-test (two-tailed significance) was performed to compare mean scores on cognitive preference. The Levene's Test for Equality of Variances was not significant for any variable. Of the 162 females rational ability score (M = 4.19) compared to the 87 males (M = 4.20), was not statistically significant with a $p = .829$. Rational engagement of females (M = 4.0) compared to males (M = 3.96) was not statistically significant with a $p = .471$. Experiential ability of females (M = 3.84) compared to males (M = 3.48) was statistically significant with a $p = <.001$. Experiential engagement scores of females (M = 3.63) compared to males (M = 3.29) was statistically significant with a $p = <.001$ (see Table 8).

Table 7

Gender REI-40 Inventory Results

Variables	Mean ± SD	Min ~ Max
Rational Ability:		
Female (N = 162)	4.19 ± .45	2.8 ~ 5.0
Male (N = 87)	4.20 ± .45	3.0 ~ 5.0
Rational Engagement:		
Female (N = 162)	4.0 ± .50	2.5 ~ 5.0
Male (N = 87)	3.96 ± .50	2.6 ~ 5.0
Experiential Ability:		
Female (N = 162)	3.84 ± .61	2.2 ~ 5.0
Male (N = 87)	3.48 ± .63	2.0 ~ 5.0
Experiential Engagement:		
Female (N = 162)	3.63 ± .56	2.1 ~ 5.0
Male (N = 87)	3.29 ± .62	2.0 ~ 4.8

Note: SD = standard deviation, Min = minimum score, Max = maximum score

Table 8

Independent t-test: Gender and Cognitive Ability and Engagement

	Mean ± SD			
Variables	**Female**	**Male**	**t-value**	**p-value**
Rational Ability	4.19 ± .45	4.20 ± .45	-.216	.829
Rational Engagement	4.0 ± .50	3.96 ± .50	.722	.471
Experiential Ability	3.84 ± .61	3.48 ± .63	4.352	<.001
Experiential Engagement	3.63 ± .56	3.29 ± .62	4.327	<.001

Summary

This chapter describes the statistical analysis and results of this study. The study's purpose was to describe the cognitive preference of SRNAs and CRNAs and explore the relationship between experience and cognitive preference. Cognitive preferences were quantified by *REI-40* scores and statistical significance between groups analyzed. The findings support a dominant cognitive preference for rational thinking. However, no statistically significant findings that support increased experience also increases experiential thinking. Chapter 5 discusses the implications of the research findings.

Chapter 5: Discussion

Understanding how rational and experiential thinking is incorporated in CRNAs' decision-making processes is vital for education and clinical development. This study supports Pacini and Epstein's (1999) research that the *REI-40 Inventory* identifies two information processing systems for decision-making that are outlined in the *Dual Processing Model of Reasoning* and *CET*. The reliability and validity of the instrument and is consistent with other research results with healthcare providers. Furthermore, this study describes the dominant cognitive preference of SRNAs and CRNAs and the role of experience on this thinking style.

Experience and Cognitive Preference

The researcher used the *REI-40 Inventory* to determine SRNAs' and CRNAs' preference for rational and experiential cognitive styles. The scores for rational cognition were higher than experiential in both groups, suggesting that both SRNA's and CRNA's ability, engagement, and preference are for rational cognitive style. These results are consistent with studies involving physician anesthesiologists, cardiologists, emergency room physicians, registered nurses, pharmacists, and paramedics (Alba, 2018; Alshaalan et al., 2019; Burbach et al., 2015; Calder et al., 2012; Jensen et al., 2016; McLaughlin et al., 2014; Sladek et al., 2008a; Sladek et al., 2010b; Williams et al., 2016).

The researcher posited that greater clinical experience would be linked to an experiential cognitive style. The rationale for this hypothesis is that experiential thinking and intuition are developed by repetition and pattern recognition (Kahneman, 2011). However, the results of this study did not support this hypothesis. There was no statistical significance or correlation between years of clinical experience and *REI-40* Experiential scores. Moreover, the differences between SRNAs' and CRNAs' *REI-40* scores were not statistically significant. Therefore, the cognitive

preference for experiential thinking remains stable and potentially an innate trait that is not influenced by years of experience.

The authors of the *REI-40* posited that the degree of cognitive dominance is determined by individual preference and the customary way of responding (Pacini & Epstein, 1996). Nurse anesthesia education is centered on evidence-based practice and current clinical guidelines. This structure of education and clinical practice may use rational cognition as the customary way of responding. This explanation may also support the findings in SRNAs' and CRNAs' rational ability scores.

This study revealed that rational ability scores were higher, although not statistically significant, in CRNAs as compared to SRNAs. One hypothesis for this finding is that the majority of CRNAs hold a graduate degree of some type. Therefore, the process of graduate education and customary way of clinical practice may develop rational cognitive ability. Additionally, respondents did score higher than the mid-point scale on the experiential cognitive style, indicating that both thinking strategies are used. This finding is consistent with the *Dual Processing Theory*, which suggests that people toggle between experiential and rational thinking and recalibrate their decisions. Additional research into the role of advanced degrees and clinical practice would be required to understand these findings further.

It is interesting to note that years of experience did not correlate to higher experiential ability and engagement. Nursing research has highlighted the role of intuition in situational awareness, clinical instincts, and ease and speed of reasoning. Furthermore, nurse researchers have posited that intuition and experiential knowledge will develop with time and clinical experience (Benner, 2001; Hutchinson et al., 2016). Benner's model (2001) and *CET* (Pacini & Epstein, 1996) posited that experiential thinking and intuition are context-specific (e.g., repeat

pattern recognition is required). Therefore, measuring experiential thinking outside a particular situation or clinical setting is potentially limiting. Further research on developing reflective actions, reaction times, and experiential thinking in a simulation lab setting can better describe this phenomenon.

Gender and Cognitive Preference

An additional data analysis revealed a statistically significant difference in experiential cognitive preference between identified genders (see Tables 7 & 8). Participants who identified as female scored higher in experiential ability and engagement compared to participants who identified as male. However, rational ability and engagement was still the dominant thinking style for females as in male participants. Furthermore, the mean difference in rational ability and engagement scores was not statistically significant between the two groups. This finding is consistent with the instrument's authors and other researchers' findings on cognitive preference and gender differences (Alshaalan et al., 2019; Calder et al., 2011; Epstein et al., 1996; Sladek et al., 2010b).

Stereotypes concerning different thinking styles associated with gender are commonly accepted in western society (Epstein et al., 1996). Intuitive, feeling-based thinking is associated with femininity, while rational, logical thinking is associated with masculinity (Epstein et al., 1996). The findings in this study revealed female participants ability and engagement with experiential decision-making to be significantly higher than male participants. One explanation for this finding is that the participant's definition of intuition is unknown and potentially a limitation to the instrument. For instance, asking a participant if they trust their feelings versus do they trust their instincts, or initial reactions has similar intent but could elicit different responses.

Cognitive Experiential Theory and the *REI-40* instrument outlined how the two information processing systems function together to make decisions. Because cognitive preference did not correlate with clinical experience, these results pose the question of cognitive preference being an established, innate quality, such as a personality trait. Moreover, the profession of nurse anesthesia may attract similar cognitive style dispositions and the findings are self-selecting. This hypothesis would lead to rational cognition being used, preferred, and more prevalent in nurse anesthesia decision-making.

Significance of Cognitive Preference and Decision-Making in Anesthesia

The Dual Processing Model of Reasoning and *Cognitive Experiential Theory* organize the decision-making process into two distinct systems. System 1 is thinking fast, intuitive, unconscious, and effortless. System 2 is thinking slow, deliberate, controlled, and with effort. Clinical experience and didactic education combine the mastery of a given skill and the development of clinical decision-making. Therefore, rational and experiential thinking establishes baselines, reference points, and situational awareness that guides clinical decision-making.

Health care providers will encounter changes in protocols, updating guidelines, and improving standards of care. Understanding how nurse anesthetists will make a future decision is vital for successfully implementing change. For rational thinkers, evidence and data supporting the effectiveness and patient outcomes are required in decision-making. The experiential thinker will require context-specific clinical experience and repetition. Both cognitive processes play a role in health care providers' interpretation and ultimately clinical decisions.

Understanding the influence of human factors and clinical norms in decision-making is critical. Heuristics is a common decision-making tool used in time-sensitive, life-saving

situations. Heuristics are rule-of-thumb parameters that guides an individual when there is a limited amount of available information. Because heuristics relies on less information, it directly depends on experience and intuitive knowledge. When applied correctly, heuristics result in good judgment and quick thinking.

Cognitive biases are human influences on heuristics that can lead to cognitive errors. Cognitive errors are not knowledge gaps but faulty thought processes (Stiegler & Dhillon, 2014; Stiegler & Ruskin, 2012). Cognitive bias is a systematic preference to ignore a particular perspective on decision options or possibilities (Stiegler & Dhillon, 2014; Stiegler & Tung, 2014). Typical cognitive biases are:

1. Confirmation bias: seeking information that only confirms the initial decision.
2. Overconfidence: an inaccurately high self-assessment of one's decision.
3. Framing and loss aversion: viewing the decision as a gain or loss.
4. Normalizing of deviance: straying away from correct or proper actions.
5. Emotions (anger and regret): prevent effective communication or leads to uncertainty or indecision (Stiegler & Dhillon, 2014; Stiegler & Tung, 2014).

Anesthesia providers can implement strategies to prevent these cognitive biases and errors. These strategies include increasing awareness through training, slowing down, mindfulness, and using checklists or guidelines (Webster et al., 2021). One misconception in evaluating clinical decisions is that System 1, experiential, is more prone to error than System 2, rational (Webster et al., 2021). Most of the time both systems work together and quite effectively. The challenge is self-checking one's decision for bias and errors. Therefore, team-based decision-making, cognitive aids, and clinical support systems demonstrate the most promising positive effect on the process (Webster et al., 2021).

Lastly, initial research using the *Dual Processing Model of Reasoning* was focused on decision-making when risk was involved (Kahneman, 2011). It would be beneficial to focus anesthesia research on risk analysis and decision-making. Currently, anesthesia lacks an accepted risk indicator instrument. The ASA Physical Status Classification is often used as a risk indicator, but the instrument developer never intended it to be use that way (Aronson et al., 2003; Saklad, 1941). Furthermore, surgeons have been using and implementing risk stratification via the Surgical Risk Indicator instrument (Mansmann et al., 2016). Collaboration and integration of the two disciplines could improve informed consent and anesthesia care planning.

Ideally, each anesthesia provider would use the patient data, current evidence, and comprehensive clinical experience to make similar, consistent decisions. This study confirms that SRNAs and CRNAs prefer rational decision-making and have above mid-scale experiential cognitive ability and engagement. Therefore, it is vital for nurse anesthetists to be aware of how these cognitive processes interact. When uncertainty occurs during decision-making, individuals will toggle and recalibrate toward their dominant cognitive preference (Pacini & Epstein, 1999). Understanding common pitfalls and being self-aware can prevent patient decision-making errors.

Strengths, Limitations, and Recommendations

The strengths of this study include the robust nature of the *REI-40 Inventory* to measure cognitive preference. The study was adequately powered, and the reliability and validity of the instrument were confirmed. However, this was the first implementation of this instrument in an SRNA and CRNA population. Further evaluation will be required to confirm the findings. Moreover, this inventory captures cognitive preferences outside of an anesthesia setting. Further research evaluating decision-making and cognitive process during anesthesia would be beneficial.

A network sampling method can result in a sample that is not representative and, therefore, limits the generalizability of the findings. A random sampling technique may provide a more varied population of anesthesia practice models and demographics. The results were self-reported by volunteer participants. Self-reporting instruments may lead to greater participation from participants interested in and knowledgeable in the research area. Lastly, this study does not examine factors of personality traits, motivation, recent continuing education, and problem-solving styles. Future research with these variables will increase the strength of generalizability and interpretation of the results.

Conclusion

Aligning the heart, how one feels, and the head, how one thinks, results in rapid but thoughtful decisions. This practice is the art and science of the profession. Understanding the role of experience and cognitive preference is critical to making consistent, quality decisions that may hold implications for patient outcomes. The CRNAs' educational background, experience, and cognitive preference play a role in developing clinical judgment and reasoning. By exploring these variables, CRNAs and educators can better understand the process, ability, and impact these factors have on decision-making. Furthermore, this information can assist CRNAs in developing, refining, and evaluating decision-making processes.

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APPENDICES

Appendix A: Informed Consent

Dear Participant:

My name is Thomas Diller, CRNA, and I am a graduate student at East Tennessee State University. I am working on Ph.D. in Nursing. To finish my studies, I will be completing a dissertation. The title of my research study is "Cognitive Preference and Skill Acquisition: the relationship between student Nurse Anesthetists and Certified Registered Nurse Anesthetists."

The purpose of this study is to describe cognitive preferences and development of SRNAs and CRNAs. I would like to give a brief online survey to SRNAs and CRNAs using *REDCap*©. It should only take about 20 minutes to finish. You will be asked questions about practice setting, education, and cognitive processes related to decision-making. Since this study deals with hypothetical cognitive decision, there is no risk to participating. Furthermore, identifiers will not be collected that would identify participants. This study may benefit you or others by increasing the knowledge and understanding of cognitive process and decision-making of anesthesia providers.

Your confidentiality will be protected as best we can. Since we are using technology, no guarantees can be made about the interception of data sent over the internet by any third parties, just like with emails. We will make every effort to make sure that your name is not linked with your answers. *REDCap*© has security features that will be used: IP addresses will not be collected, and SSL encryption software will be used.

Although your rights and privacy will be maintained, the research records may be looked at by individuals that have the legal right to see that information. This may include the ETSU IRB overseeing this research, other individuals at the University with the responsibility for

ensuring we follow the rules related to this research, the federal Office of Human Research Protections (OHRP) that protects participants like you, and the research team.

Taking part in this study is voluntary. You may decide not to take part in this study. You can quit at any time. You may skip any questions you do not want to answer you can exit the online survey form if you want to stop completely.

If you have any research-related questions or problems, you may contact me, Thomas Diller at 423-290-4852 or by email at Diller@etsu.edu. This research is being overseen by an Institutional Review Board (IRB). An IRB is a group of people who perform independent review of research studies. You may also contact the ETSU IRB at 423-439-6054 or IRB@etsu.edu for any issues, questions, or input that you may have about the research or your rights as a research participant.

Sincerely,

Thomas Diller, Ph.D.(c), MSN, CRNA

Clicking the I AGREE button below indicates:

- I have read the above information
- I agree to volunteer
- I am at least 18 years old
- I am physically present in the United States
- I am either a student Nurse Anesthetists or Certified Registered Nurse Anesthetists

☐ I AGREE

☐ I DO NOT AGREE

Appendix B: Recruitment Letter

Hello, my name is Thomas Diller. I am a Ph.D. student at East Tennessee State University (ETSU). I am doing a study that involves the cognitive preferences and the level of skill acquisition of Student Registered Nurse Anesthetists (SRNA) and Certified Registered Nurse Anesthetists (CRNA). I am looking for enrolled SRNAs and actively practicing CRNAs. This study involves a survey that should take about 20 minutes to complete. The survey will take place online.

Please think about participating. Participation is voluntary. I encourage participants to please share this information with other SRNAs and CRNAs you may know.

If you have any questions, please contact me at Diller@ETSU.edu.

If you want to learn more about this survey, please follow the link here: https://redcap.link/diller

Sincerely,

Thomas A. Diller, Ph.D.(c), MSN, CRNA

Appendix C: Research Instrument

Cognitive Preference & Level of Skill Acquisition Inventory

Section 1: Demographics

1) Age: ___ years-old
2) Gender:
    a. Female: ___
    b. Male: ___
    c. Transgender, non-binary: ___
    d. Prefer not to say: ___
3) Race/Ethnicity:
    a. Black or African American: ___
    b. Asian: ___
    c. White: ___
    d. Hispanic, Latino, or of Spanish origin: ___
    e. American Indian or Alaskan Native: ___
    f. Native Hawaiian or Other Pacific Islander: ___
    g. Some other race, ethnicity, or origin: ___
    h. Prefer not to say: ___
4) Are you a CRNA? ___ yes ___ no

    If you are a student nurse anesthetist, skip to question 11
5) I am actively practicing anesthesia as a CRNA. Yes ___ No ___
6) I am a board certified CRNA. Yes ___ No ___
7) How many years have you been a practicing CRNA? ___ years.

8) Current anesthesia practice model:
    a. Anesthesia Care Team (physician anesthesiologist present): ___
    b. All CRNA practice (no physician anesthesiologist present): ___
    c. Other: ___
9) Current primary practice location:
    a. Hospital-based:
        i. Urban: ___
        ii. Community: ___
        iii. Academic/teaching hospital: ___
    b. Outpatient/Ambulatory surgery center: ___
    c. Outpatient Gastroenterology/Endoscopy Center: ___
    d. Office-based anesthesia practice: ___
    e. Pain clinic: ___
    f. Academia/Nurse Anesthesia Faculty: ___
    g. Other: ___
10) Current primary patient population in your practice:
    a. Adult: ___
    b. Pediatrics: ___
    c. OB: ___
    d. Other: ___
11) Highest education in Nursing:
    a. Certificate: ___
    b. Bachelors: ___

c. Masters: ___

d. Doctorate-of-Nursing Practice: ___

e. Ph.D.: ___

12) Are you a Student Nurse Anesthetist? ___ yes ___ no

a. What year are you in the program? ___ first ___ second ___ third ___ other

b. How many years were you a practicing RN before starting nurse anesthesia school? ___ years

c. Are you currently, or have you ever held a CCRN certification? ___ yes ___ no

d. What is your primary Intensive Care (ICU) experience? (Check all that apply)

i. Medical ICU ___

ii. Surgical ICU ___

iii. Combined Medical/Surgical ICU ___

iv. Cardiovascular ICU ___

v. Trauma ICU ___

vi. Neuro ICU ___

vii. Burn ICU ___

viii. Pediatric ICU ___

ix. Neonatal ICU ___

x. Emergency Room ___

xi. Flight RN ___

xii. PACU ___

xiii. Other ___

Section 2: Rational Experiential Inventory (REI-40)

1) I have a logical mind.

___ definitely not true of myself

___ somewhat not true of myself

___ neither true nor untrue of myself

___ somewhat true of myself

___ definitely true of myself

2) I prefer complex problems to simple problems.

___ definitely not true of myself

___ somewhat not true of myself

___ neither true nor untrue of myself

___ somewhat true of myself

___ definitely true of myself

3) I believe in trusting my hunches.

___ definitely not true of myself

___ somewhat not true of myself

___ neither true nor untrue of myself

___ somewhat true of myself

___ definitely true of myself

4) I am not a very analytical thinker.

___ definitely not true of myself

___ somewhat not true of myself

___ neither true nor untrue of myself

___ somewhat true of myself

___ definitely true of myself

5) I trust my initial feelings about people.

___ definitely not true of myself

___ somewhat not true of myself

___ neither true nor untrue of myself

___ somewhat true of myself

___ definitely true of myself

6) I try to avoid situations that require thinking in depth about something.

___ definitely not true of myself

___ somewhat not true of myself

___ neither true nor untrue of myself

___ somewhat true of myself

___ definitely true of myself

7) I like to rely on my intuitive impressions.

___ definitely not true of myself

___ somewhat not true of myself

___ neither true nor untrue of myself

___ somewhat true of myself

___ definitely true of myself

8) I don't reason well under pressure.

___ definitely not true of myself

___ somewhat not true of myself

___ neither true nor untrue of myself

___ somewhat true of myself

___ definitely true of myself

9) I don't like situations in which I have to rely on intuition.

___ definitely not true of myself

___ somewhat not true of myself

___ neither true nor untrue of myself

___ somewhat true of myself

___ definitely true of myself

10) Thinking hard and for a long time about something gives me little satisfaction.

___ definitely not true of myself

___ somewhat not true of myself

___ neither true nor untrue of myself

___ somewhat true of myself

___ definitely true of myself

11) Intuition can be a very useful way to solve problems.

___ definitely not true of myself

___ somewhat not true of myself

___ neither true nor untrue of myself

___ somewhat true of myself

___ definitely true of myself

12) I would not want to depend on anyone who described himself or herself as intuitive.

___ definitely not true of myself

___ somewhat not true of myself

___ neither true nor untrue of myself

___ somewhat true of myself

___ definitely true of myself

13) I am much better at figuring things out logically than most people.

___ definitely not true of myself

___ somewhat not true of myself

___ neither true nor untrue of myself

___ somewhat true of myself

___ definitely true of myself

14) I usually have clear, explainable reasons for my decisions.

___ definitely not true of myself

___ somewhat not true of myself

___ neither true nor untrue of myself

___ somewhat true of myself

___ definitely true of myself

15) I don't think it is a good idea to rely on one's intuition for important decisions.

___ definitely not true of myself

___ somewhat not true of myself

___ neither true nor untrue of myself

___ somewhat true of myself

___ definitely true of myself

16) Thinking is not my idea of an enjoyable activity.

___ definitely not true of myself

___ somewhat not true of myself

___ neither true nor untrue of myself

___ somewhat true of myself

___ definitely true of myself

17) I have no problem thinking things through carefully.

___ definitely not true of myself

___ somewhat not true of myself

___ neither true nor untrue of myself

___ somewhat true of myself

___ definitely true of myself

18) When it comes to trusting people, I can usually rely on my gut feelings.

___ definitely not true of myself

___ somewhat not true of myself

___ neither true nor untrue of myself

___ somewhat true of myself

___ definitely true of myself

19) I can usually feel when a person is right or wrong, even if I can't explain how I know.

___ definitely not true of myself

___ somewhat not true of myself

___ neither true nor untrue of myself

___ somewhat true of myself

___ definitely true of myself

20) Learning new ways to think would be very appealing to me.

___ definitely not true of myself

___ somewhat not true of myself

___ neither true nor untrue of myself

___ somewhat true of myself

___ definitely true of myself

21) I hardly ever go wrong when I listen to my deepest gut feelings to find an answer.

___ definitely not true of myself

___ somewhat not true of myself

___ neither true nor untrue of myself

___ somewhat true of myself

___ definitely true of myself

22) I think it is foolish to make important decisions based on feelings.

___ definitely not true of myself

___ somewhat not true of myself

___ neither true nor untrue of myself

___ somewhat true of myself

___ definitely true of myself

23) I tend to use my heart as a guide for my actions.

___ definitely not true of myself

___ somewhat not true of myself

___ neither true nor untrue of myself

___ somewhat true of myself

___ definitely true of myself

24) I often go by my instincts when deciding on a course of action.

___ definitely not true of myself

___ somewhat not true of myself

___ neither true nor untrue of myself

___ somewhat true of myself

___ definitely true of myself

25) I'm not that good at figuring out complicated problems.

___ definitely not true of myself

___ somewhat not true of myself

___ neither true nor untrue of myself

___ somewhat true of myself

___ definitely true of myself

26) I enjoy intellectual challenges.

___ definitely not true of myself

___ somewhat not true of myself

___ neither true nor untrue of myself

___ somewhat true of myself

___ definitely true of myself

27) Reasoning things out carefully is not one of my strong points.

___ definitely not true of myself

___ somewhat not true of myself

___ neither true nor untrue of myself

___ somewhat true of myself

___ definitely true of myself

28) I enjoy thinking in abstract terms.

___ definitely not true of myself

___ somewhat not true of myself

___ neither true nor untrue of myself

___ somewhat true of myself

___ definitely true of myself

29) I generally don't depend on my feelings to help me make decisions.

___ definitely not true of myself

___ somewhat not true of myself

___ neither true nor untrue of myself

___ somewhat true of myself

___ definitely true of myself

30) Using logic usually works well for me in figuring out problems in my life.

___ definitely not true of myself

___ somewhat not true of myself

___ neither true nor untrue of myself

___ somewhat true of myself

___ definitely true of myself

31) I think there are times when one should rely on one's intuition.

___ definitely not true of myself

___ somewhat not true of myself

___ neither true nor untrue of myself

___ somewhat true of myself

___ definitely true of myself

32) I don't like to have to do a lot of thinking.

___ definitely not true of myself

___ somewhat not true of myself

___ neither true nor untrue of myself

___ somewhat true of myself

___ definitely true of myself

33) Knowing the answer without having to understand the reasoning behind it is good enough for me.

___ definitely not true of myself

___ somewhat not true of myself

___ neither true nor untrue of myself

___ somewhat true of myself

___ definitely true of myself

34) Using my gut feelings usually works well for me in figuring out problems in my life.

___ definitely not true of myself

___ somewhat not true of myself

___ neither true nor untrue of myself

___ somewhat true of myself

___ definitely true of myself

35) I don't have a very good sense of intuition.

___ definitely not true of myself

___ somewhat not true of myself

___ neither true nor untrue of myself

___ somewhat true of myself

___ definitely true of myself

36) If I were to rely on my gut feelings, I would often make mistakes.

___ definitely not true of myself

___ somewhat not true of myself

___ neither true nor untrue of myself

___ somewhat true of myself

___ definitely true of myself

37) I suspect my hunches are inaccurate as often as they are accurate.

___ definitely not true of myself

___ somewhat not true of myself

___ neither true nor untrue of myself

___ somewhat true of myself

___ definitely true of myself

38) My snap judgments are probably not as good as most people's.

___ definitely not true of myself

___ somewhat not true of myself

___ neither true nor untrue of myself

___ somewhat true of myself

___ definitely true of myself

39) I am not very good at solving problems that require careful logical analysis.

___ definitely not true of myself

___ somewhat not true of myself

___ neither true nor untrue of myself

___ somewhat true of myself

___ definitely true of myself

40) I enjoy solving problems that require hard thinking.

___ definitely not true of myself

___ somewhat not true of myself

___ neither true nor untrue of myself

___ somewhat true of myself

___ definitely true of myself

Appendix D: Codebook

Section 1:

Demographics Scoring:

1) Age: continuous variable
2) Gender identity:
    a. Female: ___ (1)
    b. Male: ___ (2)
    c. Transgender (3)
    d. Prefer not to say (4)
3) Race/Ethnicity:
    a. Black or African American: ___ (1)
    b. Asian: ___ (2)
    c. White: ___ (3)
    d. Hispanic, Latino, or other: ___ (4)
    e. American Indian or Alaskan Native: (5)
    f. Native Hawaiian or Other Pacific Islander: (6)
    g. Other: ___ (7)
    h. Prefer not to say: (8)
4) Are you a CRNA? ___ (1) yes ___ (0) no

    If you are a student nurse anesthetist, skip to question 12
5) I am actively practicing anesthesia as a CRNA. Yes ___ (1) No ___ (2)
6) I am a board certified CRNA. Yes ___ (1) No ___ (2)

7) How many years have you been a practicing CRNA? Continuous variable.

8) Anesthesia setting:

    a. Anesthesia Care Team (physician anesthesiologist present): ___ (1)

    b. All CRNA practice (no physician anesthesiologist present): ___ (2)

    c. Other: ___ (3)

9) Practice Setting:

    a. Hospital based:

        i. Urban: ___ (1)

        ii. Rural: ___ (2)

        iii. Academic/teaching hospital: ___ (3)

    b. Outpatient surgery center: ___ (4)

    c. Outpatient Gastroenterology/Endoscopy Center: ___ (5)

    d. Office-based practice: ___ (6)

    e. Pain clinic: ___ (7)

    f. Academia/Full-time faculty: ___ (8)

    g. Other: ___ (9)

10) Education as nurse anesthetist:

    a. Certificate: ___ (1)

    b. Bachelors: ___ (2)

    c. Masters: ___ (3)

    d. Doctorate-of-Nursing Practice: ___ (4)

    e. Ph.D.: ___ (5)

11) Are you a Student Nurse Anesthetist? ___ (1) yes ___ (2) no

a. What year are you in the program? ___ (1) first ___ (2) second ___ (3) third ___ other___ (4)

b. How many years were you a practicing RN before starting nurse anesthesia school? Continuous variable.

c. Did you achieve your CCRN certification? ___ (1) yes ___ (2) no

d. What is your primary Intensive Care (ICU) experience? (Check all that apply)

i. Medical ICU ___(1)

ii. Surgical ICU ___ (2)

iii. Cardiovascular ICU ___ (3)

iv. Neuro ICU ___ (4)

v. Burn ICU ___ (5)

vi. Pediatric ICU ___ (6)

vii. Neonatal ICU ___ (7)

viii. Emergency Room ___ (8)

ix. Flight RN ___ (9)

x. PACU ___ (10)

xi. Other ___ (11)

Section 2 (*REI-40*):

1) I have a logical mind. (*Rational Ability, 7*)

_1_ definitely not true of myself

_2_ somewhat not true of myself

_3_ neither true nor untrue of myself

_4_ somewhat true of myself

_5_ definitely true of myself

2) I prefer complex problems to simple problems. (*Rational Engagement, 16*)

_1_ definitely not true of myself

_2_ somewhat not true of myself

_3_ neither true nor untrue of myself

_4_ somewhat true of myself

_5_ definitely true of myself

3) I believe in trusting my hunches. (*Experiential Ability,* 23)

_1_ definitely not true of myself

_2_ somewhat not true of myself

_3_ neither true nor untrue of myself

_4_ somewhat true of myself

_5_ definitely true of myself

4) I am not a very analytical thinker. (*Rational Ability,* 3) *

_5_ definitely not true of myself

_4_ somewhat not true of myself

_3_ neither true nor untrue of myself

_2_ somewhat true of myself

_1_ definitely true of myself

5) I trust my initial feelings about people. (*Experiential Ability,* 24)

_1_ definitely not true of myself

_2_ somewhat not true of myself

_3_ neither true nor untrue of myself

_4_ somewhat true of myself

_5_ definitely true of myself

6) I try to avoid situations that require thinking in depth about something. (*Rational Engagement,* 11) *

_5_ definitely not true of myself

_4_ somewhat not true of myself

_3_ neither true nor untrue of myself

_2_ somewhat true of myself

_1_ definitely true of myself

7) I like to rely on my intuitive impressions. (*Experiential Engagement,* 31)

_1_ definitely not true of myself

_2_ somewhat not true of myself

_3_ neither true nor untrue of myself

_4_ somewhat true of myself

_5_ definitely true of myself

8) I don't reason well under pressure. (*Rational Ability,* 5) *

_5_ definitely not true of myself

_4_ somewhat not true of myself

_3_ neither true nor untrue of myself

_2_ somewhat true of myself

_1_ definitely true of myself

9) I don't like situations in which I have to rely on intuition. (*Experiential Engagement,* 34) *

_5_ definitely not true of myself

_4_ somewhat not true of myself

_3_ neither true nor untrue of myself

_2_ somewhat true of myself

_1_ definitely true of myself

10) Thinking hard and for a long time about something gives me little satisfaction. (*Rational Engagement,* 17) *

_5_ definitely not true of myself

_4_ somewhat not true of myself

_3_ neither true nor untrue of myself

_2_ somewhat true of myself

_1_ definitely true of myself

11) Intuition can be a very useful way to solve problems. (*Experiential Engagement,* 32)

_1_ definitely not true of myself

_2_ somewhat not true of myself

_3_ neither true nor untrue of myself

_4_ somewhat true of myself

_5_ definitely true of myself

12) I would not want to depend on anyone who described himself or herself as intuitive. (*Experiential Engagement,* 39) *

_5_ definitely not true of myself

_4_ somewhat not true of myself

_3_ neither true nor untrue of myself

_2_ somewhat true of myself

_1_ definitely true of myself

13) I am much better at figuring things out logically than most people. (*Rational Ability,* 6)

_1_ definitely not true of myself

_2_ somewhat not true of myself

_3_ neither true nor untrue of myself

_4_ somewhat true of myself

_5_ definitely true of myself

14) I usually have clear, explainable reasons for my decisions. (*Rational Ability,* 10)

_1_ definitely not true of myself

_2_ somewhat not true of myself

_3_ neither true nor untrue of myself

_4_ somewhat true of myself

_5_ definitely true of myself

15) I don't think it is a good idea to rely on one's intuition for important decisions. (*Experiential Engagement,* 37) *

_5_ definitely not true of myself

_4_ somewhat not true of myself

_3_ neither true nor untrue of myself

_2_ somewhat true of myself

_1_ definitely true of myself

16) Thinking is not my idea of an enjoyable activity. (*Rational Engagement,* 15) *

_5_ definitely not true of myself

_4_ somewhat not true of myself

_3_ neither true nor untrue of myself

_2_ somewhat true of myself

_1_ definitely true of myself

17) I have no problem thinking things through carefully. (*Rational Ability,* 8)

_1_ definitely not true of myself

_2_ somewhat not true of myself

_3_ neither true nor untrue of myself

_4_ somewhat true of myself

_5_ definitely true of myself

18) When it comes to trusting people, I can usually rely on my gut feelings. (*Experiential Ability,* 25)

_1_ definitely not true of myself

_2_ somewhat not true of myself

_3_ neither true nor untrue of myself

_4_ somewhat true of myself

_5_ definitely true of myself

19) I can usually feel when a person is right or wrong, even if I can't explain how I know. (*Experiential Ability,* 29)

_1_ definitely not true of myself

_2_ somewhat not true of myself

_3_ neither true nor untrue of myself

_4_ somewhat true of myself

_5_ definitely true of myself

20) Learning new ways to think would be very appealing to me. (*Rational Engagement,* 20)

_1_ definitely not true of myself

_2_ somewhat not true of myself

_3_ neither true nor untrue of myself

_4_ somewhat true of myself

_5_ definitely true of myself

21) I hardly ever go wrong when I listen to my deepest gut feelings to find an answer. (*Experiential Ability,* 29)

_1_ definitely not true of myself

_2_ somewhat not true of myself

_3_ neither true nor untrue of myself

_4_ somewhat true of myself

_5_ definitely true of myself

22) I think it is foolish to make important decisions based on feelings. (*Experiential Engagement,* 36) *

_5_ definitely not true of myself

_4_ somewhat not true of myself

_3_ neither true nor untrue of myself

_2_ somewhat true of myself

_1_ definitely true of myself

23) I tend to use my heart as a guide for my actions. (*Experiential Engagement*, 40)

_1_ definitely not true of myself

_2_ somewhat not true of myself

_3_ neither true nor untrue of myself

_4_ somewhat true of myself

_5_ definitely true of myself

24) I often go by my instincts when deciding on a course of action. (*Experiential Engagement,* 33)

_1_ definitely not true of myself

_2_ somewhat not true of myself

_3_ neither true nor untrue of myself

_4_ somewhat true of myself

_5_ definitely true of myself

25) I'm not that good at figuring out complicated problems. (*Rational Ability,* 1) *

_5_ definitely not true of myself

_4_ somewhat not true of myself

_3_ neither true nor untrue of myself

_2_ somewhat true of myself

_1_ definitely true of myself

26) I enjoy intellectual challenges. (*Rational Engagement,* 12)

_1_ definitely not true of myself

_2_ somewhat not true of myself

_3_ neither true nor untrue of myself

_4_ somewhat true of myself

_5_ definitely true of myself

27) Reasoning things out carefully is not one of my strong points. (*Rational Ability,* 4) *

_5_ definitely not true of myself

_4_ somewhat not true of myself

_3_ neither true nor untrue of myself

_2_ somewhat true of myself

_1_ definitely true of myself

28) I enjoy thinking in abstract terms. (*Rational Engagement,* 18)

_1_ definitely not true of myself

_2_ somewhat not true of myself

_3_ neither true nor untrue of myself

_4_ somewhat true of myself

_5_ definitely true of myself

29) I generally don't depend on my feelings to help me make decisions. (*Experiential Engagement,* 38) *

_5_ definitely not true of myself

_4_ somewhat not true of myself

_3_ neither true nor untrue of myself

_2_ somewhat true of myself

_1_ definitely true of myself

30) Using logic usually works well for me in figuring out problems in my life. (*Rational Ability,* 9)

_1_ definitely not true of myself

_2_ somewhat not true of myself

_3_ neither true nor untrue of myself

_4_ somewhat true of myself

_5_ definitely true of myself

31) I think there are times when one should rely on one's intuition. (*Experiential Engagement,* 35)

_1_ definitely not true of myself

_2_ somewhat not true of myself

_3_ neither true nor untrue of myself

_4_ somewhat true of myself

_5_ definitely true of myself

32) I don't like to have to do a lot of thinking. (*Rational Engagement,* 13) *

_5_ definitely not true of myself

_4_ somewhat not true of myself

_3_ neither true nor untrue of myself

_2_ somewhat true of myself

_1_ definitely true of myself

33) Knowing the answer without having to understand the reasoning behind it is good enough for me. (*Rational Engagement,* 19) *

_5_ definitely not true of myself

_4_ somewhat not true of myself

_3_ neither true nor untrue of myself

_2_ somewhat true of myself

_1_ definitely true of myself

34) Using my gut feelings usually works well for me in figuring out problems in my life. (*Experiential Ability,* 22)

_1_ definitely not true of myself

_2_ somewhat not true of myself

_3_ neither true nor untrue of myself

_4_ somewhat true of myself

_5_ definitely true of myself

35) I don't have a very good sense of intuition. (*Experiential Ability,* 21) *

_5_ definitely not true of myself

_4_ somewhat not true of myself

_3_ neither true nor untrue of myself

_2_ somewhat true of myself

_1_ definitely true of myself

36) If I were to rely on my gut feelings, I would often make mistakes. (*Experiential Ability,* 26) *

_5_ definitely not true of myself

_4_ somewhat not true of myself

_3_ neither true nor untrue of myself

_2_ somewhat true of myself

_1_ definitely true of myself

37) I suspect my hunches are inaccurate as often as they are accurate. (*Experiential Ability,* 30) *

_5_ definitely not true of myself

_4_ somewhat not true of myself

_3_ neither true nor untrue of myself

_2_ somewhat true of myself

_1_ definitely true of myself

38) My snap judgments are probably not as good as most people's. (*Experiential Ability,* 28)*

_5_ definitely not true of myself

_4_ somewhat not true of myself

_3_ neither true nor untrue of myself

_2_ somewhat true of myself

_1_ definitely true of myself

39) I am not very good at solving problems that require careful logical analysis. (*Rational Ability,* 2) *

_5_ definitely not true of myself

_4_ somewhat not true of myself

_3_ neither true nor untrue of myself

_2_ somewhat true of myself

_1_ definitely true of myself

40) I enjoy solving problems that require hard thinking. (*Rational Engagement,* 14)

_1_ definitely not true of myself

_2_ somewhat not true of myself

_3_ neither true nor untrue of myself

_4_ somewhat true of myself

_5_ definitely true of myself

Blue = Rational

Green = Experiential

Red = question number in original key

* = Reverse scoring

VITA

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	Masters Nursing Education, North Park University, Chicago, Illinois, 2002.
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