Critical Thinking in Nurse Anesthesia Education: A Pilot Study

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Abstract

Critical thinking is pivotal for student success in health professions education. Knowing the critical thinking ability of the learner helps educators tailor curriculum to enhance critical thinking. A quantitative comparative pilot study assessed critical thinking ability for students at two distinct points in a nurse anesthesia program curriculum. Critical thinking was examined using the Health Sciences Reasoning Test (HSRT) for students at the beginning and end of the first year of didactic instruction. This pilot study serves as a foundation for additional critical thinking studies. These study results may serve to help nurse anesthesia educators improve the learning process. Nurse anesthesia educators are in an important position to improve teaching and learning through classroom activities that foster critical thinking.

Keywords: *critical thinking; clinical reasoning; learner engagement*

Critical thinking is essential to the conduct of safe anesthetic practice. Nurse anesthesia program faculty strives to foster critical thinking by creating learner engagement activities throughout the academic and clinical curriculums. Both baseline assessment of students' critical thinking ability upon entry into nurse anesthesia programs and understanding of curriculum influence on critical thinking ability are currently lacking in the nurse anesthesia literature. Understanding student reasoning ability at various points in the curriculum serves to offer guidance for curriculum design and instruction throughout the training program. While literature is lacking regarding critical thinking in nurse anesthesia education, other healthcare disciplines offer some guidance on this important topic. Notably, critical thinking is linked to improved clinical performance as well as performance on examinations (Facione & Facione, 2008). Thus, the pilot study offered one approach to examining critical thinking in nurse anesthesia students.

The purpose of this study was to determine critical thinking ability of two groups of students in a nurse anesthesia program. Specifically, the study assessed critical thinking for students beginning the 27-month program of study and students at the end of the first 12 months of didactic instruction. These curricular points were chosen because students then enter 15 months of clinical education. The research question was:

What differences exist in critical thinking skills for nurse anesthesia students at the beginning of the academic curriculum as compared to the beginning of the clinical curriculum?

The overarching goal was to generate baseline assessment information for faculty to consider when planning instruction.

1. Significance of Critical Thinking

The anesthetic environment is dynamic. An intervention aimed at helping a patient might be ideal at one moment and inappropriate just a few moments later. Anesthetists must continually assess copious amounts of data, process that information correctly, formulate a plan, and select the most appropriate intervention. Subsequently, the anesthetist evaluates the effectiveness of that intervention and makes appropriate revisions if necessary. All of this information

handling and processing usually happens within a very short time.

The goal of nurse anesthesia education is to prepare students for clinical practice. Physiology, pathophysiology, pharmacology, and principles of anesthesia are significant components of nurse anesthesia education. Effective critical thinking is required to integrate these skills into an anesthetic customized to each patient and circumstance.

While there is a paucity of investigations describing the development of critical thinking skills in nurse anesthesia students, it is the stated goal of all nursing programs to develop these skills for entry-into-practice as mandated by the National League of Nursing (NLN) outcome guidelines (National League for Nursing Accrediting Commission, 1997). The American Association of Colleges of Nursing (AACN) has also identified critical thinking as a core priority for nursing education. While there have been many studies in nursing discussing the development of critical thinking skills, investigations into the development of critical thinking skills in graduate education remain sparse (McMullen & McMullen, 2009).

As a consequence of these outcome guidelines, many nursing schools have sought to develop a working definition of critical thinking. Most struggle with this task. Facione (1990) provided the most comprehensive definition of critical thinking through the Delphi Report. In this consensus statement a panel of forty-six professionals with experience in critical thinking came up with a working definition. The following is an excerpt from that statement: "We understand critical thinking to be purposeful, self-regulatory judgment which results in interpretation, analysis, evaluation, and inference, as well as explanation of the evidential, conceptual, methodological, criteriological, or contextual considerations upon which that judgment is based" (Facione & Facione, 2008, p. 2).

Diverse definitions of critical thinking have been suggested, but there remains an important component that appears to be common throughout; the reflective process. Reflection is needed to initiate and sustain the process of critical thinking (Locsin, 2001). There are divergent views regarding the development of critical thinking skills. Hicks (2001) proposed that post-educational professional experience is what develops critical thinking while Stone suggested that critical thinking can be developed through the educational process (Stone, Davidson, Evans & Hansen, 2001).

1.1 Relevant Scholarship

A literature gap exists examining the development of critical thinking skills in nurse anesthesia education. The nursing profession has published the vast majority of the studies examining critical thinking skills. Only one study in the nurse anesthesia literature addresses the development of critical thinking skills. However, recent articles describe the use of simulation in developing critical thinking skills (Gasko et al., 2012; Henrichs et al., 2002). Chipas (1995) posited that although practitioners are able to keep up with the scientific and technological advances in anesthesia, some educators fail to incorporate learner-centered (andragogical) teaching styles as opposed to the traditional teacher-centered (pedagogical) teaching style. The study examined student and faculty perceptions of teaching styles and their preferences finding that many educators continue to use traditional teacher-centered pedagogical teaching styles which tend to be much less effective in developing critical thinking skills in their students. Tedesco-Schneck (2012) described the use of active-learning pedagogical strategies which lead to the acquisition of critical thinking skills.

The slow transition from pedagogical (teacher-centered) teaching styles to andragogical (learner-centered or active-learning) teaching styles by nurse anesthesia educators may hinder the development of critical thinking skills. Relatively few educators have formal training in education and thus they usually teach the way they were taught (Dunn, DeBello & Brennan, 1981). Although nurse anesthesia educators work diligently to prepare competent students for entry into practice, adult-learning theories described during the last several decades can be used to further augment critical thinking development.

There may be several reasons why critical thinking skills are not optimally taught in nurse anesthesia programs. Splitter postulated that long-standing educational programs continue to use outdated methods of teaching. Experienced educators may not have evolved with the new understanding of learning theory. He stated that 'to teach for better thinking involves understanding the complexity of "thinking" and of those skills which comprise it (Spitler, 1995, p.21).

The literature includes many attempts to measure critical thinking development in educational programs (Sorensen &Yankech, 2008; Zimmerman, Lester-Short, Hendrix & Timson, 2011; Rogal &Young, 2008; Beckie, Lawry & Barnette, 2001; Romeo, 2010; & Wangensteen, Johansson, Bjorkstrom & Nordstrom, 2010). Some studies showed a definite increase in critical thinking skills over the length of the program (McMullen & McMullen, 2009; Sorensen &Yankech, 2008; Zimmerman, Lester-Short, Hendrix & Timson, 2011; Rogal &Young, 2008; Drennan, 2010; & Fero, et al. 2010). Other studies show equivocal results (Pardamean, 2012; Ashworth, Gerrish, & McManus, 2001).

For this reason, the investigators undertook the current study in an attempt to measure the development of critical thinking skills at specific curricular points in the nurse anesthesia educational process.

1.2 Hypothesis

The researchers hypothesized that critical thinking skills would improve after 12 months of didactic instruction.

2. Method

2.1 Design

A quantitative comparative pilot study assessed critical thinking ability for students at two distinct curricular points in the nurse anesthesia program. The purpose of the study was to determine critical thinking ability at specific points in the curriculum and to use the results to inform curriculum modifications including instructional strategies. In addition, the pilot study served as the foundation for additional studies dedicated to critical thinking.

2.2 Sampling

To determine critical thinking ability, the Health Sciences Reasoning Test (HSRT) (Insight Assessment, n.d.) was administered to two groups of nurse anesthesia students at one private health sciences university. The study sought to determine if a difference in critical thinking ability existed between the two curricular points (beginning of the academic curriculum and one year following entry into the academic curriculum). Following approval of the Institutional Review Board, all nurse anesthesia students were invited to participate in this optional study. There were no exclusion criteria for the convenience sample. Sample size projections were based upon Houser's estimate of 15 subjects per variable studied (Houser, 2012).

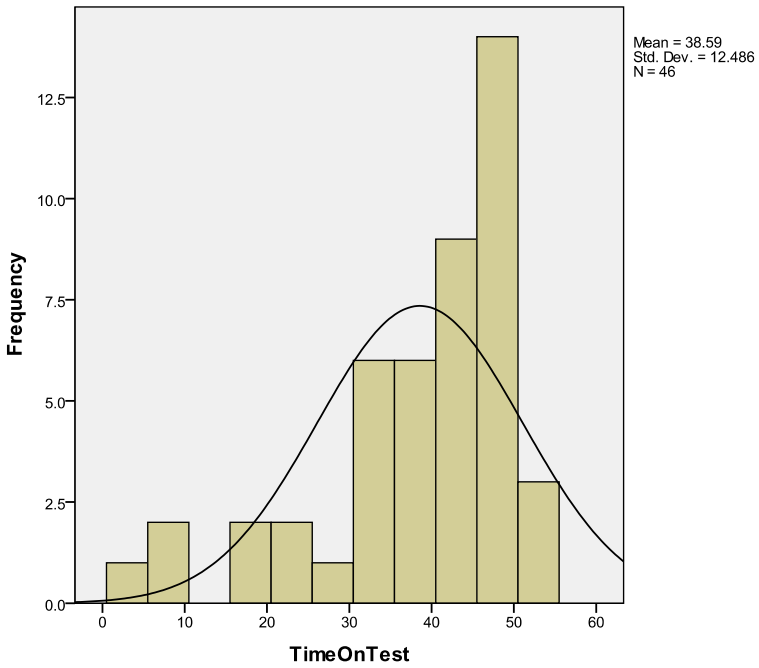
2.3 Data Sources and Analysis

The HSRT is a well-established on-line assessment specifically designed for health care professionals (Insight Assessment, n.d.). Scores have been found to predict success on high stakes professional licensing exams as well as solid clinical performance (Facione & Facione, 2008).

The 33 question Health Science Reasoning test (HSRT) was electronically administered by Insight Assessment over 50 minutes (Insight Assessment, n.d.). Demographic data collected included age, gender, ethnicity, years as a registered nurse prior to entering nurse anesthesia training, number of academic degrees held, and years since completion of the last academic degree. Groups were divided according to year in the anesthesia program. Data collection was completed in less than 30 days. Data analysis was completed using PASW Statistics 18 (SPSS Inc. 2009).

3. Results

The original data set included 47 subjects out of a possible 54, 25 from Group 1 and 22 from Group 2. One duplicate result was removed. Time spent on the HSRT was not normally distributed as seen in Graph 1. Mean time on test was 38.59 minutes, median 42.3 minutes. Times on test values below the 5th or above the 95th percentiles were excluded as outliers. The final sample of 43 included 24 from Group 1 and 19 from Group 2 is seen in Table 1.



Graph 1: Distribution of Time on Test

Table 1: Demographics and Significance

		Percentage Total	Group 1	Group 2	P-Value
Ethnicity	Caucasian	79.1%	79.2%	79%	-
	Asian/Pacific Islander	9.3%	8.3%	10.5%	-
	Hispanic/Latino	7%	8.3%	5.3%	-
	Other	2.3%	-	5.3%	-
	Decline to State	2.3%	4.2%	-	-
Ethnicity by Group	-	-	-	-	0.689
Gender	Male	30.2%	33.3%	26.3%	-
	Female	69.8%	66.7%	73.7%	-
Gender by Group	-	-	-	-	0.619
Mean Age	-	30.86	30.83	30.89	0.966
(SD)			(4.459)	(4.841)	
>90% Completion			21 of 24	16 of 19	0.757
Number of Degrees	One	55.8%	66.7%	42.1%	-
	Two	37.2%	25%	52.6%	-
	Three	7%	8.3%	5.3%	-
Mean (SD)	-	-	1.42 (0.654)	1.63 (0.597)	0.273
Years Since Degree	Two	16.3%	12.5%	21%	-
	Three	9.3%	16.7%	-	-
	Four	16.3%	20.8%	10.6%	-
	Five or More	58.1%	50%	68.4%	-
Mean (SD)	-	-	4.08 (1.100)	4.26 (1.240)	0.617
Years Experience	One	4.7%	8.3%	-	-
	Two	20.9%	20.8%	21%	-
	Three	25.6%	25%	26.3%	-
	Four	13.9%	12.5%	15.8%	-
	Five or More	34.9%	33.3%	36.9%	-
Mean (SD)	-	-	3.42 (1.381)	3.68 (1.204)	0.508

As shown in Table 1, no statistically significant difference was found between the two groups in terms of gender, ethnicity, number of academic degrees or number of subjects completing >90% of the HSRT within the 50 minutes

allotted using the chi-squared test. No statistically significant difference was found between groups in terms of age, years as a registered nurse prior to entering nurse anesthesia training, or years since completion of the last academic degree using the independent samples t-test.

Results of the HSRT were provided by Insight Assessment as overall score and subscale scores in induction, deduction, analysis, inference, and evaluation. Scores were not normally distributed and were evaluated using the Independent Samples Mann-Whitney U test. No significant difference was found between groups when comparing overall scores or subscale scores in induction, deduction, analysis, inference, or evaluation as seen in Table 2. No statistically significant correlation was found between number of years as a registered nurse prior to entering nurse anesthesia training and overall HSRT score ($p = 0.590$). Both groups scored highest in inductive reasoning and lowest in inference.

Table 2: Overall and Subscale Score Comparison

Score Mean (SD)	Group 1	Group 2	P-Value
Overall	19.93 (3.32)	18.12 (5.40)	0.417
Induction	7.34 (1.39)	6.54 (1.81)	0.146
Deduction	5.42 (1.56)	6.01 (2.30)	0.210
Analysis	4.13 (1.33)	3.67 (1.43)	0.346
Inference	3.03 (0.68)	2.72 (1.36)	0.565
Evaluation	4.78 (0.99)	4.43 (1.54)	0.565

4. Discussion

The current study results demonstrated no statistically significant difference in critical thinking ability for students at two distinct curricular points. This result surprised the investigators. The science of thinking and of teaching has exploded in the past several decades. So much more is known about how students learn, especially the differences in adult learning theory and complexity related to generational differences. The development of critical thinking skills is imperative to nurse anesthesia education, yet the lack of investigations showing critical thinking development detracts from its importance and limits the ability to evaluate if critical thinking is even taking place in nurse anesthesia education.

The results contrast with earlier nursing studies where critical thinking ability improved over the course of a curriculum in undergraduate nursing (McMullen & McMullen, 2009). This study also shows improvement in some areas and decline in others that is not consistent across student groups.

We were surprised to uncover this result as we postulated that critical thinking would naturally improve similarly for all students after 12 months of classroom instruction. The decrease in mean score was not found to be statistically significant. The results may be confounded by testing two different cohorts rather than the same cohort and the small samples. While the pilot examined two different cohorts, future studies will longitudinally examine one cohort at three distinct curricular points including the beginning and end of the academic year as well as completion of the 15-month clinical practicum.

The literature offers insight that supports the testing of critical thinking for graduate students in health professions. The framework for this study is based on the foundation that cognitive and affective dispositions, both essential in critical thinkers, foster the ability to problem solve, evaluate and exercise sound judgment in critical scenarios often played out in the operating room. The classic Delphi Report underscores the need to assess critical thinking in graduate students with application to students entering healthcare professions (American Philosophical Association, 1990). Determining baseline critical thinking skills in nurse anesthesia students may assist in curricular improvements and serve as a framework for clinical education.

Existing literature in nursing is plentiful, but as mentioned earlier, few studies in nurse anesthesia education address critical thinking. Ensuring safe anesthesia practice necessitates faculty examination of this important issue. McMullen and McMullen (2009) examined graduate nursing students critical thinking abilities over time to assess individual growth patterns and academic outcomes. Understanding the baseline critical thinking ability was foundational for the study. Understanding the student ability to critically think at the beginning of the academic program can inform faculty about the need to tailor instruction. Profetto-McGrath (2003) studied undergraduate nursing students. Critical thinking scores increased over three years, but not significantly in the fourth year of education. The authors suggested continued development to include critical thinking in undergraduate nursing

education. Rogal and Young (2008) used a pre-test post-test design to test critical thinking in undergraduate nursing students. The researchers found that the majority of students improved critical thinking ability during the course of study. In contrast, Parmadean (2012) found no change in critical thinking skills in dental students from the first to the third year of education when using the HSRT.

Reasoning skills overall speak to the ability to make decisions on what to think or what to do in a variety of scenarios. According to the interpretive scoring for the HSRT,

"High overall scores are attained by test takers who excel in the sustained, focused and integrated application of core thinking skills measured on this test, including analysis, interpretation, inference, evaluation, explanation, induction and deduction. The overall score predicts the capacity for success in educational or workplace settings which demand reasoned decision making and thoughtful problem solving" (Insight Assessment, n.d.).

Other healthcare disciplines have used the Health Sciences Reasoning Test (HSRT) to study critical thinking. Several articles serve as reference points for the validity of the HSRT assessment tool. A recent study by Wetmore, Boyd, Bowen and Patillo (2010) shared,

"Reported content and construct validity identify how well the HSRT measures critical thinking skills based on the 1990 APA definition of critical thinking and theoretically should have similar correlations to the criterion as the CCTST. Criterion validity for the HSRT continues to emerge…. HSRT subscale content requires application of classic reasoning skills to contexts more appropriate to health care professionals. Analysis, inference, evaluation, deductive reasoning, and inductive reasoning subscale scores range from a KR-20 of .77 to .84 with an average KR-20 of .81.35 These data document overall internal consistency (p. 1339)."

This study was conducted in dentistry.

Although the total critical thinking scores over time were lacking for the two cohorts, inductive reasoning represented the highest measure of thinking overall. In anesthesia, inductive reasoning skills are used to draw inferences about what is thought to be true based on case reports, clinical studies, prior anesthesia experiences, and simulations.

The lowest scoring measure of thinking for the two cohorts was inference. In anesthesia, inference is used to draw conclusions from reason and evidence. For example, based upon evidence that exists in the anesthesia literature regarding unintentional hypothermia, the anesthetic plan includes precautions to avoid temperature decreases in the operating room. Copious studies exist that inform our practice.

While all thinking measures point to the need to focus instruction on activities that foster critical thinking ability, attention to improve analytical and evaluation thinking skills for nurse anesthesia students is needed. In anesthesia, analysis is used to identify and interpret copious data for use in constructing an anesthetic plan. Strong interpretive skills are essential for highly skilled analytical thinkers. Students need to form understanding of relationships between concepts. In addition, strength in critical thinking is exemplified in students who are able to explain concepts. Herein lays the strength of andragogy in a learner-centered environment rather than a teacher-centered environment. This skill links specifically to evaluative reasoning where data is used to determine the strength or weakness of claims made.

The rigorous front-loaded curriculum includes 12 months of classroom and simulation experience covering basic sciences, pharmacology and anesthesia principles complete with case-based scenarios and patient applications. The faculty consistently tries to use teaching techniques that enhance critical thinking skills in the classroom and simulation laboratory, yet acknowledge that baseline assessment information about critical thinking skills is lacking.

5. Implications for Nurse Anesthesia Education

How do we plan teaching without basic knowledge about our student's ability to think? Perhaps examination of critical care nursing experience may yield clues regarding existing critical thinking skills for students entering nurse anesthesia programs. This practice is based upon the incorrect assumption that experience as a critical care nurse implies critical thinking ability. The current study substantiates the very weak relationship between the years of practice as an ICU nurse with the overall HRST scoring. While the sample size is small and the study examined students in one program only, the results speak to the need to conduct future studies. Most importantly, the results inform faculty with the evidence to explore the educational literature to determine what types of classroom and simulation techniques best serve today's nurse anesthesia student.

The study results suggest that we assess students' critical thinking ability at the beginning of the program. Faculty

could then develop teaching strategies that promote critical thinking. Identifying strong and weak critical thinking attributes early may prompt faculty and students to explore study strategies to enhance reasoning ability. Finally, faculty may consider adding strategies to lesson planning throughout the curriculum that include active engagement exercises to promote critical thinking ability.

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