Marian University

Leighton School of Nursing

Doctor of Nursing Practice

Final Project for Students Graduating in May 2022

Simulation-Based Training for Anesthesia Machine Set-up

Nicholas Keesler

Leighton School of Nursing, Marian University

Chair:	Bradley Stelflug, DNAP, CRNA
	_____ (Signature)
Committee Member(s):	Christina Pepin, Ph. D., RN, CNE
	_____ (Signature)
Date of Submission:	November 4th, 2021

Table of Contents

Dedication

The anesthesia profession is based in medical science, but is practiced as an art. As anesthesia has evolved and developed so has the training of nurse anesthetists. In keeping with the evolving progress of nurse anesthetist training, I chose to further develop the process of the anesthesia machine set-up training. Student nurse anesthetists have little to no exposure to the anesthesia machine prior to beginning their training, but it is a machine that they will use every day. I feel that it is a strong foundation is paramount to nurse anesthesia training. This DNP project is dedicated to my loving wife, Caitlin Keesler. She has been my foundation providing love and support.

Acknowledgement

I would like to express my gratitude to my Chair Dr. Stelflug for his help in developing and guiding this project. Also, for encouraging me to continue to follow this path of improving Nurse anesthesia education through simulation. I also want to express my thanks to my Committee Member Dr. Pepin, who has patiently and kindly guided me throughout this project from the beginning to the end.

Abstract

Background and Review of Literature: The presurgical anesthesia machine check is a critical procedure that all anesthesia providers must be capable of performing. Failing to perform an anesthesia machine check increases morbidity and mortality during patient care. Simulation training for anesthesia providers is a safe and effective educational pathway allowing providers to improve their skills prior to beginning clinical practice. Optimizing learning by modifying simulation practices to follow INACSL practice standards will enhance the learning for future anesthesia providers.

Purpose: This DNP project was a quality improvement project to examine the effect on SRNA knowledge, confidence, and satisfaction of learning when comparing anesthesia machine checklist versus simulation-based training.

Methods: This DNP project utilized a quality improvement design and was evaluated by the Student Satisfaction and Self-confidence in Learning instrument and a post-test knowledge assessment.

Implementation Plan/Procedure: A total of 24 SRNA's enrolled in Marian University's nurse anesthesia simulation course were divided into 2 groups. Group one participated in the current practice of an anesthesia machine checkoff, while group two participated in the current practice and the anesthesia machine set-up simulation. Both groups underwent the same checkoff for the current anesthesia machine checkoff. Both groups were given a post-test of the Student Satisfaction and Self-confidence in Learning instrument. Finally, both groups also completed a post-test knowledge assessment.

Implications/Conclusion: Overall, the participants in the experimental group scored higher in agreement in the satisfaction ($U = 28.0$, $p = 0.032$) and self-confidence of student

learning (U = 43.5 , p = 0.273). The experimental group scored higher in the knowledge section. If current practice is modified to incorporate INACSL best practice standards for simulation, nurse anesthesia educational programs will be able to increase confidence and safety of SRNAs as they progress through their anesthesia training.

Keywords: SRNA, Simulation, INACSL, Jeffries Simulation Model, Anesthesia Machine

Doctoral of Nursing Practice Project: Simulation Based Training for Anesthesia

This project is submitted to Marian University Leighton School of Nursing faculty as partial fulfillment of degree requirements for the Doctor of Nursing Practice, Nurse Anesthesia Track. This was an evidenced-based study into the effects of anesthesia machine setup simulation on student knowledge and confidence. Current International Nursing Association for Clinical Simulation and Learning (INACSL) simulation frameworks and methodologies were used to assess and evaluate the current anesthesia machine set-up practices and then implemented ways to improve the knowledge, confidence, and clinical judgment needed for a successful anesthesia machine setup. The goal of this project was to provide the first-year student registered nurse anesthetist (SRNA) students with simulation experiences that would positively impact their learning and behavior, preparing them for their future as Certified Registered Nurse Anesthetists (CRNA).

Background

The beginning of any clinical experience should start with a firm foundation in knowledge and learning. Knowledge and learning occur through the combination of experiences and reflection (INACSL Standards Committee, 2016a). In the case of anesthesia machine setup, it is essential to instill a foundational learning experience that individuals may carry to all facets of an individual's anesthesia practice.

With the continual use of simulation as a teaching tool, researchers are continually advancing to discover the best evidence-based practices. INACSL is at the forefront of simulation design, implementation. INACSL standards for simulation provide in-depth guidelines allowing for standardization of language regarding the development, research use, and teaching applications (Sittner et al., 2016). A focused simulation design promotes a process that

increases consistency with the institutional mission and program goals for teaching and education (INACSL Standards Committee, 2016b).

Through the inclusion of the INACSL standards of best practice in this research study, it is possible to develop an improved institutional framework to apply to simulation, specifically anesthesia machine setup. The lack of follow-through with INACSL standards of best practice may lead to a poor simulation (INACSL Standards Committee, 2016b).

Problem Statement

A student registered nurse anesthesia (SRNA) is an expert in their nursing practice before applying and accepting a placement into a nurse anesthetist training program. With adult learners, it is necessary to develop a training method that is purposeful and systematic, but flexible (INACSL Standards Committee, 2016b). With first-year anesthesia students, it is vital to incorporate their knowledge and experiences, but also to expand upon that knowledge in a way that is consistent with adult learning strategies and graduate level teachings. The question posed by this Doctoral of Nursing practice project is whether SRNA students' participation in anesthesia machine set-up simulation improves knowledge and confidence compared to basic anesthesia machine set-up checkoff.

Gap Analysis

This project was implemented at Marian University in the CRNA program curriculum. The current practice for anesthesia machine set-up is a student check-off which is completed under the supervision of the simulation course instructor. Current practice requires the SRNA to complete an anesthesia machine checkoff.

SRNAs go through an anesthesia machine checkoff on an Apollo Drager anesthesia machine, which are currently used in many clinical site's students use for their clinical training.

The anesthesia machine checkoff does not increase a SRNAs critical thinking skills to address critical issues during an anesthesia machine set-up. However, an anesthesia machine set-up simulation with a debrief, which has been shown to benefit learners, would better prepare SRNAs for their clinical experiences (Ballister, 2018; Cannon-Diehl et al., 2012; Fletcher, 1995; Grota & O'neal, 2020; Hanshaw & Dickerson, 2020; INACSL Standards Committee, 2016-a, 2016-b; McMullen et al., 2016).

This site is appropriate for project implementation due to its curriculum requirements and the availability of a high-fidelity simulation lab. Additionally, simulation-based training is becoming a modern mainstay in the education of SRNA students and is encouraged by the National Board of Certification and Recertification for Nurse Anesthetists (NBCRNA). Accrediting organizations acknowledge that simulations help develop critical thinking skills and provide experiential learning opportunities for SRNA students (Council on Accreditation, 2020).

Review of Literature

The practice of nursing within the healthcare realm is constantly evolving and our education strategies are continually changing to meet the demands of the times. A recent trend in medical education has been the use of simulation-based training to develop critical thinking and psychomotor development (Kim et al., 2016). Students engaging in simulation training can develop technical skills and receive prompt feedback. This immediate feedback provides a pathway to improving comprehension and overall performance. A key benefit of simulation is that it allows learners to take their simulation experiences into the real world to improve healthcare quality (Hegland et al. 2017).

Search Methodology

PubMed, CINAHL, Google Scholar, and the American Association of Nurse Anesthetists (AANA) webpage were utilized for the search of literature regarding anesthesia and nursing education and simulation. Keywords with the Boolean phrases *and* and *or* were used during the search. Keywords included: *simulation, simulation-based, training, education, confidence, knowledge, performance, nursing education, nurse anesthetist, anesthetist, CRNA, training, and debrief*. Inclusion criteria required articles to be published within the last five years, published in the English language, and contain keywords used in the search. Studies from before 2015 were excluded from the literature search. However, that exclusion criteria was waived for one article, Fletcher (1995) considering the classical importance to anesthesia simulation, stating that simulation accelerates understanding and confidence early in nurse anesthesia training.

Additionally, articles needed to establish a measurement of knowledge, confidence, or performance based on a simulation training experience. The International Nursing Association for Clinical Simulation and Learning (INACSL) was also incorporated into the discovery of articles related to simulation. After a thorough search through 28 full text articles, six journal articles levels I-VII of the nursing hierarchy of evidence were found and used to write this review of the literature. (Appendix A)

Simulation

Utilizing simulation as an educational technique allows educators to assess competency and has been shown to decrease medical errors in the healthcare environment (Cannon-Diehl et al., 2012). An example of the utilization of simulation to decrease medical errors would be the American Heart Association's (AHA) use of manikins with audible cues for the correct depth of chest compressions during basic and advanced life support training. The AHAs manikin

simulation training allows students to practice their chest compression technique and instructors to provide feedback. The development and use of INACSL standards for simulation allow for a standardization of simulation design, language, and behaviors (Sittner et al., 2015). Teaching through simulation provides a safe and controlled environment for knowledge and learning to occur, by combining experiences and reflection (INACSL Standards Committee, 2016a).

During an anesthesia provider's education, they will undoubtedly come across an anesthesia machine, and it is fundamental to understand its purpose and function. Simulation can be used as a steppingstone in developing a deeper understanding of how-to set-up and operate anesthesia machines. As educators continue to adopt and invest in new simulation practices, they should try to incorporate INACSL simulation standards to incorporate a uniform teaching method (INACSL Standards Committee, 2016a). Integration of these standards will improve the development of critical thinking skills protecting future patients.

Knowledge

Before any simulation, it is paramount to assess the knowledge, perceptions, and attitudes of the participants (Cannon-Diehl et al., 2012). The anesthesia machine provides various uses in the operating theatre during its use for patient care. Anesthesia providers need to differentiate between these uses of an anesthesia machine.

The anesthesia machine delivers anesthetic vapors to the patient at exact concentrations along with other gases such as oxygen, nitrous, and air. Developing an understanding of the mechanics and physiology of delivering anesthesia is central to providing patient care (Shields & Gentry, 2020). An example of this is Shields & Gentry's (2020) research, which discusses that transesophageal echocardiography simulation was a net positive with a P value of less than 0.1 with first-year SRNA students due to their improved image interpretation and pathology

identification. Shields and Gentry's (2020) study showed that initial pretest scores were similar for online and simulation groups averaging 33.5 for the online group and 35.6 for the simulation group. Post test scores were higher for simulation with an average of 69.4 compared to online with an average of 42.3 (Shields & Gentry, 2020) Simulation may allow students to develop a stronger knowledge base and learn about the anesthesia machine before their transition from didactic to clinical practice.

Moving from didactic to clinical practice could prove to be a difficult transition with little previous hands-on experience. Kim et al. (2016) found that simulation is an effective strategy to enhance baccalaureate nursing students' psychomotor skills. They also found that educational outcomes improved through the implementation of a variety of learning methods in congruence with simulation (Kim et al., 2016). This becomes especially important when performing anesthesia machine set-up. While understanding how to prepare the anesthesia machine is an often-routine activity, if done incorrectly patient care outcomes may suffer through unrecognized machine faults monitoring oxygen, carbon dioxide, and inadequate suction (Fletcher, 2015).

Additionally, Hustad et al. (2019) reported simulation experiences improved clinical skills and judgment. They wrote that simulation provided learning in a safe environment, allowing participants to close the knowledge gap between theory and clinical practice (Hegland et al., 2017). A common consensus between multiple studies showed that simulation training is a beneficial tool to be utilized throughout the didactic and clinical curriculum to further critical thinking skills and knowledge development (Ballister, 2018; Cannon-Diehl et al., 2012; Fletcher, 1995; Grota & O'neal, 2020; Hanshaw & Dickerson, 2020; INACSL Standards Committee, 2016-a, 2016-b; McMullen et al., 2016). Students need to be exposed to simulation consistently to form a foundational knowledge base which can then be transitioned into clinical practice.

Confidence

Through the use of simulation-based training, it is possible to build the confidence of students before and during their interactions during clinical practice (Hanshaw & Dickerson, 2020). Additionally, Hanshaw & Dickerson (2020) summarized, through a review of multiple studies, that there was an increase in participant self-confidence after participating in a simulation scenario. The transition from didactic to clinical practice setting often results in performance anxiety, which may be decreased through simulation training (Ballister, 2018). Two studies also reported that along with increasing confidence gained by the use of simulation as a teaching method, it also decreased anxiety (Ballister, 2018; Hanshaw & Dickerson, 2020).

Debriefing

A simulation debriefing reflects the actions performed which can lead to new interpretations by students and cognitive reframing which enhances learning and self-awareness (INACSL Standards Committee, 2016a). Hanshaw and Dickerson (2020) wrote a comprehensive literature review using twenty studies and identified debriefing as the most crucial aspect of simulation learning. Debriefings provide an avenue for students to align theory with clinical practice and further develop their critical thinking skills (Ballister, 2018; Cannon-Diehl et al., 2012; Fletcher, 1995; Grota & O'neal, 2020; Hanshaw & Dickerson, 2020; INACSL Standards Committee, 2016-a, 2016-b; McMullen et al., 2016). The importance of debriefing sessions demands that they be incorporated throughout simulation-based curriculums.

INACSL (2016a) presents a debriefing protocol for simulation-based education and with the constant push to evolve simulation training, having protocols in place to standardize debriefing benefits both educators and students (INACSL Standards Committee, 2016a). This

also presents an opportunity for the student to reflect on the simulation and appraise their actions or inactions (Hanshaw & Dickerson, 2020). Additionally, the debriefing session after simulation-based training allows for further development of the participating students, preparing them for clinical practice (Hegland et al., 2017).

A key difference McMullen et al. (2016) included in their study was that participants were able to pause the scenario and debrief at the moment. McMullen et al. (2016) wrote that the student may feel overwhelmed and stressed during a simulation leaving them unable to absorb information. Pausing the simulation was an action that provided an opportunity for the student to relax and reflect, which improved performance (McMullen et al., 2016).

Review of Literature: Conclusion

Simulation-based educational training sessions can improve the overall performance, knowledge, and confidence of participants. Through the experiences and knowledge gained through simulation training, students are better prepared for entering clinical practice (Ballister, 2018). This preparation allows for a smoother transition into clinical practice (Ballister, 2018).

Although there is not much research specifically related to anesthesia machine set up, the articles presented in this review of literature discuss the benefits of simulation on student learning. Additionally, the simulation debriefing session allows the knowledge and the necessary skills to be tied together, forming a solid foundation for the learning experience. Finally, through gained confidence and knowledge future anesthesia providers will ultimately be able to increase the quality of patient care provided.

DNP Theoretical Framework

The Jeffries Simulation Theory was selected as the theoretical framework for this project. The Jeffries Simulation Theory model was developed in 2005 and was meant as a simulation

design template (Jeffries, 2005). This theory has five major components of designing a simulation: *objectives, fidelity, complexity, cues, and debriefing* (Jeffries et al, 2015).

Simulations are an effective method of teaching and developing critical thinking skills in a safe environment (Jeffries, 2005). Through using Jeffries Simulation theory this project's objective was to develop a simulation that will teach and test first year SRNA students critical thinking skills for an anesthesia machine set-up. The experimental group had three objectives to complete within a twenty-minute time frame. Secondly, fidelity will involve a functioning Apollo Drager anesthesia machine, which students will see in clinical practice. Jeffries Simulation Theory indicates that some simulations may be complex to new learners and cues help students progress through the simulation (Jeffries, 2005).

Finally, perhaps one of the most important components for learning is debriefing . Debriefing allows the learner to review and discuss their actions throughout the simulation. Debriefing also allows the teacher to evaluate and discuss the learner's decision making and how to approach similar scenarios in the future (Jeffries, 2015). In studying the importance of debriefing Kim et al., (2016) found that debriefing helps improve cognitive learning and improved critical thinking skills.

Using the Jeffries Simulation Theory model with a focus on objectives, cues, and debriefing, this project design guided learning and problem solving during an anesthesia machine set-up simulation. Reflection of the simulation simultaneously allows the educators to continue to develop and improve simulation for future learners. This theory allows the examination of learner's knowledge outcomes, skills, competency, critical thinking, and self-confidence, which are of interest to this project.

Goals, Objectives, and Expected Outcomes

This project was designed to increase the knowledge and confidence of first-year SRNA students through anesthesia machine set-up simulation prior to their first clinical experience. The goals of this project were to 1) evaluate the knowledge of anesthesia machine set-up through a post-test; 2) evaluate the confidence level after anesthesia machine set-up simulation; 3) evaluate if the addition of debriefing increases SRNA knowledge of anesthesia machine set-up. These goals were assessed through a posttest assessment and evaluation. The objective of this project was to give first year SRNA students high-fidelity and high-quality simulation-based training for anesthesia machine setup which will enhance their learning and ability to perform a successful anesthesia machine setup. The expected outcomes of this project were to improve learning and anesthesia machine setup through the use of INACSL best practices for simulation.

Project Proposal

Project Design

This project is designed to be a quality improvement intervention for anesthesia machine set-up simulation. This project compared current check-off based training for anesthesia machine setup utilized at Marian University to anesthesia machine setup using INASCL best practices for simulation. Through comparing the practices, it was to be determined if this project is an improvement over Marian University's current anesthesia machine setup checkoff using posttests to assess confidence levels and knowledge.

Site

Marian University is home to Indiana's first Doctorate of Nursing Practice CRNA program with an average class size of twenty students. This project made use of the CNRA programs high-fidelity simulation lab located at Marian University. Marian University's CRNA

simulation lab contains an Apollo Drager anesthesia machine with oxygen, nitrogen, and carbon dioxide gas connections.

Methodology

This project focused on a quality improvement process to the enhance the teachings of the anesthesia machine set-up at Marian University. This project involved the use of a fully functional anesthesia machine for simulation purposes. This quality improvement project promoted the use of simulation in combination with a checkoff list versus a standard checkoff list. First-year SRNA students were evenly and randomly assigned to either the control or experimental group. The control group participated in the current training for anesthesia machine set-up check off.

The control group participated in the standard practice anesthesia machine set-up checkoff with the instructor. The experimental group went through a basic anesthesia machine set-up checkoff first. Next, a set of two first-year SRNAs left the room and the machine was rendered faulty. The faults used for this simulation were a failure of a low-pressure test due to a circuit leak, a cracked suction canister that needs exchanged, and an empty oxygen cylinder on the back of the anesthesia machine that needed exchanged. Interventions required the students to problem-solve through the machine set-up to identify and remedy the fault within a twenty-minute time frame.

Immediately after the completion of the simulation by the two first-year SRNAs the author conducted a debriefing session of up to twenty minutes. The debriefing session was used to assess the student insights about their problem solving and decision-making skills required for successful anesthesia machine set-up. Once the debriefing session was completed the students

were asked to complete a post-test to assess confidence and knowledge immediately after the simulation.

Measurement

This project measured the SRNA student's knowledge and confidence with a post-test. A competency evaluation was performed at the completion of each simulation. A post-test developed by the National League for Nursing and modified for this project was used to measure confidence for both groups (National League of Nursing, 2021). A knowledge-based post-test comprised of questions written to establish if the SRNA student understands the importance of anesthesia machine setup developed using Nagelhout's 6th edition *Nurse Anesthesia*, 2018. Faults were decided with CRNA faculty and author of this project. Students were given twenty minutes to correct the faults, before the senior SNRA intervenes to assist in the correction of faults with prompt progression into debriefing session.

Data Collection

Data from this quality improvement intervention was collected during first-year SRNA skills checkoffs in March 2021. Information was gathered electronically through Qualtrics, a third-party vendor, and stored on the cloud with an encryption key. Data from the post-test and competency evaluation was collected with anonymous response reporting to maintain confidentiality. A limitation to this quality improvement project was the small sample size of SRNA first-year anesthesia students. Another limitation of this study was the restriction of group sizes. These limitations may be overcome by scheduling small group sizes for the simulation in the future.

Analysis

After the ordinal data was collected, it was analyzed using a non-parametric test. In this case a Mann Whitney U test was used to compare the control and simulation group results. Data was compiled and synthesized to evaluate the dependent variable (check-off) and independent variable (simulation) through comparing the mean score of the two samples and related confidence intervals. A statistical package for social sciences software was used to conduct the statistical analysis.

Timeline

This project proposal was completed in December 2020. Institutional Review Board (IRB) submission occurred in January 2021. Upon approval from the IRB, the implementation and data collection commenced on March 8th, 2021, and was completed by the end of April 2021. Final data analysis was completed by May 2021.

Findings and Results

A total of 24 first-year Marian SRNAs qualified for this study. The students were randomly divided into the control group and the subject group. A total of 10/12 students in the control group completed the post-survey with knowledge test (83% response rate). All twelve students in the subject group participated in and completed the post-survey (100% response rate). Most respondents (77%) were between the ages of 26-35 and have been working as a registered nurse for at least 4 years (82%). All respondents, (100%) do not have any previous experience setting up an anesthesia machine prior to beginning CRNA school. Please refer to Table 1 to view the demographics of all survey respondents.

Table 1

Demographics and Background Characteristics of All Survey Respondents

Characteristics	n	%
Experience Setting Up an Anesthesia Machine Prior to Beginning CRNA School		
Yes	0	0
No	22	100
Age Group		
20-25 years	1	4.5
26-30 years	12	54.5
31-35 years	5	22.7
36-40 years	2	9.1
40+ years	2	9.1
Years Working as a Registered Nurse		
1-3 years	4	18.2
4-6 years	9	41.0
7-11 years	3	13.6
12+ years	6	27.2

Note. n=22

Satisfaction and Self-Confidence with Current Learning

Questions one through five on the questionnaire were specifically measuring overall satisfaction with current learning. Questions six through thirteen on the questionnaire were specifically measuring self-confidence with current learning. All questions were analyzed separately by their reported levels of agreement and compared amongst groups. Please see Appendix I to view table 2-14.

Post-Test Overall Satisfaction with Current Learning between Control Group and Subjects

To determine if satisfaction with current learning differed in a statistically significant way, student's reported levels of satisfaction on a 5-point scale that ranged from 1 to 5. The results of a Mann Whitney U test indicated that those in the post-test subject group were more satisfied with current learning (Mdn=4.8, range 3.6-5.0) than those in the post-test control group (Mdn=3.8, range 2.4-5.0). This difference in satisfaction was statistically significant (U= 28.0,

p=.032). In addition to the summed values, four individual items in the subscale were statistically significant. See table 15 for satisfaction results.

Table 15

Results of 5-items to measure satisfaction with current learning in post-test.

Item	Control group mean (SD)	Subject group mean (SD)	Mean difference	p-Value
Satisfaction 1	3.80 (1.03)	4.75 (0.45)	+0.95	0.008*
Satisfaction 2	3.90 (0.88)	4.17 (0.94)	+0.27	0.389
Satisfaction 3	3.50 (1.08)	4.67 (0.49)	+1.17	0.007*
Satisfaction 4	3.50 (1.18)	4.50 (0.67)	+1.00	0.032*
Satisfaction 5	3.80 (0.92)	4.58 (0.67)	+0.78	0.030*
Summed satisfaction	18.50 (4.40)	22.67 (2.77)	+4.17	0.032*

**Note.* Using Mann Whitney U test, statistically significant change at $p < 0.05$.

Post-Test Overall Self-Confidence in Learning between Control Group and Subjects

To determine if self-confidence in learning differed in a statistically significant way, student's reported levels of satisfaction on a 5-point scale that ranged from 1 to 5. The results of a Mann Whitney U test indicated that there was not a statistically significant difference in self-confidence in learning (U= 43.5, p=.273) between post-test subject group (Mdn=4.2, range 3.75-4.9) and control group participants (Mdn=4.0, range 3.5-5.0). Likewise, zero items in the subscale were statistically significant. See table 16 for satisfaction results.

Table 16

Results of 8-items to measure self-confidence in learning in post-test.

Item	Control group mean (SD)	Subject group mean (SD)	Mean difference	p-Value
Self-Confidence 6	4.00 (0.67)	3.92 (0.79)	-0.08	0.939
Self-Confidence 7	4.10 (0.74)	4.08 (0.52)	-0.02	0.908
Self-Confidence 8	4.00 (0.67)	4.33 (0.49)	+0.33	0.215
Self-Confidence 9	3.70 (1.25)	4.42 (0.52)	+0.72	0.204
Self-Confidence 10	4.20 (0.92)	4.33 (0.65)	+0.13	0.883
Self-Confidence 11	4.40 (0.52)	4.25 (0.45)	-0.15	0.462
Self-Confidence 12	4.20 (0.42)	4.17 (0.84)	-0.03	0.746
Self-Confidence 13	3.70 (1.16)	4.08 (0.90)	+0.38	0.392
Summed Confidence	32.30 (3.74)	33.58 (2.46)	+1.28	0.273

**Note.* Using Mann Whitney U test, statistically significant change at $p < 0.05$.

Pin Index Safety System Configuration for Oxygen

Students in both groups were asked to identify the pin index safety system configuration for oxygen. In the subject group, all students (100%) selected the correct answer (2,5). In the control group, all but one student (90%) selected the correct answer.

Safe Delivery of Anesthesia Care

In a multiple-choice format questionnaire, students in both groups were asked to identify which answer was not a requirement for safe delivery of anesthesia care. In the subject group, all students (100%) selected the correct answer (uncontrolled release of positive pressure from the breathing circuit). In the control group, all but one student (90%) selected the correct answer.

Piped Gas Pressure

All students in both groups were able to verify that piped gas pressures are 50 or greater psi/g.

Knowing When Breathing Circuit System Pressure and Leak Test Should be Conducted

Both groups of students were asked to select when a breathing circuit system pressure and leak test should be conducted. Correct answers included: prior to each use, if any component

of the circuit is changed, and daily. All students in both groups correctly selected daily. In the control group only 70% correctly selected if any component of the circuit is changed whereas all students in the subject group selected the correct answer (100%). For daily, 50% of students in the control group answered correctly compared to 75% in the subject group.

Ensuring Anesthesia Equipment

Finally, both groups of students were asked to select who was ultimately responsible for ensuring the anesthesia machine was ready for use, with the correct answer being "The Anesthesia provider". In the subject group 67% correctly answered the question while the other 33% answered the "Certified Registered Nurse Anesthetist". In the control group 63% of the responses answered correctly and 36% selected the "Certified Registered Nurse Anesthetist".

Qualitative Findings

The students in the subject group were asked a final question which was to describe their experience with the anesthesia machine set-up simulation. A recurrent theme in the student's responses was that the simulation allowed them to troubleshoot common anesthesia machine set-up problems that they may encounter in the clinical setting. One student responded that "*this simulation was a good exercise to help students independently trouble shoot common anesthesia problems*". Additionally, another response from the subject group stated that "*trouble shooting helped cement concepts and encourage problem solving in the simulation".*

Another common theme in the student responses was that the anesthesia machine set-up simulation provided them an opportunity to critically think through the problems and apply the knowledge they have gained from the book to an actual problem during the simulation. A response from one of the participants stated that "*the simulation allowed opportunity for critical thinking and problem-solving skills to be applied to learning the task*". Finally, a student replied

that the simulation " *made me apply what I have learned from the course… instead of just regurgitating it*".

Discussion

Checklists are an important aspect of patient safety in the operating room, and similarly important for the delivery of anesthesia care. The anesthesia machine set-up is a foundational skill that all CRNAs must know, because although there may be variations in machines, proper anesthesia machine set-up will prepare the CRNA to provide the best possible care for a patient.

This intervention was chosen to build confidence in first year SRNAs. Hanshaw and Dickerson (2020) found that with simulation-based training, it is possible to build a student's confidence before and during their interactions throughout clinical practice. In addition to building confidence, simulation practice also decreases practitioner anxiety when in the clinical setting (Ballister, 2018; Hanshaw & Dickerson, 2020).

In general, the subject group participants demonstrated a more positive outlook on performing the anesthesia machine set-up simulation over the standard anesthesia machine checkoff. An interesting point of discussion is the subject groups lower confidence rating in their post survey after the anesthesia machine set-up simulation. The subject group had a lower score in the post simulation survey, which may be related to the participants predicting the simulation to be similar to the checkoff and performed more poorly than anticipated. Although their performance was not graded for this simulation, the students may have been discouraged by their personal performance and comfort with the anesthesia machine set-up.

Strengths

Simulation is a versatile teaching strategy that is suitable for learners with different styles of learning. This anesthesia machine set-up simulation utilized existing resources at Marian

University with a focus on improving educational practices already employed in the education of SRNAs. The outcome measures of this project reinforce simulation as a vital teaching method for future SNRAs at Marian University and beyond. As stated above, the responses from the subject group provide stronger support for including more simulation in the curriculum for the training of SRNA students.

Limitations and Recommendations

There were several important limitations of this project. The sample population consisted of a small, homogenous sample from one mid-west Certified Registered Nurse Anesthetist program. Increasing the knowledge relating simulation to CRNA training will require replicating the project over several semesters and conducting the project at different sites may expand the value of this project. Additionally, presenting the qualitative responses from the subject group about the anesthesia set-up simulation to other anesthesia programs will encourage the incorporation of more simulation in SRNA curriculums.

This project focused on incorporating more simulation into CRNA education in addition to the current checkoff method. With this being one of the first simulations for first year SRNA students, and the perceived difficulty of the simulation is what may have resulted in a lower confidence rating of the subject group versus the control group who only participated in the standard check-off. A pre-test for the subject group would prove beneficial for future studies to compare pre-test confidence and post-test confidence with the anesthesia machine set-up simulation.

Implications for Future Practice

The research question posed by this anesthesia machine set-up simulation evaluated if first year SRNA participation would result in increased knowledge, confidence, and clinical

judgement. The project aims to augment current teachings and improve the ability for students to understand and act on cues to accurately interpret issues that may arise during an anesthesia machine set-up. Findings of the anesthesia machine set-up simulation project suggest an increased satisfaction after the simulation, evident by the student surveys and responses.

Simulation provides students with an opportunity to utilize active learning in a safe environment with varying, but appropriate, degrees of complexity. Simulation provides participants the opportunity to receive post-experience feedback immediately to enhance understanding and improve future outcomes. Finally, development and improvement of anesthesia machine set-up will only further enhance the knowledge and confidence of future CRNAs and improve patient safety and care.

References

Ballister, M. (2018). Student registered nurse anesthetists: Impact of structured high-fidelity simulation on anesthesia ready time. *Anesthesia EJournal, 6*(2), 7-11.

Cannon-Diehl, M., Rugari, S., & Jones, T. (2012). High-Fidelity simulation for continuing education in nurse anesthesia. *AANA Journal, 80*(3), 191-196.

Council on Accreditation. (2020, November). *The value of simulation in nurse anesthesia education*. https://www.coacrna.org/wp-content/uploads/2020/01/COA-Response-Regarding-the-Use-of-Simulation.pdf

Fletcher, J. (1995). AANA journal course: Update for nurse anesthetists—anesthesia simulation: A tool for learning and research. *Journal of the American Association of Nurse Anesthetists 63*(1), 61-67.

Grota, P. G., & O'Neal, C. (2020). Using international nursing association for clinical simulation and learning standards to evaluate the rigor of high-fidelity simulation learning experiences. *Clinical Simulation in Nursing, 46*, 50–56. https://doi.org/10.1016/j.ecns.2020.05.001

Hanshaw, S. L., & Dickerson, S. S. (2020). High fidelity simulation evaluation studies in nursing education: A review of the literature. *Nurse Education in Practice, 46*, 102818. doi:10.1016/j.nepr.2020.102818

Hegland, P. A., Aarlie, H., Strømme, H., & Jamtvedt, G. (2017). Simulation-based training for nurses: Systematic review and meta-analysis. *Nurse Education Today, 54*, 6-20. doi:10.1016/j.nedt.2017.04.004

Hustad, J., Johannesen, B., Fossum, M., &; Hovland, O. J. (2019). Nursing students' transfer of learning outcomes from simulation-based training to clinical practice: A focus-group study. *BMC Nursing*, 18. doi:10.1186/s12912-019-0376-5

INACSL Standards Committee. (2016a). INACSL standards of best practice: Simulation[SM]: debriefing. *Clinical Simulation in Nursing*, 12(S), S21-S25. http://dx.doi.org/10.1016/j.ecns.2016.09.008

INACSL Standards Committee. (2016b). INACSL standards of best practice: Simulation[SM]: Simulation design. *Clinical Simulation in Nursing,* 12(S), S5-S12. https://doi.org/10.1016/j.ecns.2016.09.005

Jeffries, P. R. (2005). A framework for designing, implementing, and evaluating simulations used as teaching strategies in nursing. *Nursing Education Perspectives, 26*(2), 96-103.

Jeffries, P. R., Rodgers, B., & Adamson, K. (2015). NLN Jeffries simulation theory: Brief narrative description. *Nursing Education Perspectives*, *36*(5), 292–293.

Kim, J., Park, J., & Shin, S. (2016). Effectiveness of simulation-based nursing education depending on fidelity: A meta-analysis. *BMC Medical Education, 16*. doi:10.1186/s12909-016-0672-7

Mcmullen, M., Wilson, R., Fleming, M., Mark, D., Sydor, D., Wang, L., Zamora, J., Phelan, R., & Burjorjee, J. E. (2016). "Debriefing-on-demand". *Simulation in healthcare: The journal of the society for simulation in healthcare, 11*(3), 157-163. doi:10.1097/sih.0000000000000140

National League of Nursing. (2021). *Student satisfaction and self-confidence in learning*. National League of Nursing. http://www.nln.org/docs/default-source/default-document-library/instrument-1_educational-practices-questionnaire.pdf?sfvrsn=0.

Shields, J., & Gentry, R. (2020). *Effect of Simulation Training on Cognitive Performance Using Transesophageal Echocardiography*. https://nurseanesthesiology.aana.com/wp-content/uploads/2020/03/Shields-R.pdf

Sittner, B. J., Aebersold, M. L., Paige, J. B., Graham, L. L., Schram, A. P., Decker, S. I., & Lioce, L. (2015). INACSL standards of best practice for simulation: Past, present, and future. *Nursing Education Perspectives, 36*(5), 294-298. doi:10.5480/15-1670

Appendix A

Literature Review Matrix

Literature Review Matrix							
#	**Reference (APA)**	**Level of Evidence**	**Research Question/Statement**	**Variables**	**Sample**	**Instruments**	**Results**
1	Ballister, M. (2018). Student registered nurse anesthetists: Impact of structured high-fidelity simulation on anesthesia ready time. Anesthesia EJournal, 6(2), 7-11.	Level 7	Does HFS increase basic skill proficiency in SRNAs with an evaluation within the first month of clinical training	One class with structured HFS training and one without	2 consecutive classes of SRNA students	Iowa Model of evidence-based practice	Structured HFS did not impact the anesthesia ready time of new-to-practice SRNAs. However, the information collected during implementation of HFS and data analysis can be used to develop future avenues to improve current processes for structured HFS and clinical training opportunities.
2	Cannon-Diehl, M., Rugari, S., & Jones, T. (2012). High-Fidelity simulation for continuing education in nurse anesthesia. *AANA Journal, 80*(3), 191-196.	Level 3	What is the usefulness of high-fidelity simulation (HFS) as a valuable tool for continuing education.	Age, Years of practice, employment status, Simulation experience	22 Practicing Nurse anesthetists	Survey Questions	Best evidence does not exist regarding a specific place for HFS among experienced nurse anesthetists. A knowledge gap persists related to exactly how and when to use HFS as an effective teaching and learning method for continuing education among practicing nurse anesthetists.
3	Fletcher, J. (1995). AANA journal course: Update for nurse anesthetists—anesthesia simulation: A tool for learning and research. Journal of the American Association of Nurse Anesthetists 63(1), 61-67.	Level 5	High fidelity simulators are a new technology for training and research in anesthesiology.	NA	NA	NA	The field of anesthesia simulation is in its infancy. The simulators themselves should become more sophisticated as technology improves and becomes more cost-effective.

Appendix A cont.

4	Grota, P. G., & O'neal, C. (2020). Using international nursing association for clinical simulation and learning standards to evaluate the rigor of high-fidelity simulation learning experiences. Clinical Simulation in Nursing, 46, 50–56. https://doi.org/10.1016/j.ecns.2020.05.001	Level 3	The primary purpose of this article is to share an approach applying The International Nursing Association for Clinical Simulation and Learning (INACSL) Standards to support the substitution of two-hour traditional clinical with one hour of high-quality, rigorous simulation or SLE as determined by faculty governance.	Different simulation-based learning experiences	Eight SLEs across courses were evaluated using the rubric in blinded peer review.	Kolb's theory of experiential learning, INACSL standards of best practice Simulaton^{SM}, Evaluation rubric	The rubric is an effective way to standardize plans for high quality SLE. Further studies of validity and reliability need to be conducted.
5	Hanshaw, S. L., & Dickerson, S. S. (2020). High fidelity simulation evaluation studies in nursing education: A review of the literature. Nurse Education in Practice, 46, 102818. doi: 10.1016/j.nepr.2020.102818	Level 1	What is the state of the science on the evidence of learning outcomes in high-fidelity simulation in undergraduate nursing education?	Sample size, sex, level year in nursing program, Knowledge performance/time, Cognitive knowledge, Sim Fidelity knowledge	20 research studies focusing on evaluating outcomes of high-fidelity simulation in undergraduate pre-licensure baccalaureate nursing students.	Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA)	Design of high-fidelity simulation in the nursing literature is being grounded in outcome variables and increasingly based in pedagogical and nursing judgment theoretical framework. Varied learning outcomes relating to simulation learning have positive outcomes, although there is a lack of comprehensiveness related to practice outcomes. A deeper understanding of the lived experience of high-fidelity simulation is needed to look at retention of learning and transference into nursing clinical practice.

Appendix A cont.

6	Hegland, P. A., Aarlie, H., Strømme, H., & Jamtvedt, G. (2017). Simulation-based training for nurses: Systematic review and meta-analysis. Nurse Education Today, 54, 6-20. doi:10.1016/j.nedt.2017.04.004	Level 1	The aim of this systematic review is to evaluate effect of simulation-based training on nurses' skills and knowledge	Heterogeneity of the studies	Fifteen RCTs	Data was analyzed through meta-analysis and narrative syntheses. GRADE was used to assess the quality of evidence	Simulation training appears to be an effective strategy to improve nurses' skills, but further good-quality RCTs with adequate sample sizes are needed.
7	Hustad, J., Johannesen, B., Fossum, M., &; Hovland, O. J. (2019). Nursing students' transfer of learning outcomes from simulation-based training to clinical practice: A focus-group study. BMC Nursing, 18(1). doi:10.1186/s12912-019-0376-5	Level 3	The aim of this study was to explore nursing students' experiences of simulation-based training and how the students perceived the transfer of learning to clinical practice.	Age, Gender, Degree year, types of clinical placement	Eight focus group interviews were conducted with a total of 32 s- and third-year nursing students who participated in a simulation-based training organized as preparation for clinical placement	Transcribed interviews were analyzed with thematic analysis.	This study revealed students' transfer of learning outcomes from simulation-based training to clinical practice. The students' experiences of the simulation-based training remain as enduring and conscious learning outcomes throughout their completion of clinical practice.
8	INACSL Standards Committee (2016, December). INACSL standards of best practice: Simulation[SM]: Debriefing. *Clinical Simulation in Nursing*, 12(S), S21-S25. http://dx.doi.org/10.1016/ j.ecns.2016.09.008	Level 7	Reflection of experiences during simulation can lead to new interpretations by participants.	NA	NA	INACSL 2016 Standards of Best Practice	NA
9	INACSL Standards Committee (2016, December). INACSL standards of best practice: Simulation[SM]: Simulation design. *Clinical Simulation in Nursing, 12(S)*, S5-S12. http://dx.doi.org/10.1016/ j.ecns.2016.09.005.	Level 7	Standardized simulation design provides a framework for developing effective simulation-based experiences. The design of simulation-based experiences incorporates best practices from adult learning, education, instructional design, clinical standards of care, evaluation, and simulation pedagogy.	NA	NA	INACSL 2016 Standards of Best Practice	NA

Appendix A cont.

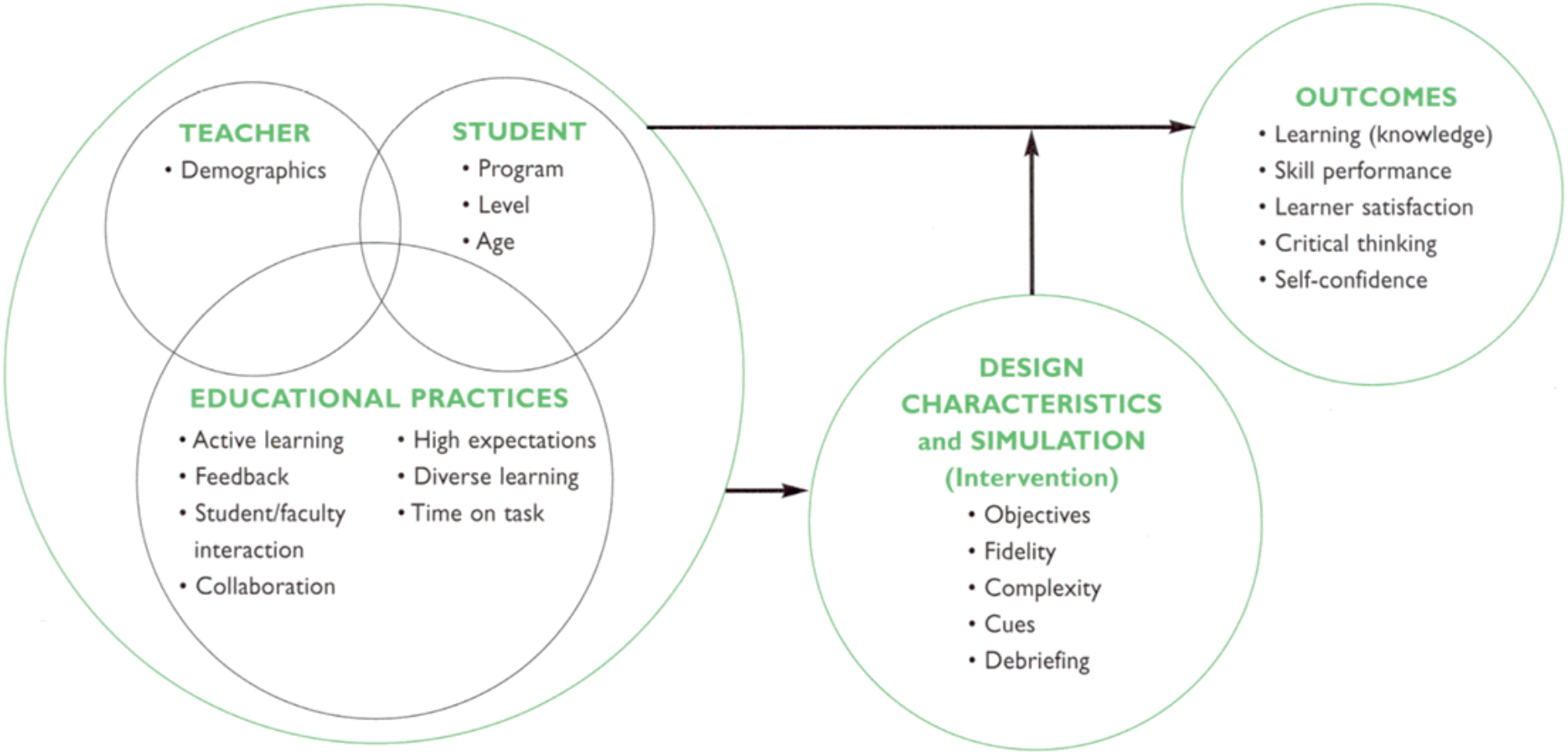
10	INACSL Standards Committee (2016, December). INACSL standards of best practice: Simulation[SM]: Outcomes and objectives. *Clinical Simulation in Nursing, 12(S)*, S13-S15. http://dx.doi.org/10.1016/j.ecns.2016.09.006	Level 7	The Kirkpatrick Model is a commonly used ranking model that evaluates training programs and transfer of learning outcomes. These outcomes are an integral component of instructional and research design.	NA	NA	INACSL 2016 Standards of Best Practice	NA
11	INACSL Standards Committee (2016, December). INACSL standards of best practice: Simulation[SM]: Participant evaluation. *Clinical Simulation in Nursing, 12(2)*, S26-S29. http://dx.doi.org/10.1016/j.ecns.2016.09.009	Level 7	Formative evaluation of the participants fosters personal and professional development, to assist the participant in progression toward achieving objectives or outcomes.	NA	NA	INACSL 2016 Standards of Best Practice	NA
12	Kim, J., Park, J., & Shin, S. (2016). Effectiveness of simulation-based nursing education depending on fidelity: A meta-analysis. BMC Medical Education, 16(1). doi:10.1186/s12909-016-0672-7	Level 1	The purpose of this study was to determine the effect size of simulation-based educational interventions in nursing and compare effect sizes according to the fidelity level of the simulators through a meta-analysis	Study outcomes included learning and reaction outcomes. Learning outcomes were categorized into three domains: cognitive, psychomotor, and affective.	40 selected studies were performed by using the Case Control Study Checklist developed by the Critical Appraisal Skills Programmed	This study was planned and conducted in adherence to PRISMA standards [6] of quality for reporting metanalysis.	These results suggest that simulation-based nursing educational interventions have strong educational effects, with particularly large effects in the psychomotor domain. Since the effect is not proportional to fidelity level, it is important to use a variety of educational interventions to meet all of the educational goals.
13	Mcmullen, M., Wilson, R., Fleming, M., Mark, D., Sydor, D., Wang, L., Zamora, J., Phelan, R., & Burjorjee, J. E. (2016). "Debriefing-on-demand". Simulation in Healthcare: The Journal of the Society for Simulation in Healthcare, 11(3), 157-163. doi:10.1097/sih.0000000000000140	Level 2	Simulation is an effective tool in medical education with debriefing as the cardinal educational component. Alternate debriefing strategies might further enhance the educational value of simulation	Debriefing sessions	8 postgraduate year 1 anesthesia residents	Convenience Sample	The debriefing-on-demand approach was successfully incorporated into our simulation scenarios and was well received by this group of junior trainees new to simulation.

Appendix A cont.

14	Sittner, B. J., Aebersold, M. L., Paige, J. B., Graham, L. L. M., Schram, A. P., Decker, S. I., & Lioce, L. (2015). INACSL standards of best practice for simulation: Past, present, and future. *Nursing Education Perspectives, 36*(5), 294–298.	Level 5	Describe the historical evolution of the international Nursing Association for Clinical Simulation and Learning's Standards of Best Practice: Simulation	NA	Journal publications, INACSL website and surveys and reports from INACSL Standards Committee	Comprehensive review	Simulation standards will continue to evolve as the science of simulation advances

Appendix B

Jeffries Simulation Model



"Jeffries Simulation Model," by P. R. Jeffries, 2005, Nursing Education Perspectives, 26(2), 96–103. (https://journals.lww.com/neponline/pages/articleviewer.aspx?year=2005&issue=03000&article=00009&type=abstract) Copyright 2005 by National League for Nursing Inc.

Appendix C

Student Satisfaction and Self-Confidence in Learning

Student Satisfaction and Self-Confidence in Learning

Instructions: This questionnaire is a series of statements about your personal attitudes about the instruction you receive during your simulation activity. Each item represents a statement about your attitude toward your satisfaction with learning and self-confidence in obtaining the instruction you need. There are no right or wrong answers. You will probably agree with some of the statements and disagree with others. Please indicate your own personal feelings about each statement below by marking the numbers that best describe your attitude or beliefs. Please be truthful and describe your attitude as it really is, not what you would like for it to be. This is anonymous with the results being compiled as a group, not individually.

Mark:
1 = STRONGLY DISAGREE with the statement
2 = DISAGREE with the statement
3 = UNDECIDED - you neither agree or disagree with the statement
4 = AGREE with the statement
5 = STRONGLY AGREE with the statement

Satisfaction with Current Learning	**SD**	**D**	**UN**	**A**	**SA**
1. The teaching methods used in this simulation were helpful and effective.	O 1	O 2	O 3	O 4	O 5
2. The simulation provided me with a variety of learning materials and activities to promote my learning the medical surgical curriculum.	O 1	O 2	O 3	O 4	O 5
3. I enjoyed how my instructor taught the simulation.	O 1	O 2	O 3	O 4	O 5
4. The teaching materials used in this simulation were motivating and helped me to learn.	O 1	O 2	O 3	O 4	O 5
5. The way my instructor(s) taught the simulation was suitable to the way I learn.	O 1	O 2	O 3	O 4	O 5
Self-confidence in Learning	**SD**	**D**	**UN**	**A**	**SA**
6. I am confident that I am mastering the content of the simulation activity that my instructors presented to me.	O 1	O 2	O 3	O 4	O 5
7. I am confident that this simulation covered critical content necessary for the mastery of medical surgical curriculum.	O 1	O 2	O 3	O 4	O 5
8. I am confident that I am developing the skills and obtaining the required knowledge from this simulation to perform necessary tasks in a clinical setting	O 1	O 2	O 3	O 4	O 5
9. My instructors used helpful resources to teach the simulation.	O 1	O 2	O 3	O 4	O 5
10. It is my responsibility as the student to learn what I need to know from this simulation activity.	O 1	O 2	O 3	O 4	O 5
11. I know how to get help when I do not understand the concepts covered in the simulation.	O 1	O 2	O 3	O 4	O 5
12. I know how to use simulation activities to learn critical aspects of these skills.	O 1	O 2	O 3	O 4	O 5
13. It is the instructor's responsibility to tell me what I need to learn of the simulation activity content during class time..	O 1	O 2	O 3	O 4	O 5

 Revised December 22, 2004

Appendix D

Demographics Questionnaire

How many years of nursing experience do you have?

- ◯ 1-3
- ◯ 3-6
- ◯ 6-9
- ◯ >9

Have you had any previous experience setting up an anesthesia machine prior to beginning CRNA school?

- ◯ Yes
- ◯ No

How old are you?

- ◯ 20-25
- ◯ 26-30
- ◯ 31-35
- ◯ 36-40
- ◯ >41

Appendix E

Modified Student Satisfaction and Self Confidence in Learning

The teaching methods used in this simulation were helpful and effective.

	Strongly Disagree with the statement	Disagree with the statement	Undecided- you neither agree or disagree with the statement	Agree with statement	Strongly Agree with statement
Choose One	○	○	○	○	○

The simulation provided me with a variety of learning materials and activities to promote my learning of the anesthesia machine setup.

	Strongly Disagree with the statement	Disagree with the statement	Undecided- you neither agree or disagree with the statement	Agree with statement	Strongly Agree with statement
Choose One	○	○	○	○	○

I enjoyed how I was taught the simulation.

	Strongly Disagree with the statement	Disagree with the statement	Undecided- you neither agree or disagree with the statement	Agree with statement	Strongly Agree with statement
Choose One	○	○	○	○	○

The teaching materials used in this simulation were motivating and helped me to learn.

	Strongly Disagree with the statement	Disagree with the statement	Undecided- you neither agree or disagree with the statement	Agree with statement	Strongly Agree with statement
Choose One	○	○	○	○	○

The way I was taught the simulation was suitable to the way I learn.

	Strongly Disagree with the statement	Disagree with the statement	Undecided- you neither agree or disagree with the statement	Agree with statement	Strongly Agree with statement
Choose One	○	○	○	○	○

Appendix E cont.

I am confident that I am mastering the content of the simulation activity that my instructors presented to me.

	Strongly Disagree with the statement	Disagree with the statement	Undecided- you neither agree or disagree with the statement	Agree with statement	Strongly Agree with statement
Choose One	○	○	○	○	○

I am confident that this simulation covered critical content necessary for the mastery of the anesthesia machine set-up for the Certified Registered Nurse Anesthetist curriculum.

	Strongly Disagree with the statement	Disagree with the statement	Undecided- you neither agree or disagree with the statement	Agree with statement	Strongly Agree with statement
Choose One	○	○	○	○	○

I am confident that I am developing the skills and obtaining the required knowledge from this simulation to perform an anesthesia machine set-up in a clinical setting

	Strongly Disagree with the statement	Disagree with the statement	Undecided- you neither agree or disagree with the statement	Agree with statement	Strongly Agree with statement
Choose One	○	○	○	○	○

My instructors used helpful resources to teach the simulation.

	Strongly Disagree with the statement	Disagree with the statement	Undecided- you neither agree or disagree with the statement	Agree with statement	Strongly Agree with statement
Choose One	○	○	○	○	○

It is my responsibility as the student to learn what I need to know from this simulation activity.

	Strongly Disagree with the statement	Disagree with the statement	Undecided- you neither agree or disagree with the statement	Agree with statement	Strongly Agree with statement
Choose One	○	○	○	○	○

Appendix E cont.

I know how to get help when I do not understand the concepts covered in the simulation.

	Strongly Disagree with the statement	Disagree with the statement	Undecided- you neither agree or disagree with the statement	Agree with statement	Strongly Agree with statement
Choose One	◯	◯	◯	◯	◯

I know how to use simulation activities to learn critical aspects of these skills

	Strongly Disagree with the statement	Disagree with the statement	Undecided- you neither agree or disagree with the statement	Agree with statement	Strongly Agree with statement
Choose One	◯	◯	◯	◯	◯

It is the instructor's responsibility to tell me what I need to learn of the simulation activity content during class time.

	Strongly Disagree with the statement	Disagree with the statement	Undecided- you neither agree or disagree with the statement	Agree with statement	Strongly Agree with statement
Choose One	◯	◯	◯	◯	◯

Appendix F

Knowledge Assessment Questionnaire

What is the Pin Index Safety System configuration for Oxygen?

- ○ 3,5
- ○ 1,5
- ○ 2,5
- ○ 2,4

Requirements for safe delivery of anesthesia care include all EXCEPT:

- ○ Reliable delivery of oxygen at any appropriate concentration up to 100%
- ○ Reliable means of positive pressure ventilation
- ○ Backup ventilation equipment available and functioning
- ○ Uncontrolled release of positive pressure from the breathing circuit
- ○ Adequate suction
- ○ Using current standards for patient monitoring

Verify that piped gas pressures are ___ or greater psi/g.

- ○ 30
- ○ 40
- ○ 50
- ○ 60

A breathing circuit system pressure and leak test should be conducted ___. (SELECT ALL THAT APPLY)

- ☐ Prior to each use
- ☐ If any component of the circuit is changed
- ☐ Daily

Who is ultimately responsible for ensuring anesthesia equipment is safe and ready for use?

- ○ a. The Physician anesthesiologist
- ○ b. The Certified Registered Nurse Anesthetist
- ○ c. The Anesthesia tech
- ○ d. The Anesthesia Assistant
- ○ e. The Anesthesia care provider

Appendix G

IRB Exemption Form

MARIAN UNIVERSITY
Indianapolis ®

Institutional Review Board

DATE:	01-27-2021
TO:	Nicholas Keesler
FROM:	Institutional Review Board
RE:	IRB #S21.205
TITLE:	Simulation Based Training for Anesthesia Machine Set-up
SUBMISSION TYPE:	New Project
ACTION:	Determination of Exempt Status
DECISION DATE:	01-27-2021

The Institutional Review Board at Marian University has reviewed your protocol and has determined the procedures proposed are appropriate for exemption under the federal regulations. As such, there will be no further review of your protocol and you are cleared to proceed with your project. The protocol will remain on file with the Marian University IRB as a matter of record. Please be mindful of the importance of reporting only de-identified, HIPAA-compliant information about the patient in any exhibit or publication.

Although researchers for exempt studies are not required to complete online CITI training for research involving human subjects, the IRB **recommends** that they do so, particularly as a learning exercise in the case of student researchers. Information on CITI training can be found on the IRB's website: http://www.marian.edu/academics/institutional-review-board.

It is the responsibility of the PI (and, if applicable, the faculty supervisor) to inform the IRB if the procedures presented in this protocol are to be modified or if problems related to human research participants arise in connection with this project. Any procedural modifications must be evaluated by the IRB before being implemented, as some modifications may change the review status of this project. Please contact me if you are unsure whether your proposed modification requires review. Proposed modifications should be addressed in writing to the IRB. **Please reference the above IRB protocol number in any communication to the IRB regarding this project.**

Amanda C. Egan, Ph.D.
Chair, Marian University Institutional Review Board

Appendix H

Table 2

Helpfulness of Teaching Methods Used in Machine Set-Up Checkoff/Simulation

Helpfulness of Teaching Methods	n	%
Control Group		
Strongly Disagree	0	0.0
Disagree	2	20.0
Undecided	0	0.0
Agree	6	60.0
Strongly Agree	2	20.0
Subject Group		
Strongly Disagree	0	0.0
Disagree	0	0.0
Undecided	0	0.0
Agree	3	25.0
Strongly Agree	9	75.0

Note. n=22

Table 3

Learning Materials and Activities to Promote Learning for the Anesthesia Machine Set-Up Checkoff

Promotion of Learning	n	%
Control Group		
Strongly Disagree	0	0.0
Disagree	1	10.0
Undecided	1	10.0
Agree	6	60.0
Strongly Agree	2	20.0
Subject Group		
Strongly Disagree	0	0.0
Disagree	1	8.3
Undecided	1	8.3
Agree	5	41.7
Strongly Agree	5	41.7

Note. n=22

Appendix H cont.

Table 4

Enjoyment of Simulation Teaching Methods

Enjoyment of Simulation Teaching Methods	n	%
Control Group		
Strongly Disagree	0	0.0
Disagree	2	20.0
Undecided	3	30.0
Agree	3	30.0
Strongly Agree	2	20.0
Subject Group		
Strongly Disagree	0	0.0
Disagree	0	0.0
Undecided	0	0.0
Agree	4	33.3
Strongly Agree	8	66.7

Note. n=22

Table 5

Teaching Materials Motivated Students and Enhanced Learning

Motivating and Helpful	n	%
Control Group		
Strongly Disagree	0	0.0
Disagree	3	30.0
Undecided	1	10.0
Agree	4	40.0
Strongly Agree	2	20.0
Subject Group		
Strongly Disagree	0	0.0
Disagree	0	0.0
Undecided	1	8.3
Agree	4	33.3
Strongly Agree	7	58.3

Note. n=22

Appendix H cont.

Table 6:

Simulation Teaching Methods Suitable to Learning Style

Simulation Teaching Methods Suitable to Learning Style	n	%
Control Group		
Strongly Disagree	0	0.0
Disagree	1	10.0
Undecided	2	20.0
Agree	5	50.0
Strongly Agree	2	20.0
Subject Group		
Strongly Disagree	0	0.0
Disagree	0	0.0
Undecided	1	8.3
Agree	3	25.0
Strongly Agree	8	66.7

Note. n=22

Table 7

Confidence in Mastering the Content of the Simulation Activity

Confidence in Mastering the Content of the Simulation Activity	n	%
Control Group		
Strongly Disagree	0	0.0
Disagree	0	0.0
Undecided	2	20.0
Agree	6	60.0
Strongly Agree	2	20.0
Subject Group		
Strongly Disagree	0	0.0
Disagree	1	8.3
Undecided	1	8.3
Agree	8	66.7
Strongly Agree	2	16.7

Note. n=22

Appendix H cont.

Table 8

Confidence that the Checkoff/Simulation Covered Critical Content

Confidence that Simulation Covered Critical Content	n	%
Control Group		
Strongly Disagree	0	0.0
Disagree	0	0.0
Undecided	2	20.0
Agree	5	50.0
Strongly Agree	3	30.0
Subject Group		
Strongly Disagree	0	0.0
Disagree	0	0.0
Undecided	1	8.3
Agree	9	75.0
Strongly Agree	2	16.7

Note. n=22

Table 9

Confidence in Developing the Skills and Obtaining the Knowledge from the Simulation to Perform Anesthesia Machine Setup

Confidence in Developing Skills and Obtaining Knowledge	n	%
Control Group		
Strongly Disagree	0	0.0
Disagree	0	0.0
Undecided	2	20.0
Agree	6	60.0
Strongly Agree	2	20.0
Subject Group		
Strongly Disagree	0	0.0
Disagree	0	0.0
Undecided	0	8.3
Agree	8	66.7
Strongly Agree	4	33.3

Note. n=22

Appendix H cont.

Table 10

Helpfulness of Resources Instructors Used to Teach Checkoff/Simulation

Helpfulness of Resources Instructors Used to Teach Simulation	n	%
Control Group		
Strongly Disagree	0	0.0
Disagree	3	30.0
Undecided	0	0.0
Agree	4	40.0
Strongly Agree	3	30.0
Subject Group		
Strongly Disagree	0	0.0
Disagree	0	0.0
Undecided	0	0.0
Agree	7	58.3
Strongly Agree	5	41.7

Note. n=22

Table 11

Student Responsibility to Learn From the Checkoff/Simulation Activity

Student Responsibility to Learn From the Simulation Activity	n	%
Control Group		
Strongly Disagree	0	0.0
Disagree	1	10.0
Undecided	0	0.0
Agree	4	40.0
Strongly Agree	4	40.0
Subject Group		
Strongly Disagree	0	0.0
Disagree	0	0.0
Undecided	1	8.3
Agree	4	33.3
Strongly Agree	7	58.3

Note. n=22

Appendix H cont.

Table 12

Knowing How to Get Help with Confusing Concepts

Knowing How to Get Help with Confusing Concepts	n	%
Control Group		
Strongly Disagree	0	0.0
Disagree	0	0.0
Undecided	0	0.0
Agree	6	60.0
Strongly Agree	4	40.0
Subject Group		
Strongly Disagree	0	0.0
Disagree	0	0.0
Undecided	0	0.0
Agree	9	75.0
Strongly Agree	3	25.0

Note. n=22

Table 13

Using Simulation Activities to Learn Critical Aspects of Anesthesia Machine-Set-Up

Using Simulation Activities to Learn Critical Aspects of Set-up	n	%
Control Group		
Strongly Disagree	0	0.0
Disagree	0	0.0
Undecided	0	0.0
Agree	8	80.0
Strongly Agree	2	20.0
Subject Group		
Strongly Disagree	0	0.0
Disagree	1	8.3
Undecided	0	0.0
Agree	7	58.3
Strongly Agree	4	33.3

Note. n=22

Appendix H cont.

Table 14

Responsibility of Instructors to Educate on Simulation during Class

Responsibility of Instructors to Educate on Simulation	n	%
Control Group		
Strongly Disagree	1	10.0
Disagree	0	0.0
Undecided	2	20.0
Agree	5	50.0
Strongly Agree	2	20.0
Subject Group		
Strongly Disagree	0	0.0
Disagree	1	8.3
Undecided	1	8.3
Agree	6	50.0
Strongly Agree	4	33.3

Note. n=22