OBSERVATIONAL EXPERIENTIAL LEARNING FACILITATED BY DEBRIEFING FOR MEANINGFUL LEARNING:

EXPLORING STUDENT ROLES IN SIMULATION

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DEDICATION

This work is dedicated to my family, as they were a rock-solid support system for the last three years. To my wife, Jenna, who first pushed me to pursue my dream to attend Indiana University and never for a moment doubted my ability to finish. You saw every joy, every struggle, and always had faith that I would succeed. When I did, you were always impressed and listened to my exciting discoveries, but never surprised that I overcame. Your belief in me got me to this point. You watched me learn about myself during this journey and we grew closer because of it. We both realized through this doctoral journey and life events that occurred along the way that we can do hard things together. I love you and thank you for all the sacrifices you made for me to succeed at IU.

I dedicate this work to my daughter, Claire Jane. You will likely experience debriefing throughout your life when you ask questions and I'm sure you will get tired of it. It all comes with love. Our hope is that it plants a seed of genuine inquiry to learn and think deeply, to get curious, and an ability to reflect and consider another person's perspective. I hope you will value education and all the life-lessons that come with it. You are so loved!

To my parents, for their unwavering pride in my work and desire for me to pursue my dreams. To my mother, who always beams with joy when I succeed and my father who is a living example of being patient through difficult times. I dedicate this work to the memory of my grandmother who only knew of my admission to Indiana University prior to her passing. Her persistence, compassion, and faith inspired me to become a nurse and to pursue excellence in everything I set my mind to. And to my mother-in-law and father-in-law who always encouraged and supported me. Thank you all for making my graduation in Indianapolis one of the most special events of my life.

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Brandon Kyle Johnson

OBSERVATIONAL EXPERIENTIAL LEARNING FACILITATED BY DEBRIEFING FOR MEANINGFUL LEARNING:

EXPLORING STUDENT ROLES IN SIMULATION

Simulation is an educational strategy used in prelicensure nursing education that has been demonstrated to effectively replace selected clinical experiences. Simulation experiences may include the use of differing roles including the active participant, who makes decisions during the simulation and the passive observer, who watches the simulation unfold. There is a lack of rigorous research testing whether students in the passive observer role during simulations demonstrate and retain knowledge similarly to those in active participant roles. In addition, differences in knowledge applied to a contextually similar case between those who actively participate and passively observe have not been studied.

The purpose of this study was to explore the relationship between nursing student’s roles in simulation and cognitive knowledge demonstration, retention, and application about two contextually similar cases of respiratory distress. An experimental, pretest-multiple posttest, repeated measures study was conducted with a convenience sample of 119 baccalaureate prelicensure nursing students from a large multi-campus Southwestern university. Two knowledge instruments were administered throughout different stages of the simulation and four weeks later. Associations between role in simulation and scores on the knowledge instruments were examined using t-tests and mixed repeated measures-analysis of variance.

Of the 59 active participants and 60 observers, there were no significant differences in knowledge demonstrated or retained after simulation, after debriefing, or four weeks later. Additionally, there were no significant differences in knowledge demonstrated when applied to a contextually similar case after debriefing or four weeks later between active participant and observer. Future research is needed to examine these relationships in larger and more diverse samples and different contextual clinical situations in simulation. These results will contribute to the further testing and implementation of using observation as a strategy for teaching and learning with simulation for nursing and health professions education.

Deanna L. Reising, PhD, RN, ACNS-BC, FNAP, ANEF, Chair

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LIST OF ABBREVIATIONS

AC	Abstract Conceptualization
AE	Active Experimentation
CE	Concrete Experience
DML	Debriefing for Meaningful Learning©
INACSL	International Nurses Association for Clinical Simulation and Learning
KELT	Kolb’s Experiential Learning Theory
KR-20	Küder-Richardson 20
MNS	Mirror Neuron System
NLN	National League for Nursing
NLNJST	National League for Nursing Jeffries Simulation Theory
NSS	National Simulation Study
OEL	Observational Experiential Learning
RO	Reflective Observation
SCT	Social Cognitive Theory
SLT	Social Learning Theory

CHAPTER 1 INTRODUCTION

Background of the Study

The use of simulation where students care for virtual patients as a form of clinical learning is increasing in prelicensure nursing education. Hayden, Smiley, Alexander, Kardong-Edgren, and Jeffries (2014) in the National Council State Boards of Nursing National Simulation Study (NSS) provided evidence that simulation could effectively replace up to 50% of traditional patient care clinical experiences with no statistical difference in outcomes from students who had less than 25% simulation for clinical experiences. This monumental study has served as a catalyst for nursing education research to provide more evidence for simulation pedagogy, outcomes, and impact on transfer to practice.

Meta-analyses and reviews support that simulation results in significant increases in knowledge and is superior to other learning strategies (Adamson & Rodgers, 2016; Cant & Cooper, 2009, 2017; J. H. Kim, Park, & Shin, 2013; Lapkin, Levett-Jones, Bellchambers, & Fernandez, 2010; Weaver, 2011; Yuan, Williams, Fang, & Hong Ye, 2012). Yet, more recent reviews found that evidence was lacking and there were insignificant findings related to knowledge increases that were partially due to inadequate methodological quality (Jin & Pok-Ja, 2015; Olson et al., 2018). Therefore, more rigorous research design methods are needed to support outcomes in simulation (Adamson & Rodgers, 2016; Cant & Cooper, 2017; O'Donnell, Decker, Howard, Levett-Jones, & Miller, 2014) and further inquiry is needed to assess if knowledge gained in simulation is retained over time (Cant & Cooper, 2017; Jeffries, Adamson, & Rodgers, 2016; McGaghie, 2008; Weaver, 2011; Yeung, Dubrowski, & Carnahan, 2013).

While much attention is paid to the simulation component of this clinical pedagogy, it should be noted that "debriefing is where it's at" (Adamson & Rodgers, 2016, p. 16) indicating that the debriefing is where the majority of learning occurs. Debriefing, now receiving national calls to implement across the curriculum, is arguably the most significant and meaningful component of simulation pedagogy and has demonstrated knowledge transfer, reflective practice, assimilation, accommodation with changing of mental frames, and anticipation leading to thinking like a nurse (Bradley, 2016; Decker, 2007; Dreifuerst, 2009; Fanning & Gaba, 2007; INACSL Standards Committee, 2016a; National League for Nursing, 2015; Rudolph, Simon, Dufresne, & Raemer, 2006; Schön, 1983; Tanner, 2006a). Through the use of simulation with high quality debriefing, learners are engaged in a pedagogical strategy deeply supported with active, constructivist, and experiential learning (Adamson & Rodgers, 2016; Dreifuerst, 2009; Jeffries, Rodgers, & Adamson, 2016b; Kolb, 2015; Laschinger, 1990).

Currently, the International Nursing Association for Clinical Simulation and Learning (INACSL) Standards of Best Practice: Simulation^{SM} articulate that debriefing "assists in conceptualizing how the learning constructed during the simulation and debriefing can be applied to future clinical situations" (INACSL Standards Committee, 2016a, p. s23). However, simulation with multiple participants can involve the assignment of different learner roles including the active participant or passive observer for a variety of reasons including limited resources, space, finances, and faculty time (Bong et al., 2017; INACSL Standards Committee, 2016b; O'Regan, Molloy, Watterson, & Nestel, 2016). Active participants make decisions and directly provide patient care during the scenario while observers watch the scenario unfold without direct participation in the decision-making or provision of care (Jeffries & Rizzolo, 2006; O'Regan et al., 2016). The NSS found that in 6 of the participating prelicensure nursing schools, learners spent a majority of time in simulation in the observer role (Hayden et al., 2014).

There is tension between the theoretical foundations for simulation and the assignment of different student roles. First, Kolb’s Experiential Learning Theory (KELT) is one of the most well supported theoretical underpinnings for simulation pedagogy (Decker & Dreifuerst, 2012; Dreifuerst, 2009; INACSL Standards Committee, 2016c; Jeffries, Rodgers, & Adamson, 2016a; Kolb, 2015; Laschinger, 1990; Stocker, Burmester, & Allen, 2014). Experiential learning involves transforming knowledge and behavior from a previous event, the concrete experience, and then testing the knowledge gained in new situations (Kolb, 2015). Yet, when observing simulation scenarios and not directly testing knowledge in new situations actively, there is a concern that the current practices in simulation do not facilitate KELT in its literal definition completely for students in observer roles and that theoretical frameworks are needed to describe how learning occurs for active participants and passive observers (Bong et al., 2017; Stocker et al., 2014).

Secondly, Social Learning Theory (SLT) (Bandura, 1971) and Social Cognitive Theory (SCT) (Bandura, 2001) are theories supporting vicarious learning through observation and associated with simulation pedagogy, yet these theories receive minimal attention and empirical support regarding the observer role in simulation (Bethards, 2014; Bong et al., 2017; LeFlore, Anderson, Michael, Engle, & Anderson, 2007; Leigh, Miller, & Ardoin, 2017; Livsey & Lavender-Stott, 2015; Reime et al., 2017; Rode, Callihan, & Barnes, 2016). Additionally, the term vicarious learning can imply behavior mimicry, where learners may be doing the correct behavior but fail to understand the thinking behind the action. Thus, when students are evaluated in dyads or groups or assessed through immediate repeated simulations it brings forward an arguable limitation of the current literature suggesting that all learners, active participants and observers, are gaining similar knowledge and understanding the thinking behind actions.

Therefore, literature surrounding learner satisfaction varies regarding the observer role and perception of how similar of an experience it was to the peers in active roles (Bonnel & Hober, 2016; Harder, Ross, & Paul, 2013; Hober & Bonnel, 2014; Levett-Jones et al., 2015; Norman, 2018; Reime et al., 2017; Thidemann & Soderhamn, 2013; Traynor, Gallagher, Martin, & Smyth, 2010). There are recommendations to explore learning domain outcomes in simulation as opposed to learner satisfaction alone considering it is widely accepted that satisfaction is high (O'Donnell et al., 2014). However, despite the previous reports of some learner dissatisfaction in the observer role possibly indicating less attention or learner engagement, there is some research demonstrating that there are no differences in knowledge outcomes between active participant and observer roles (Fluharty et al., 2012; Jeffries & Rizzolo, 2006; Kaplan, Abraham, & Gary, 2012; LeFlore et al., 2007; Rode et al., 2016; Scherer, Foltz-Ramos, Fabry, & Chao, 2016; Smith, Klaassen, Zimmerman, & Cheng, 2013; Thidemann & Soderhamn, 2013). Yet, it is unclear if observers are relying on the debriefing to bridge the gaps in knowledge, or if their role provides perspective in discovering knowledge as the scenario unfolds. The concern is that *exposure* is not the same as *attention*, and just because observers are watching the scenario unfold, it does not indicate they are actively engaged in inquiring and analyzing the concrete experience (Biocca, 1988; Chaffee & Schleuder, 1986; Lang, Zhou, Schwartz, Bolls, & Potter, 2000). While all learners may gain knowledge, more exploration is needed examining whether or not observers and active participants similarly apply the knowledge to future situations and retain the knowledge over time.

Kolb stated that the concrete experience requires minimal analysis or inquiry (Kolb, 2015). Yet, it is essential that the concrete experience for learners in simulation is an intentional learning experience whether they are observers or participants. During the debriefing after simulation, the concrete experience is further transformed into new knowledge by guiding learners through reflection. Specific methods for debriefing, such as Debriefing for Meaningful Learning© (DML), encourage facilitators to reveal the relationships between thinking and action (Dreifuerst, 2015). When students observing the simulation are not devoting attention to the scenario, it is unclear if they are fully experiencing the transformation of learning facilitated by debriefing (Bong et al., 2017; Stocker et al., 2014).

Statement of the Problem

Revealing relationships between thinking and actions develops higher order thinking and reasoning skills including assimilation and accommodation, which are considered the goals of a practice profession (Dreifuerst, 2009). Moreover, these are two of the four elementary knowledge outcomes of KELT (Kolb, 2015). For assimilation and accommodation to develop, the experiential learning process must be fully engaged in by all participants during the simulation and debriefing. Therefore, with large numbers of students assigned to observer roles, current research and practice within nursing education equates observing nursing practice with active and experiential learning guided by the same frameworks for those actively participating in clinical decision-making despite little discipline-specific research to substantiate it.

Extensive research outside the discipline of nursing has been conducted on brain-based observational learning including the action-observation network and mirror neurons. This research strongly supports well-known theories supporting observational learning including SLT and SCT (Bandura, 1971, 2001). However, other researchers have critiqued KELT for this very reason indicating that observational learning has been theoretically neglected in relation to experiential learning (Hoover & Giambatista, 2009; Hoover, Giambatista, & Belkin, 2012). Kolb (2015) acknowledged this critique suggesting that observational learning “lightens the cognitive demands of direct experiential learning” (p. 91) and suggests it as “a precursor to learning from direct experience” (p. 91). Therefore, new theories incorporating observational and experiential learning should be explored.

Additionally, while there is some research demonstrating active participants and observers in simulation have no difference in knowledge outcomes (Fluharty et al., 2012; Jeffries & Rizzolo, 2006; Kaplan et al., 2012; LeFlore et al., 2007; Rode et al., 2016; Scherer et al., 2016; Smith et al., 2013; Thidemann & Soderhamn, 2013), there is no research demonstrating that observers can build on the knowledge from a previously observed concrete experience and assimilate/accommodate in a parallel clinical situation facilitated with debriefing. Likewise, there is no nursing research examining how the concrete experience of the simulation scenario helps active participants and observers construct knowledge, and how that knowledge is retained over time and applied in similar clinical situations. Therefore, a gap exists mandating better understanding of the learning occurring for both active participants and observers in simulation experiences including exploring theories and frameworks currently supporting simulation and others exploring observational learning in simulation, and how knowledge is retained and applied to similar clinical situations if the practice of allowing large numbers of observers is to continue.

Purpose of the Study

The purpose of this study was to explore the relationship between prelicensure baccalaureate nursing students’ roles in simulation (active participant or observer) and cognitive knowledge demonstration, retention, and application (assimilation/accommodation) to a similar clinical situation using simulation with DML debriefing. This exploratory, experimental, pretest-multiple posttest, repeated measures research study explored the impact of student roles in simulation (active participant and observer) on the knowledge of the care for two different cases of respiratory distress. Additionally, this study used DML to facilitate a new theoretical framework, observational-experiential learning (OEL), to examine the development of assimilative and accommodative knowledge that occurs when building on knowledge from the previous concrete experience. This was operationalized through the assessment of two similar simulated cases of respiratory distress with different underlying pathophysiological structures where learning is transferred to a hypothetical parallel clinical situation based on the experience previously participated in or observed (Dreifuerst, 2010; Forneris & Fey, 2016; INACSL Standards Committee, 2016a).

Research Questions

This study asked the following questions:

1. Is there a difference in knowledge demonstrated and knowledge retained by nursing students in active participant versus observer roles after a simulation about the care of a patient with respiratory distress (opioid-induced respiratory depression) at baseline, before and after debriefing with DML, and 4 weeks later?
2. Is there a difference in knowledge demonstrated and knowledge retained by nursing students in active participant versus observer roles

when applied (assimilated/accommodated) to a parallel case about a patient with a different kind of respiratory distress (anaphylaxis) after DML and 4 weeks later?

Significance of the Study

Nursing students leave the academic classroom and enter into a complex healthcare system demanding higher-order thinking and practicing in ways that reflect their full scope of practice (Institute of Medicine, 2011; Ironside, McNelis, & Ebright, 2014). Higher-order thinking can be facilitated through debriefing that includes reasoning, reflection, assimilation, accommodation, and anticipation where learners apply knowledge from one experience to another future situation (Dreifuerst, 2009; INACSL Standards Committee, 2016a). "Assimilation and accommodation are the ultimate goals in a practice profession and the essence of reflection" (Dreifuerst, 2009, p. 111). Further, assimilation and accommodation are elementary forms of knowledge that develop through KELT and are facilitated through debriefing (Dreifuerst, 2009, 2012; Kolb, 2015).

The significance of this study is paramount as it contributes valuable insight into theoretical underpinnings supporting the numerous students in the observer role (Hayden et al., 2014) and examines knowledge demonstration, retention, and application evidentiary of higher-order thinking including assimilation and accommodation. Current literature suggests that the concrete experience is missing in observational learning (Bong et al., 2017), therefore, exploration of frameworks that incorporate SLT, SCT, and KELT to understand how observers *can* and *do* have a concrete experience that can be associated with learning is needed. This study offers a framework that incorporates these theories and examines the use of a particular debriefing method, DML, which supports KELT and uses reflective learning to facilitate the development of assimilation and accommodation also in observational learning.

Definition of Terms

Accommodation

Accommodation is when knowledge is opposed to existing mental frames (Inhelder & Piaget, 1958). Accommodation is the elementary form of knowledge developed in KELT when tension is created between the concrete experience and the active experimentation phase (Kolb, 2015). In simulation, accommodation is facilitated by the debriefer asking ‘what if’ questions, guiding reflection-beyond-action, where learners begin to apply previous knowledge to anticipate changes in future situations (Dreifuerst, 2009, 2010) that are “similar on the surface, but different in deep structure” (Forneris & Fey, 2016, p. 149).

Active participant

A learner role in simulation commonly assigned as Nurse 1, Nurse 2, or Charge Nurse. These learners are actively participating in the decision-making in the scenario (Jeffries & Rizzolo, 2006).

Assimilation

Assimilation is when knowledge applied to another situation is consistent with previous and existing mental frames (Inhelder & Piaget, 1958). Assimilation is the elementary form of knowledge developed in KELT when tension is created between abstract conceptualization and reflective observation phase (Kolb, 2015). In simulation, assimilation is facilitated by the debriefer planting ideas with provocative and directed Socratic dialogue (Dreifuerst, 2009).

Debriefing for Meaningful Learning© (DML)

DML is a structured debriefing method grounded in experiential learning that facilitates reflection-in-action, reflection-on-action, and reflection-beyond-action to develop assimilative and accommodative knowledge with anticipatory thinking (Dreifuerst, 2009, 2012, 2015; Schön, 1983). The iterative process of abstractly conceptualizing, reflective observing, and actively experimenting with new knowledge achieved through the 6 E's: engage, explore, explain, elaborate, evaluate, and extend (Dreifuerst, 2012) and operationalize constructs in KELT.

Observer

Considering there are no standards for the observer role and a variety of ways to include observers in simulation, this study will use a consistent strategy supported in the literature. The observer will be a learner that is located externally to the simulation and watching the scenario unfold in an audio-visual room. The observer receives the same prebrief and debriefing, but does not actively participate in the decision-making of the simulation (O'Regan et al., 2016).

Theoretical Framework

Considering the strong foundation of simulation with KELT and the concern as to whether or not learners have a concrete experience while in frequently used observer roles, a new theoretical model is needed for underpinning observational learning with active and experiential learning. While

Kolb stated that the concrete experience requires no analysis or inquiry (Kolb, 2015), the learners in active participant roles are immersed in the decision-making and care of the patient in the scenario, thus, their concrete experience may be different than those of the observers. The observers who are watching the scenario unfold are often in a different environment with different immediate sensations, one that is assumed to be active and observed with intentional attention. However, *exposure* to the scenario in a different environment like a separate audiovisual room is not the same as the *attention* required by active participants (Biocca, 1988; Chaffee & Schleuder, 1986; Lang et al., 2000). Therefore, to study and describe this observer phenomenon, this study introduces vicarious experiential learning (Hoover & Giambatista, 2009; Hoover et al., 2012) as a framework for bringing together SLT, SCT, and KELT.

Hoover and Giambatista (2009) describe vicarious experiential learning as an educational methodology that:

> Exists when a personally responsible participant(s) cognitively, emotionally, and behaviorally processes knowledge, skills, and/or attitudes through processes of observation in a learning situation characterized by a high level of active involvement despite absence of direct, personalized consequences. (p.36).

This framework was adapted from the KELT dimensions underlying the processes of experiential learning and diagrammed to explicate observation within clinical situations; specifically simulation (see Figure 1, adapted with permission) (A. Kolb, personal communication, June 8, 2018). This framework is called Observational Experiential Learning (OEL) as the word vicarious implies a passively felt experience without participation, but through observation there is careful noticing with attention (Merriam-Webster, 2017a, 2017b). This theoretical framework incorporates all concepts of observational learning in SLT, is informed by concepts within SCT, and expands and operationalizes KELT.

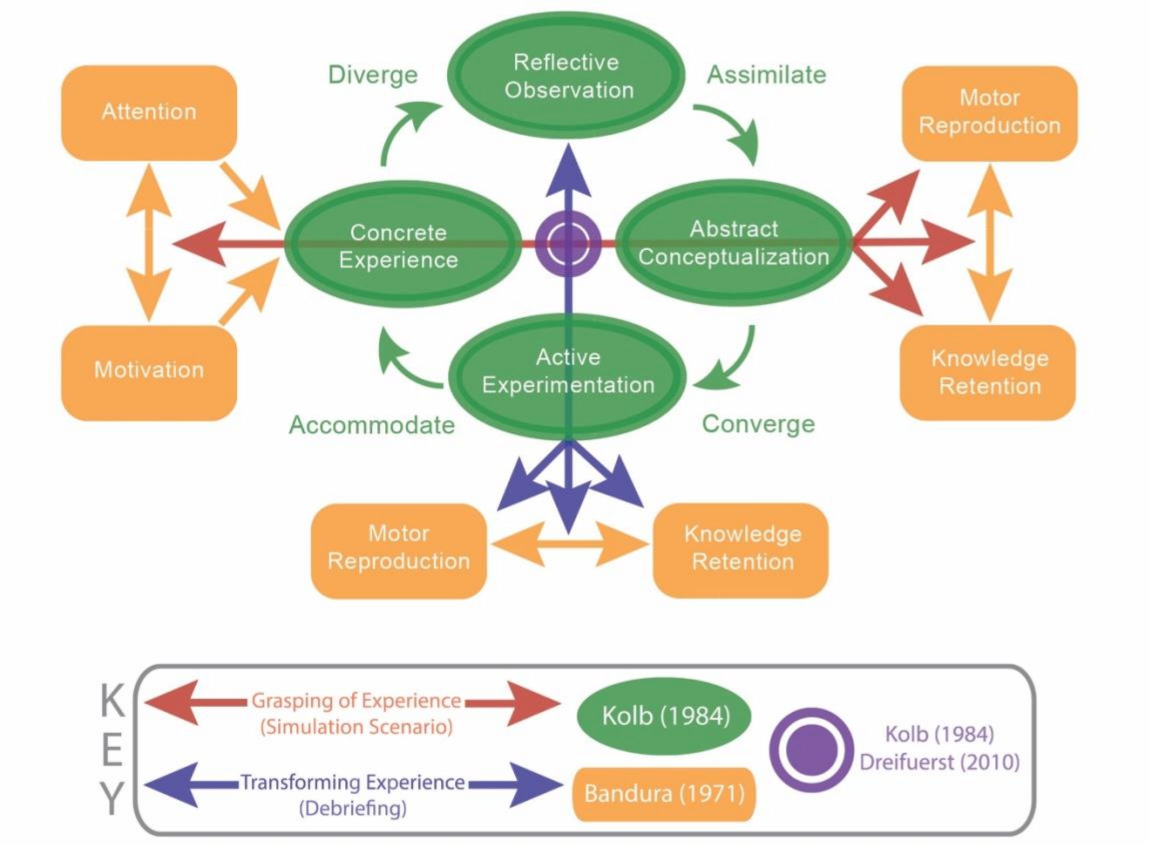


Figure 1. Observational Experiential Learning (OEL) Framework.

The concrete experience, reflective observation, abstract conceptualization, and active experimentation (green circles) are a reiteration of KELT with no changes to the original theory (Kolb, 2015). The concrete experience (CE) is the immediate sensation of learning requiring no analysis or inquiry. The abstract conceptualization (AC) is the ability to describe the concrete experience symbolically and to be able to verbally to recreate it (Kolb, 2015). These two concepts involve the grasp of an experience and are connected by the red line in the middle of the diagram representing how learners grasp knowledge based on the simulation scenario.

Reflective observation (RO) is the internal reflection on the previous concrete experience and the beginning stage of transforming an experience into learning by ascribing meaning to the experience. Active experimentation (AE) is the final stage of KELT where learners test or apply the prior experience in a new situation, completing the transformation of the experience (Kolb, 2015). This is currently achieved in simulation by presenting a case in debriefing that is similar to the previous experience, but contains subtle differences (Dreifuerst, 2010; Forneris & Fey, 2016). The vertical transformation pole, in blue, is best attributed to the debriefing in simulation where learners are guided through RO and then begin thinking about how the knowledge is applied in future situations (Decker & Dreifuerst, 2012; Dreifuerst, 2009; INACSL Standards Committee, 2016a). The two most important elementary forms of knowledge, assimilation and accommodation, are outcomes of the experiential learning cycle which is facilitated by tension between the different forms of grasping and transforming of an experience (Kolb, 2015).

Attention, motivation, motor reproduction, and knowledge retention (in orange), describe Bandura’s (1971) SLT for observational learning. Two antecedents are depicted in Figure 1: attention and motivation. Attention is more than simple exposure to modeling of behavior, rather, attention is the concernment and noticing of behavior (Bandura, 1971). Motivation was first underpinned with positive reinforcement and behavioristic principles of the inputoutput model, but later found that the underlying motivation is supported by the concept of human agency in SCT (Bandura, 1971, 2001). Human agency consists of intentionality, forethought or anticipation, self-reactiveness and regulation, and self-reflection. A human agent plans intentionally, anticipates an action plan, and executes that action plan followed by self-reflection (Bandura, 2001). Considering the CE requires no analysis or inquiry (Kolb, 2015), it is assumed that those learners who are observing the simulation are immersed in the actual experience; however, they simply may be watching with little attention or intention for reproduction. Observers however may also view the unfolding simulation from an exocentric frame of reference providing an advantage to foster more abstract and symbolic insight (Dede, 2009a). Nevertheless, the observer must be cued and engaged to inform the attention, intention, and action planning of the CE for future transformation. Therefore, the CE in OEL is more than passively watching an event or exposure to a situation with little analysis or inquiry. Rather it is a deeper, more informed CE that engages the observer's attention and intention to motivate future reproduction.

The final two concepts in SLT are the outcomes of the framework: retention and motor reproduction. Retention processes involve the memory of an experience or behavior over a period of time and observed behavior must be evaluated and reproduced to assess for the skillful mastery of observational learning (Bandura, 1971). This study evaluated Level 2 outcomes of knowledge retention in simulation by operationalizing assimilation and accommodation concepts in two knowledge instruments which appear similar on the surface but different in deep structure (Forneris & Fey, 2016, p. 149; Tagliareni & Forneris, 2017). These concepts, found at the ends of both poles of experiential learning, indicate that learning occurs through the grasped scenario, noted by the red line, and through the transformation of debriefing, noted by the blue line.

Finally, the center purple circle in the center (Figure 1) merges the two bodies of knowledge bringing simulation and OEL together. Although there is a common assumption that experiential learning occurs when learners are in direct experience (Bong et al., 2017; Stocker et al., 2014), Kolb (2015) asserted that experiential learning occurs by creating tension between grasped and transformed experiences. Therefore, the central purple circle demonstrates that it is in the tension and interaction between all four concepts that draw out experiential learning resulting in the development of elementary forms of knowledge including assimilation and accommodation (Dreifuerst, 2009, 2012; Hoover & Giambatista, 2009; Kolb, 2015).

Further, to bridge simulation as a teaching and learning pedagogy grounded in KELT and OEL, Dreifuerst’s (2010) DML is the debriefing method supporting this study and also is represented by the center circle. DML is underpinned with KELT to foster the development of assimilation and accommodation for clinical reasoning (Dreifuerst, 2010). Additionally, through reflection-beyond-action, anticipation is fostered as a concept of human agency (Dreifuerst, 2009) and to develop reasoning and higher order thinking. Through DML’s structured, yet iterative, process of guided reflection and abstract conceptualization through ‘what-if’ Socratic questioning, tension developing assimilative knowledge occurs. This is followed by the presentation of a parallel case that is requires assimilation and accommodation in the reflection-beyond-action component of DML facilitating accommodative knowledge in the final stage of KELT (Dreifuerst, 2010, 2015).

OEL involves the intentional and attentional observation of a concrete experience. This observed concrete experience is abstractly conceptualized when learners are able to symbolically think about the actions that occurred. The debriefing then facilitates the transformation of experience by guiding reflection while describing actions through abstract conceptualization with Socratic questioning in DML. Finally, as part of the structured process of DML, learners are presented with a parallel case to form the final phase, active experimentation, of KELT. These concepts all come together to inform a new model, underpinning observation in simulation. To test this, knowledge was evaluated before and after debriefing and as applied (assimilated/accommodated) to a similar case of respiratory distress with containing nuances in clinical care to examine learning in active participant versus observer roles.

Organization of the Study

This research study is presented in five chapters. Chapter I includes the background of the study, statement of the problem, research questions, purpose and significance of the study, and the theoretical framework. Chapter II presents a review of the literature including simulation as an experiential teaching/learning pedagogy, the observer role in simulation, observational learning, observational-experiential learning, DML, and theoretical connections for these components.

Chapter III describes the methodology used for this research study including the selection of participants, instrumentation, data collection, and data analysis procedures. Chapter IV presents the findings of the research including demographic information and results of the data analyses for the research questions. Chapter V provides a summary of the study, a discussion of the findings with implications for simulation and nursing education, limitations, recommendations for further research, and conclusions.

CHAPTER 2 REVIEW OF LITERATURE

This chapter describes pertinent literature to the study of learner roles in simulation and the impact on cognitive knowledge demonstration, knowledge retention, and knowledge applied (assimilated/accommodated) in two different cases of respiratory distress that share similarities with prelicensure baccalaureate nursing students. Debriefing is supported as the necessary component of simulation that assists applying the learning from one simulation to another clinical simulation (INACSL Standards Committee, 2016a). Further, Debriefing for Meaningful Learning© (DML) is one evidence-based debriefing method underpinned by experiential learning theory that guides students through reflection-in, reflection-on, and reflection-beyond action to assist learners in assimilation, accommodation, and anticipation (Dreifuerst, 2009, 2012). Educational theories will be examined regarding how experiential and observational learning come together to support the theoretical model for this study and how simulation with DML facilitates observational experiential learning (OEL). Little is known about the differences between students in active participant roles or observational roles in simulation and how debriefing impacts knowledge retention in different clinical situations. This chapter includes a review of the literature related to simulation as an experiential learning pedagogy, the observer role in simulation, observational learning, observational-experiential learning, and Debriefing for Meaningful Learning© (DML).

Simulation as a Teaching/Learning Pedagogy

Simulation is supported with many educational frameworks and theories. Constructivism is one central educational theory guiding simulation due to a focus on learner-centered, interactive environments (Jeffries, Rodgers, et al., 2016a; Jeffries & Rogers, 2007). One primary attribute of constructivism is that learners construct knowledge through experience using assimilation and accommodation (Inhelder & Piaget, 1958). Assimilation occurs when new knowledge is consistent with previous and existing frames whereas accommodation occurs when knowledge is opposed to existing frames requiring the learner to adapt unfamiliar events into concepts or schemas (Inhelder & Piaget, 1958; Piaget, 1970). Thus, prior knowledge is necessary to be built upon and the learner must be actively engaged in the simulation to assimilate and accommodate new knowledge and transform into a learning experience (Dreifuerst, 2010).

Active learning is a form of learning frequently described in educational literature that applies to the theoretical underpinning for simulation. Active learning is rooted in the work of Vygotsky (1986) which integrates with the work of Inhelder and Piaget, where the growth of thought starts with collaborative dialogue and social interaction. Bruner (1961) also contributed to the understanding of active learning and described that discovery of knowledge is facilitated by teachers that take dialogue and assist in the rearranging and organization of that knowledge through problem-solving. In contrast to conventional pedagogies and content saturation, the focus of active learning principles moves toward the student's organization of knowledge and how to retrieve information rather than the storage or memorization of content, leading to a more autonomous thinker (Bruner, 1961; Ironside, 2003, 2004).

Active learning, then, builds on constructivism and is defined as something more than "sitting in classes listening to teachers, memorizing pre-packaged assignments, and spitting out answers. [Students] must talk about what they are learning, write about it, relate it to past experiences . . . they must make what they learn part of themselves" (Chickering & Gamson, 1987, p. 3). Rather, to actively learn requires doing, thinking, exploring, discovering errors while being encouraged to learn from them, and exercising emotion control to become a self-regulated learner (Bell & Kozlowski, 2008; Bonwell & Eison, 1991). Teachers must recognize that while learners may initially perform skills poorly, self-regulated learners demonstrate higher analytical and adaptive transferability levels (Bell & Kozlowski, 2008). Fink (2003) suggested that active learning involves experience through doing or observing as well as dialogue with self or others. Thus, an active learner differs from the passive learner because passive learners receive knowledge whereas active learners experience, construct, and reflect on knowledge.

In addition to active learning, Fink (2013) described significant learning as an engaging and high energy environment that connects learning to life rather than to course content. Two central concepts to the model of significant learning include foundational knowledge and application of knowledge. Grasping foundational knowledge requires a deep understanding of a concept that provides the beginning point of significant learning experiences. Further, the application of foundational knowledge requires the organization, execution, and ability to think about one's own thinking (Fink, 2013). In this high energy and engaging environment, significant learning experiences teach students to enjoy learning how to learn.

Another theory, the National League for Nursing Jeffries Simulation Theory (NLNJST) suggests that simulation provides a learner-centered, interactive, collaborative, and experiential learning environment with dynamic interactions between learner and facilitator (Jeffries, Rodgers, et al., 2016a). Simulation as a teaching and learning pedagogy is in its infancy compared to the traditionally valued typical patient care clinical experience. However, the theoretical underpinning guiding simulation is far advanced in comparison to the scarcity of educational practices and evidence that inform learning in traditional patient care clinical experiences (Ironside et al., 2014) . Although simulation has a wealth of theoretical support, essential to the NLNJST and traditional nursing practice experiences are the outcomes for the participant, patient, and healthcare system. Therefore, to further the argument regarding simulation as a form of clinical learning, the next sections will discuss outcomes of cognitive knowledge primarily related to prelicensure nursing students as participants in simulation.

Together with constructivism, active learning, significant learning, and the NLNJST, one common theory extends these theories in an ongoing and cyclical manner: Kolb's Experiential Learning Theory (KELT). KELT provides a broad and encompassing theory that is well supported as an underpinning to simulation experiences (Decker & Dreifuerst, 2012; Dreifuerst, 2009; INACSL Standards Committee, 2016c; Jeffries, Rodgers, et al., 2016a; Kolb, 2015; Laschinger, 1990). Because KELT is strongly supported in simulation-based education and incorporates components of previously mentioned theories, a more in-depth analysis will be provided as it is incorporated into the suggested model for the proposed dissertation study.

Experiential Learning in Simulation

Experiential learning is defined as a process whereby knowledge results through the transformation of an experience (Kolb, 2015). Philosophically, experiential learning theory is rooted in empiricism and was first described by William James (1912). James proposed a dual knowledge theory of how one grasps, or takes hold of, an experience (James, 1912, 2010). The two ways to grasp an experience consist of apprehension, or the tangible experience, and comprehension, or the symbolic representation or conceptualization of an experience.

Social psychologist, Kurt Lewin, advanced James's work and focused on the interpretation of an experience. Lewin (1951) recognized that learning occurs when there is a tension present between a grasped experience and the analysis occurring afterward (Lippitt, 1949). Analyzing an experience afterward with challenging and thoughtful dialogue is also known as reflection (Schön, 1983). The combination of a grasped experience with reflection is suggested to *transform* a *grasped* experience (Kolb, 1984, 2015). Therefore, due to the underlying work of James and Lewin, Kolb recognized that the two opposing poles, grasping and transforming an experience, and the tension created between the poles, produced a remarkable learning environment (Kolb, 2015). These poles serve as two equipotent modes of learning and provide the foundation of KELT as it is known today (Kolb, 2015). For a complete diagram, see Figure 2.

Further, Kolb continued to develop his theory and expand on the work of Jean Piaget. Kolb incorporated Piaget's two operational aspects of thought including behavioral action and intellectual operations supporting a cognitive process as to how learning through experience occurs (Piaget, 1971). Additionally, Kolb incorporated the mutual processes of assimilation and accommodation into KELT as elementary forms of knowledge that result from the tension created between the knowledge poles. To provide further understanding, each of the poles will be fully explored as well as the four forms of elementary knowledge that result from KELT.

Grasping an experience. One form of grasping an experience is through apprehension also known as the concrete experience (Kolb, 2015). Building on James's dual knowledge theory, the concrete experience is the immediately sensed experience and requires no inquiry or analytical confirmation. Rather, the experience is instantaneous (Kolb, 2015). The other form of grasping an experience is through comprehension, also known as abstract conceptualization. This form of knowing introduces order into the seamless flow of a concrete experience. Abstract conceptualization allows for the communication, prediction, and recreation of the experience (Kolb, 2015).

In addition, Zull advanced KELT through the investigation of the neuroscience involved with experiential learning concepts. Convinced that learning arises from the structure of the brain, Zull hypothesized that the sensory cortex senses the concrete experience and the front integrative cortex is responsible for working memory to help streamline the concrete experiences through abstract conceptualization (Zull, 2002, 2011). Further, two areas of the brain, the mirror neuron system (MNS) and the action-observation network, take sensory observations and assist in transforming an observation into an executable action (Rizzolatti, 2005; Rizzolatti & Craighero, 2004; Rizzolatti, Ferrari, Rozzi, & Fogassi, 2006). This body of work provides reasonable information that through observing an experience, the ability to grasp the concrete experience is made possible.

Transforming an experience. Building further on the work of Lewin, Kolb hypothesized two dimensions for transforming the experience. The first way to transform an experience is through intention, also known as reflective observation. Transforming through reflective observation occurs after a concrete experience and through internal reflection, or looking back, on the experience (Kolb, 2015; Schön, 1983). This specific transformational experience coincides with Piaget's discussion regarding intellectual operations as an operative aspect of thought and gives the experience more value by adding an affective component (Jung, 1973; Piaget, 1971). Further, Kagan and Kogan (1970) discussed that internal reflection is the dominant component of thought when a learner is concerned about mistakes and error when immersed in an unfamiliar experience. Therefore, reflective observation is the internal dialogue occurring in an experience and when thinking of previous experiences (Kolb, 2015; Schön, 1983).

Alternatively, extension, or active experimentation, transforms the experience through real-world manipulation (Kolb, 2015). Also expanding on Piaget’s operative aspect of thought, active experimentation involves the behavioral actions associated with a concrete or conceptual experience (Kolb, 2015; Piaget, 1971). Opposed to reflective observation, active experimentation, or the investigation into the experience, *extends* the concepts of an experience by testing previously grasped knowledge in a new real life situation (Kolb, 2015). Further, Zull asserted that the temporal cortex assists with memory formation through reflective observation and the motor cortex is responsible for the transformation of an experience through active experimentation (Zull, 2002, 2011).

Through this process of grasping and transforming experience, four different elementary forms of knowledge result including divergence, convergence, assimilation, and accommodation. Grasping through a concrete experience and transforming through reflective observation results in divergent knowledge where learners are best at viewing a situation with various perspectives. Alternatively, grasping through abstract conceptualization and transforming through reflective observation results in assimilative knowledge implying inductive reasoning (Kolb, 2015; Kolb & Kolb, 2013). To contrast, grasping through abstract conceptualization and transforming through active experimentation results in convergent knowledge, which is a form of learning primarily dealing with technical tasks and problems. However, essential to completing the process is by grasping through a concrete experience and transforming through active experimentation resulting in accommodative knowledge where learners apply knowledge to new situations. Therefore, it is not the *concrete* experience that makes experiential learning come to life, rather, it is the tension created through all four components, assisting in grasping and transforming, that facilitate experiential learning environments (Figure 2). Figure 2 is from *Experiential Learning: Experience as the Source of Learning and Development, 2nd © 2015* and is reprinted by permission of Pearson Education, Inc., New York, New York which is referenced in Appendix A.

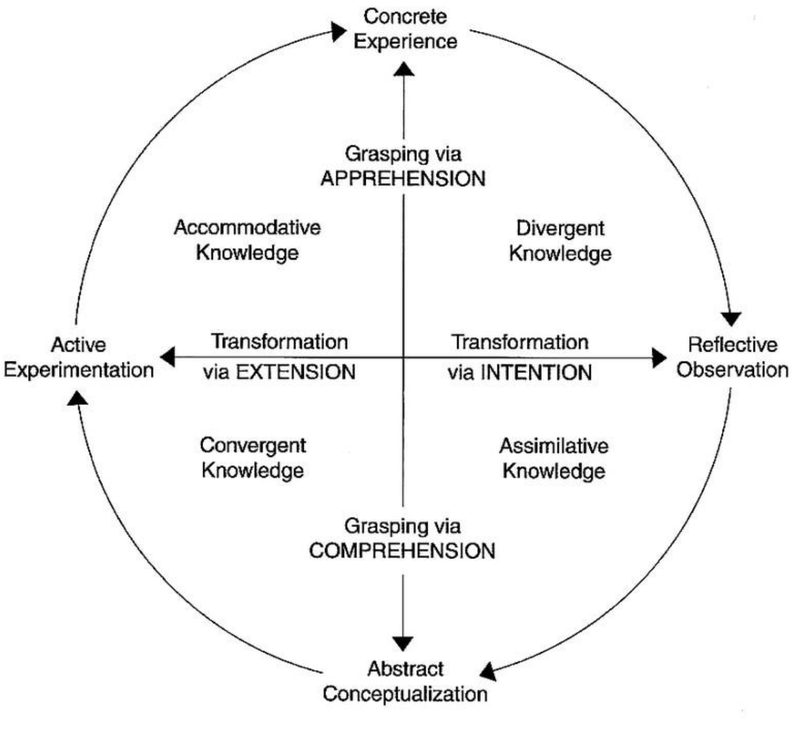


Figure 2. Kolb's Experiential Learning Process (Kolb, 2015).

KELT concepts in simulation. While the active unfolding of a clinical situation in simulation allows for the concrete experience, it is the essential component of debriefing which occurs directly after the simulation where the guiding of reflective thinking and asking students to abstractly conceptualize, or recreate the experience, that assists in learning transformation (Decker, 2007; Dreifuerst, 2009; Forneris & Fey, 2016; INACSL Standards Committee, 2016a; Jordan & Collins-Yoder, 2014; Laschinger, 1990; Stocker et al., 2014; Warrick, Hunsaker, Cook, & Altman, 1979). A well-designed simulation has all components of experiential learning where active learning engages the student toward a significant learning outcome. The ability to grasp and transform knowledge is made possible through the clinical scenario and the debriefing process using simulation. However, for a learner to grasp and transform the clinical experience into something meaningful, learner engagement, or the underlying motivation and attention, is essential (Doolen, Giddings, Johnson, de Nathan, & Badia, 2014; Dreifuerst, 2009). The experience observed or actively participated in by students cannot be passive, lacking inquiry (Kolb, 2015), because these educational experiences are designed to prepare them for the complex demands of healthcare.

A learner grasps clinical care through the concrete experience of a simulation environment. The simulation scenario provides learners the ability to actively participate in an actual situation where they are thinking and acting like a nurse. Surrounded by a fidelity-enhanced environment, an active participant in simulation has the capability to interact in an unfolding clinical situation designed to begin and end similarly to an actual patient scenario (INACSL Standards Committee, 2016c). This experience is designed to assist in the grasp of actual patient care by immersing the learner in a concrete experience (Chmil, Turk, Adamson, & Larew, 2015; Laschinger, 1990). During this time, some participants engage in hands-on care of a simulated patient while others are in an observer role and view the clinical experience as it unfolds. A majority of time, learners in simulation are in an observation role (Hayden et al., 2014). Commonly assumed by educators is the idea that hands-on participation is most beneficial and necessary for KELT (Bong et al., 2017); however, as previously discussed, experiential learning occurs through creating tension between the grasped and transformed experience rather than the actual experience itself (Kolb, 2015).

Directly after the simulation, all learners participate in debriefing, the most supported component of simulation that results in significant learning, where the experience is transformed into new knowledge through the teacher and learner reflecting on conflicting situations that occurred during the simulation (Adamson & Rodgers, 2016; Andrew, 1998; Bradley, 2016; de Oliveira et al., 2015; Doolen et al., 2014; Dreifuerst, 2009; Lisko & O'Dell, 2010). Debriefing facilitates the reflective observation and abstract conceptualization of the previous experience allowing for the symbolic grasp and internal transformation of an experience through a critical conversation about the experience (Forneris & Fey, 2016). Schön (1983) defined reflection as looking back or at an experience through reflection-on-action and reflection-in-action. This is accomplished through faculty members engaging learners in structured, thoughtful dialogue and examining the thinking processes that underpinned the actions that occurred in the simulation.

In addition, debriefing contributes to the abstract conceptualization of an experience. Assimilative knowledge is created through the tension of reflective observation and abstract conceptualization concepts. Assimilation is a defining attribute of debriefing (Dreifuerst, 2009; Kolb, 2015). Further, Dreifuerst (2009) asserted that “assimilation and accommodation are the ultimate goals in a practice profession and the essence of reflection” (p.111). Adding to Schön, Dreifuerst (2009) discussed that anticipation and reflection are related concepts and through reflection-beyond-action a learner can only begin to look forward to new situations while looking back, or anticipating future situations through the lens of reflection (p.111). In contrast to reflecting back on action through thoughtful dialogue, reflection-beyond-action is accomplished through using Socratic dialogue and asking what-if questions to engage in critical conversations about future situations building on previous simulation experiences (Dreifuerst, 2009; Forneris & Fey, 2016; Jordan & Collins-Yoder, 2014). This ability to reflect-in-action, reflect-on-action, and reflect-beyond-action results in a simultaneous and iterative process of reflectively observing and abstractly conceptualizing an experience resulting in assimilative knowledge through tension created between grasping and transforming an experience.

In the final stage, accommodative knowledge is formed by grasping through the concrete experience and transforming through active experimentation (Kolb, 2015). After a learner has an experience and then transforms through reflection and creates assimilative knowledge through abstract conceptualization during debriefing, to complete the learning cycle the newly available knowledge needs to be tested in a situation that allows for accommodation, or knowledge that does not fit pre-existing frames (Inhelder & Piaget, 1958). Forneris and Fey (2016) proposed that in the debriefing, the active experimentation concept is addressed by having the learner “compare the previous situation to a similar situation—one that is similar on the surface but has different deep structure” (p. 249).

The active experimentation phase is where hands-on learning is preferred and real-world manipulation with the knowledge is necessary (Kolb, 2015; Kolb & Kolb, 2013; Stocker et al., 2014; Tutticci, Coyer, Lewis, & Ryan, 2016). However, nursing educators have discussed strategies to assist in implementing the active experimentation concept through questioning during debriefing or concept mapping which deviates from the concepts within the KELT cycle (Chmil et al., 2015; Forneris & Fey, 2016; Stocker et al., 2014). In simulation, the current INACSL Standards of Best Practice: Simulation^{SM} Debriefing presumes that it is the practice of quality debriefing that facilitates the final stage of active experimentation where learning is transferred to a clinical situation that is parallel to previous ones; one that is similar with nuances in clinical care (Forneris & Fey, 2016; INACSL Standards Committee, 2016a).

This situation, whether a new actual experience or hypothetically examined during the debriefing, would be strategically considered and presented to learners based on pre-existing knowledge and actions from a previous simulation (assimilation) but also have some components that alter existing frames (accommodation). The new situation allows the learner to build on previously grasped and transformed knowledge by *extending* the knowledge into a new scenario, similarly to anticipating through reflecting (Dreifuerst, 2009). Assimilation and accommodation are components of judgment, reasoning, and metacognitive thinking, the distinguishing factors of the expert nurse (Benner, Stannard, & Hooper, 1996; Dreifuerst, 2009; Pesut, 2004; Tanner, 2006b). Yet, a majority of research and standards in simulation are focused on the design of the initial concrete experience and debriefing that experience rather than the similar contextual clinical situation debriefing attests to address (Chmil et al., 2015) (See Table 1 for each KELT concept paired with a simulation practice).

Table 1

Experiential Learning and Simulation Practices

KELT Concept (Pole of Knowledge)	**Current Simulation Practice**
Concrete Experience (Grasping)	Participating or observing a simulation.
Reflective Observation (Transforming)	Debriefing: Reflection-in/Reflection-on Action—analysis of experience (Dreifuerst, 2009; Schön, 1983).
Abstract Conceptualization (Grasping)	Debriefing: Socratic questioning, Engaging in Critical Conversation creating new meaning of experience (Dreifuerst, 2009, 2010; Forneris & Fey, 2016).
Active Experimentation (Transforming)	Debriefing: Reflection-Beyond-Action/Anticipation, Applying knowledge to a situation that is similar to a previous one with some similarities and differences (Dreifuerst, 2009; Forneris & Fey, 2016; INACSL Standards Committee, 2016a).

While assimilation is a defining attribute of debriefing, and assimilation and accommodation are presumed to be the goals of practice professions (Dreifuerst, 2009), there is a lack of research substantiating that accommodative knowledge, developed in the active experimentation phase, is demonstrated and retained. Additionally, an assumption exists that students in both active participant and observer roles demonstrate similar knowledge outcomes and retain knowledge over time related to parallel cases based on previous simulations. Current research and practice within the nursing discipline has equated having students observe nursing practice with active and experiential learning yet there has been no research to explore if the student’s role in simulation has an impact on the cognitive knowledge retention in different clinical situations over time, necessary for completion of KELT.

Debriefing demonstrates positive impacts on clinical reasoning (Dreifuerst, 2012). However, there is a lack of research rigorously testing specifically whether there are differences occurring between those who actively participate versus observe related to the accommodative knowledge demonstrated and retained through debriefing the parallel case. Most students are observing the actively participating students that care for the patient (Hayden et al., 2014). This is not surprising or unique to most experiences as Bruner (1986) suggested that most encounters with the world are indirect. There are known strengths and weaknesses when experiencing through the egocentric, or active participant, or the exocentric, or passive observer, frame of reference (Dede, 2009a). Additionally, theories addressing observational learning, brain-based learning, and their relationship with experiential learning need exploration in nursing education literature. Therefore, understanding the relationship between students in different roles in simulation and knowledge retention and application in different parallel cases is necessary to ascertain if debriefing, as presumed, transfers applied knowledge from the previous simulation for all students. The following section will examine the current state of the science regarding the observer role in simulation.

Observer Role in Simulation

One of the current practices in simulation is the assigning of roles to student learners (INACSL Standards Committee, 2016b; O'Regan et al., 2016).

Different student roles are frequently used due to the need to accommodate large numbers of student participants. This is partly related to the continuing triple threat in nursing education regarding lack of clinical sites, lack of faculty, and increasing student enrollment (American Association of Colleges of Nursing, 2018; National Council of State Boards of Nursing, 2016; National League for Nursing, 2014, 2017) and in part due to faculty time, finances, and a convenient desire to keep students in scheduled clinical groups for all experiences (Bong et al., 2017). Additionally, the growing evidence that simulation can replace clinical hours in prelicensure nursing education (Hayden et al., 2014) and the ability to accommodate large numbers of students in the experience makes simulation a popular choice for clinical learning.

Currently, a participant in the active, process based-role such as the frequently used primary nurse, secondary nurse, charge nurse, or unlicensed assistive staff member, actively makes decisions and provides patient care in the scenario. Alternatively, a participant in the passive, response based-role, such as the observer, family member, or documenter, is watching the scenario unfold by active participants and not directly participating in the decision-making of the team (Cioffi, 2001; Jeffries & Rogers, 2007; O'Regan et al., 2016). The observers may be in the room with students who are the active participants, in a control room with faculty members, or in an audio-visual room separate from the clinical scenario with the capability to visualize the scenario unfold on a projected screen (O'Regan et al., 2016). For the purposes of this study evaluating learning in the different roles, active participants will be assigned to the role of the nurse and charge nurse and observers will be separate from the clinical scenario in an audio-visual room.

The literature varies regarding the specific objectives for students in the passive observer roles. A systematic review of studies found that the role varies to either one that is structured and purposive such as the use of a directed observer that has clearly stated objectives or the non-directed observer that may have no guidance or may be playing an unrealistic role to their profession (family member, physician, social worker) (O'Regan et al., 2016). Despite the large amount of students observing simulation, there are no current standards regarding what an observer should or should not be doing in simulation. Additionally, the INACSL Standards of Best Practice Simulation^{SM} do not incorporate theoretical foundations or empirical evidence supporting that observational experiences are similar to participation experiences.

The literature is lacking in theoretical testing specific to observational learning in simulation and the current theories underpinning simulation pedagogy have not been rigorously tested to support that outcomes for the observer are similar to those of the active participant. Finally, there is a scant amount of literature regarding the objectives and learning outcomes for the observer as well as multiple limitations in the current research studies examining the knowledge retained when in different roles in simulation.

For these reasons, a literature review regarding the observer role and nursing education in simulation was conducted between 2006-2018. The following sections will address the findings from the literature related to the theoretical underpinnings, the outcomes and methodological limitations, and the perceptions of students in observer roles in comparison to active participants.

Social Learning Theory and the Observer Role

While KELT is a frequently used framework underpinning simulation, theories about observational learning were found in the literature search for observers in simulation. Eight articles reported the use of a guiding framework and only five of those eight used a framework directly applicable to observational learning (Bethards, 2014; Bong et al., 2017; LeFlore et al., 2007; Livsey & Lavender-Stott, 2015; Rode et al., 2016). In these five articles, Social Learning Theory (SLT) was reported as a guiding framework.

Social Learning Theory (Bandura, 1971) is frequently used when testing outcomes for observational learning. Four concepts are essential to observational learning: attention, motivation, knowledge retention, and motor reproduction. Livsey and Lavender-Stott (2015) evaluated motor reproduction with a behavioral scale and Rode et al. (2016) evaluated knowledge retention over time with knowledge examinations. LeFlore et al. (2007) tested SLT concepts knowledge retention and motor behavior in nurse practitioner students. Bethards (2014) was the first to discuss the concepts of SLT in simulation for prelicensure nursing education as an underpinning framework; however, no empirical support was provided. Leigh et al. (2017) used SLT as a guiding foundation when assigning the observer to the role of the debriefer; however, no empirical testing was performed and some debriefing methods require the clinical teacher as facilitator. Finally, Bong et al. (2017) recognized that observers may not need an active participant experience to achieve equivalent levels of non-technical performance and attributed this to the ability to socially learn through observation. This brings forward compelling evidence for the testing of this framework when investigating roles in simulation.

Knowledge Outcomes and the Observer Role

Adamson and Rodgers (2016), in a recent systematic review written to support the NLNJST, found that “simulation works” and results in superior student learning outcomes in comparison to other teaching strategies. However, more rigorous research design methods are needed (Adamson & Rodgers, 2016; O'Donnell et al., 2014). Knowledge in simulation should be linked to a supporting theory and the clinical scenario. Yet many research studies using simulation fail to define the construct of knowledge well or use psychometrically tested questions (O'Donnell et al., 2014).

While the literature for knowledge retention outcomes in simulation is growing, unfortunately only eight studies measured knowledge with a narrowed examination into outcomes for students in different roles. The focus of this section is knowledge demonstrated on written/computer-based knowledge assessments as opposed to studies that examined applied behavioral evaluation.

When compared to active participants, observers experienced similar increases in knowledge demonstrated immediately after the simulation with no significant differences in knowledge demonstrated (Fluharty et al., 2012; Jeffries & Rizzolo, 2006; Kaplan et al., 2012; LeFlore et al., 2007; Rode et al., 2016; Scherer et al., 2016; Smith et al., 2013; Thidemann & Soderhamn, 2013).

Observers had no significant difference compared to active participants in retained knowledge measured at a later time period after the simulation (LeFlore et al., 2007; Rode et al., 2016).

O'Donnell et al. (2014) mandated that future research involving knowledge as a construct be conducted with psychometrically evaluated instruments. Yet, the most common form reported in research examining knowledge demonstration and/or retention was content validity, a nonstatistical form of validity establishing the questions were in the same content domain (McDonald, 2014; Waltz, Strickland, & Lenz, 2017).

Jeffries and Rizzolo (2006) and LeFlore et al. (2007) used well established NCLEX style questions and a Knowledge Assessment Test for Pediatric Advanced Life Support questions, respectively. The additional three studies examining knowledge demonstration and retention used faculty-written multiple-choice questions with no report of reliability measures (Fluharty et al., 2012; Kaplan et al., 2012; Scherer et al., 2016; Smith et al., 2013; Smith-Stoner, 2009; Thidemann & Soderhamn, 2013). Only one study reported internal consistency reliability regarding their knowledge instruments in attempt to substantiate these outcomes (Rode et al., 2016); however, this may be due to limitations with tests with a small number of questions and its effects on internal consistency reliability (McDonald, 2014). Therefore, the findings discussed below, while informative, are questionable due to the lack of reported psychometric analysis even if limitations resulted in inadequate validity and reliability measures.

Jeffries and Rizzolo (2006) in the multi-site, multi-method National League for Nursing/Laerdal simulation study (*n*=410) reported no significant differences in knowledge demonstrated between active participant, observer, or those who were in the role of significant other. This was the first documented empirical study in the nursing education literature examining differences in outcomes, perception, and satisfaction for students in different roles.

LeFlore et al. (2007) found no significant differences in nurse practitioner students ($n = 16$, $p = 0.58$) on three knowledge examinations over time between a control group, a self-directed learning group, and a group that observed an expert performance of the simulation only. This study, while in a different population and different ways of teaching through observational learning highlights the potential abilities to integrate different learning opportunities for students in observer roles.

Kaplan et al. (2012) found no significant differences regarding knowledge demonstration between observer and active participant roles in simulation ($n = 92$, $p = .97$). Smith et al. (2013) added to this and examined knowledge demonstration between active participants and students in the family member roles and found no significant differences ($n = 72$, $p = 0.78$). Thidemann and Soderhamn (2013) reported that knowledge after a simulation and debriefing increased significantly from pretest to posttest in two different years of data collection (Year 1 $n = 57$, $p < 0.001$; Year 2 $n = 85$, $p < 0.001$); however, did not isolate student role in the analysis for comparing for knowledge demonstration.

Fluharty et al. (2012) reported no significant difference in knowledge change scores between active participant and observer roles in a simulation about end-of-life care (*n* = 124, *p* = .51). While this study demonstrated no differences between student roles and learning outcomes in simulation, results were confounded due to students in observer roles receiving a checklist of the behaviors required for successful completion of the simulation.

Scherer et al. (2016) had a group of students observe a simulation and immediately actively participate in the same simulation and found that observers performed significantly better on the first knowledge posttest regarding end-of-life care (*n* = 20, *p* = .029). Unfortunately, out of a maximum of eight points, the posttest scores ranged from a mean of 4.80 and 5.60 indicating a possible mismatch in the sensitivity of the intervention to the content of the knowledge evaluation instrument. Additionally, the authors suggested that participation in the same scenario may have resulted in this finding and recommended using different scenarios to further advance this study. This change would support KELT as it would assess the final stage of active experimentation.

Rode et al. (2016) evaluated the differences between a group receiving eight large-group simulations in comparison to a control group that received traditional lecture and found no significant differences in knowledge retained between observer and active participant (*n* = 30, *p* = .692). This study demonstrated the most rigorous psychometric testing and supported each examination with a measure for internal consistency and point biserial indices.

However, a small sample size, different instructors delivering content, and availability of Powerpoint presentations to all students limit these study findings.

These studies demonstrate a need for further research with psychometric testing to support knowledge demonstration and retention for students in the observer role. In the absence of psychometrically tested instruments to measure knowledge, the accuracy of stated outcomes from the other studies is in question. While numerous studies explored the student observation experience, advances in theoretical underpinnings, methodology, and psychometric testing are needed. In addition, standards for evidence-based observational learning are needed within the standards of best practice for simulation. Further, all of the above studies included debriefing which has been determined as the most significant component of simulation that bridges the gap for learners (Adamson & Rodgers, 2016). The literature is lacking in evidence exploring the differences that exist regarding knowledge demonstration and retention when isolating role as a predictor in the analysis. Also, considering the observer views simulation with a different perspective than active participants but then participates in the same debriefing, studies have yet to examine how learning for the observer progresses throughout simulation and debriefing. Therefore, more studies are needed to explore how learning occurs for observers in simulation and how knowledge changes over time.

Student Perceptions of the Observer Role

Jeffries and Rizzolo (2006) conducted the first empirical study that examined differences in perceptions of student role in simulation. Their study found that students in the observer role self-rated lower clinical judgment scores in comparison to those in active roles. From the first study that examined perception of student role to the present, students have mixed perceptions regarding their own learning when in the observer role despite evidence supporting differences do not exist. Twelve studies examined perceptions and experiences of students in the observer role and questions still remain on whether or not students feel the learning is similar to their peers in active participant roles.

Results are mixed regarding student satisfaction of the observer role. Some researchers support that students find the observer role beneficial and are satisfied with the role (Levett-Jones et al., 2015; Thidemann & Soderhamn, 2013; Traynor et al., 2010). Alternatively, Harder et al. (2013) and Hober and Bonnel (2014) found that students do not prefer the observer role and that observers must feel valued as part of the entire scenario. Both quantitative and qualitative evidence supported that the observer role minimizes stress and allows for the grasping of a situation (Bong et al., 2017; Hober & Bonnel, 2014; Traynor et al., 2010) and promotes thinking about thinking (Bonnel & Hober, 2016). Norman (2018) found that using an observer guide significantly improved satisfaction scores in comparison to those without a guide (n = 119, p = 0.013); however, no increase in self-confidence or collaboration. Additionally, Reime et al. (2017) found that observers, even while using a checklist, preferred hands-on learning in the active role and rated themselves significantly lower in three learning outcomes. These findings highlight that although knowledge outcomes may be similar to those in active roles, students do not necessarily perceive the roles are similar.

Strategies discussed to help improve the reception of the observer role include directed objectives (O'Regan et al., 2016), worksheets to attract engagement (Bethards, 2014), incorporating models to increase mindfulness and intentional observation (Collins, Lambert, Helms, & Minichiello, 2017), and having the observer facilitate debriefing (Leigh et al., 2017) have been used. Unfortunately, at this time strategies such as these have not been empirically or qualitatively evaluated to assess increases in student perception.

For all of the previous reasons regarding the observer role in simulation, the following sections will discuss how one best learns through observation. Further, the brain-based evidence supporting observational learning as well as how different strategic protocols that are empirically supported to improve outcomes for observational experiences will be discussed.

Learning Through Observation

Observational learning, also referred to as vicarious learning, visual learning, mimicry, or imitation, has received a large amount of theoretical attention. For clarity, these terms will be used to define an *intentional* learning environment as opposed to the passive watching or unintentional behavior reproduction.

Over the last 40 years with the advancement of technology and brain-based learning, the theory of observational learning now has empirical support through the use of functional magnetic resonance imaging techniques to validate the areas of the brain that are active when observing action as opposed to participating in action. Disciplines other than nursing have tested observational learning in depth and will be discussed. The purpose of this section is to briefly discuss the history and theoretical underpinning for observational learning as well as describe advances through neurological evidence supporting the theoretical concepts. Further, a review of literature is provided supporting knowledge retained and/or executed through observational learning.

History of Observational Learning

Observational learning is a process where a learner reproduces overt behavior that has previously been modeled (Bandura, 1971, 2005; Wodtke & Brown, 1967). Bandura (1971), Wodtke, and Brown (1967) contrasted this form of learning to behaviorism suggesting that learning through observation is primarily driven by social beliefs and outcome expectations as opposed to positive reinforcement (Bandura, 2005). In *Social Learning Theory*, Bandura (1971) identified four concepts within observational learning including attention, retention, motor learning, and motivation. If the learner is attentive and motivated to learn, symbolic representations, or codes, assist in developing imaginal and verbal retention processes. These symbolic codes are available for knowledge retention and lead to behavior reproduction.

Alternatively, Kuhn (1973) developed cognitive imitation theory by expanding on Piaget’s cognitive development theory and proposed that observational learning was not primarily for overt actions. This theory examined imitation as one aspect of cognitive function where both overt and covert actions are characterized by accommodating/imitating over assimilating/adapting (Kuhn, 1973; Piaget & Cook, 1952). Kuhn (1973) differentiated adaptation and imitation by stating:

> Adaptation occurs when there is a coordinated and reciprocal assimilation of external reality to the individual's action scheme and accommodation of these schemes to reality. Imitation, then, as the accommodatory pole of cognitive functioning, occurs when there is accommodation of individual to object without assimilation of the object to the individual's structure. Thus, imitation is characterized by an absence of equilibrium between subject and object. (p. 161).

Therefore, this cognitive aspect of imitative learning asserted that imitation and accommodation are active, constructive, and reflective mental activities that are "available for further transformation as the individual develops" (Kuhn, 1973, p. 163).

Additionally, Carroll and Bandura (1982, 1985, 1987, 1990) and Bandura (2001, 2005) built on the cognitive aspect of observational learning and suggested that through cognitive ideas, observed behavior, and feedback for error correction, an individual can translate knowledge into performance. Social learning theory was redefined as social cognitive theory. Thus, social cognitive theory (SCT) asserted that through verbal modeling and thinking aloud, even covert reasoning and decision-making become observable (Bandura, 2005; Meichenbaum, 1984). Social cognitive theory challenged the assumption that observational learning is only for overt behavior and supported that learning does not have to occur through action and errors in a direct experience (Bandura, 2005; Fryling, Johnston, & Hayes, 2011).

Further, in contrast to Skinnerian behaviorism that suggested learning is motivated by positive reward, Bandura (2001) asserted that the concept of motivation in social cognitive theory is driven by human agency, or a commitment to a future action that is performed. Human agency is characterized by intentionality, forethought, self-reactiveness, and self-reflection (Bandura, 2001). Intention is more than a prediction of future actions based on previous rewards (behaviorism), rather, it is a commitment to bringing about the future action. Forethought involves more than directed planning and includes the anticipation of consequences, actions, and desired outcomes.

While intention and forethought are underlying thought processes, the concept of self-reactiveness shapes the thoughts into executed actions where self-monitoring, self-guidance, and corrective self-reactions arise from morality and self-worth. Self-reactiveness is characterized by strong interest and challenging goals. Self-reflectiveness involves the ability to judge the accuracy of one’s thinking and actions to adjust future actions. In addition, self-efficacy is also a fundamental component of self-reflection where people evaluate the belief in capability to control the outcome of an event (Bandura, 2001). Through efficacy beliefs, self-regulation and motivation function as a mechanism for how people choose challenges, persevere, and handle failure in their life course. Therefore, human agency is the underlying motivational process in SCT that will produce intended knowledge retention and behavior reproduction.

Brain-Based Observational Learning

While theoretical work regarding observational learning continues, technology in the 21st century allowed for empirical testing of neurophysiological evidence that learning occurs when observing as opposed to participating. Due to a large body of literature regarding brain-based learning, this literature review will focus on seminal work in brain-based studies that expand on the four major concepts of social learning theory. The following sections will explore the concepts within Social Learning Theory and the brain-based evidence supporting those concepts.

Attention, motivation, and visual precision. The current generation of learners are surrounded by a world full of visual experiences including gaming, virtual reality, and other forms of technology. It is estimated that the average young adult spends nearly 10,000 hours of gaming by age 21 (McGonigal, 2011). McGonigal (2011) asserted that through gaming, a player seeks to solve complex problems and will not cease until achieving an epic win because games are engaging, teaching, and inspiring us differently than reality. Further, Kühn and Gallinat (2014) stated that this amount of lifetime gaming results in structural changes in the hippocampal, parietal, and occipital brain regions that correlate with advanced visual capabilities including visuospatial expertise and enhanced visual attention as opposed to people that do not game (p. 845). Thus, as the gaming generation sits in front of a television, places goggles over their eyes for a three-dimensional experience, or uses their smart-device to game, the structures associated with visual attention in their brains develop differently and more precisely.

Conversely, literature regarding television effects reports that although exposure to television is high, *exposure* is not the same as *attention* (Biocca, 1988; Chaffee & Schleuder, 1986; Lang et al., 2000). Rather, intention and goals, also described as the motivation or human agency of the viewer, has a role in the attention to messages (Gantz, 1978; Gunter, 1987; Petty, Cacioppo, & Schumann, 1983). Similar to gaming literature described above, by adding complexity, difficulty, or both, to television messages, memory and attention are improved (Lang, Bolls, Potter, & Kawahara, 1999; Lang et al., 2000; Thorson, Reeves, & Schleuder, 1986; Yoon, Bolls, & Lang, 1998; Yoon, Bolls, Lang, & Potter, 1997). Therefore, difficulty and complexity are important in engaging the attention and motivation of an observer. Without those components, passive *watching* is the result. Chaffee and Schleuder (1986) concluded, “One can ‘watch’ a [television] news program simply because it is on, without particularly engaging the mind in any serious sense” (p. 104). Thus, a stark contrast exists between watching and observing.

All things considered, the average college student who is a 21-year-old sitting in a higher educational setting has a more precise visual neurobiology than students in the past according to the aforementioned studies. Yet, Poh, Swenson, and Picard (2010) reported that the sympathetic stimulation, associated with neurobiological activity, of college students in a traditional classroom environment plummets in comparison to the neurobiological activity that occurs when students are studying, preparing for examinations, working in laboratory settings, and even when a college student is sleeping. The sympathetic stimulation and arousal in a lecture is unfortunately similar to passively watching television.

Given these points, an assumption surfaces regarding the level of attention and motivation when observing. Whether a student is observing a lecture, a simulation, or in a clinical learning environment, there must be intentional goals, difficulty, and complexity to engage the attention prior to the experience. Therefore, engaging the attention and motivation to learn an intended behavior are two essential antecedents that contrast observational learning to watching without thinking.

Retention, motor reproduction, and the mirror-neuron system. The two remaining concepts necessary for observational learning are retention and motor reproduction. To fully understand how observing a behavior leads to retention of knowledge and motor reproduction, a review of a complex mechanism of neurons is provided. The mirror neuron system (MNS) activates areas of the occipital, temporal, and parietal vision lobes as well as two cortical motor regions when observing a behavior (Fabbri-Destro & Rizzolatti, 2008; Rizzolatti, 2005; Rizzolatti & Craighero, 2004; Vogt & Thomaschke, 2007). Rizzolatti and Craighero (2004) found that the MNS mediates imitation and transforms observed information into knowledge and that there is correspondence in the brain when executing or observing an action.

The area of the brain that is activated is known as the action-observation network (Caspers, Zilles, Laird, & Eickhoff, 2010). The action-observation network is thought to have a role in language, emotion, and not only the execution and observing of actions, but also the *intention* behind action (Fabbri-Destro & Rizzolatti, 2008; Iacoboni et al., 2005; Rizzolatti, 2005; Rizzolatti et al., 2006). In addition, Iacoboni et al. (2005) described that activating this network helps “code the ‘why’ of the action and respond differently to different intentions” (p. e79). Further, Caggiano et al. (2012) asserted that this process is where an observer begins to understand meaning.

Within this complex network of neurons, humans begin processing the understanding and execution of actions, emotions, speech, and intentions, all through observation. This assists in the building of stronger motor representations to accurately estimate practiced outcomes (Fabbri-Destro & Rizzolatti, 2008; Lago-Rodriguez, Lopez-Alonso, & Fernandez-del-Olmo, 2013). Cross, Kraemer, de C. Hamilton, Kelley, and Grafton (2009) supported the hypothesis that the action-observation network has similar neurological representations that are constructed when an individual observes or physically practices an action. Also, as previously discussed, covert actions are observable when the observed person thinks out loud while executing the action (Bandura, 2005; Meichenbaum, 1984). Tettamanti et al. (2005) furthered this idea by demonstrating that the MNS is activated when a learner is listening to sentences regarding motor actions.

In addition, Gog, Paas, Marcus, Ayres, and Sweller (2009) asserted that for cognitive skills, a background of prior knowledge is essential for a learner to interpret action by allowing a mental simulation for a task that is parallel, or similar, to another. Evidence is beginning to demonstrate that the hippocampus and cerebellum are the primary brain structures involved in taking prior knowledge to then sequentially assimilate and accommodate the information (Callan et al., 2013; Monfardini et al., 2013; Schiffer, Ahlheim, Wurm, & Schubotz, 2012). Hippocampal activity decrease is understood as a learning hallmark and when a difference is presented to a priori knowledge, hippocampal activity increases and informs the brain to accommodate the information. While Schiffer et al. (2012) described that hippocampal activity increases when accommodating and decreases when assimilating information, Callan et al. (2013) demonstrated that the cerebellum primarily assists in accommodating new information when the learner recognizes and attempts to control for errors. Furthermore, Monfardini et al. (2013) suggested that the cerebellum activates similarly when learning in a trial-by-error format as well as learning through observation.

In summary, observational learning consists of four concepts: attention, motivation, retention, and motor reproduction (Bandura, 1971, 2005). Prior knowledge and an informed attention *with* intentional goals begin to assist in the early stages of observational learning. By adding increased difficulty and complexity, an increase in attention results. This differentiates observational learning from the passive activity of watching an event. Consequently, as an event unfolds, the MNS is activated and assists in the transformation of the observed action into executed action. The MNS has a role in understanding the intention behind observed action and meaning. With repeated exposure to observable actions, assimilation occurs along with hippocampal activity decrease, suggesting learning has occurred; or, hippocampal activity increases, indicating the learner had to accommodate for different information that does not fit an existing frame. The cerebellum also assists in accommodating information by activating when a learner desires to decrease errors in performance. However, questions still remain on how learning an observed behavior is optimized and how to increase the likelihood that the brain is activated at its full potential to retain, retrieve, and execute previously observed experiences. The following section will examine how to engage these neural structures to best optimize learning through observation.

Evidence-Based Observational Learning Protocols

The neuroscience and exercise science disciplines are avidly researching the most optimal way a learner observes behavior and retains the knowledge of the event in addition to the ability to reproduce the behavior. Researchers in these disciplines desire to observe maximized brain activity and to assess the outcomes through assessing retention through motor behavior experiments. Due to the large volume of literature, the search was limited to results between 2013-2017. Although the literature reported is primarily concerned with the retention and execution of a simple motor task, the evidence is supportive of the most precise method to learn through observation when compared to physical practice and should be further tested in the nursing education research for simulation.

Application of knowledge through observation is supported to show similar outcomes in opposition to, or in conjunction with, physical practice (Andrieux & Proteau, 2013, 2014; Domuracki, Wong, Olivieri, & Grierson, 2015; Gatti et al., 2013; Hayes, Elliott, & Bennett, 2013; Sakadjian, Panchuk, & Pearce, 2014; St-Onge et al., 2013), and self-observation (Anderson & Campbell, 2015; Callan et al., 2013; Hiyamizu, Maeoka, Matsuo, & Morioka, 2014). Further, observing the expert, or flawless, performance (Anderson & Campbell, 2015; Andrieux & Proteau, 2013, 2014; Callan et al., 2013; Domuracki et al., 2015; St-Onge et al., 2013) and the novice, or flawed, performance (Andrieux & Proteau, 2013, 2014; Domuracki et al., 2015) are known as effective ways to engage different areas of the brain when observing action. With this in mind, mixed observation of the expert and novice performance supersedes any stand-alone form of observation (Andrieux & Proteau, 2013, 2014; Domuracki et al., 2015). In addition, the role of motor imagery is supported to have a beneficial role in observational learning (Bach, Allami, Tucker, & Ellis, 2014; Gatti et al., 2013; Gonzalez-Rosa et al., 2015; Lawrence, Callow, & Roberts, 2013). In the following sections, each of these methods will be described for further understanding.

Error reduction through self and flawed observations. Observing a previous self-performance or another individual lacking expertise in the skill are effective methods to improve future behavioral execution (Anderson & Campbell, 2015; Andrieux & Proteau, 2013, 2014; Callan et al., 2013; Domuracki et al., 2015; Hiyamizu et al., 2014). While Hiyamizu et al. (2014) demonstrated that a self-observation group (n=13) outperformed a balancing skill in comparison to a group who observed another individual (n = 13, $p < 0.05$), the researchers did not specify the level of expertise of other individual. On the other hand, Anderson and Campbell (2015) compared active participants that self-observed to a group observing an expert and found that self-observation alone is not sufficient, but assists in the learning process. However, Callan et al. (2013) tested groups of experienced pilots (n = 15) and non-pilots (n = 15) and found that viewing a previous self-performance resulted in increased cerebellar activity associated with error correction as opposed to experts watching another expert pilot landing. Therefore, while self-observation alone may not be adequate, it does potentiate the capability to recognize errors and should be considered in observational learning.

Observing a novice has similar findings when compared to self-observation in that it enhances the ability to correct for errors, but alone may contribute to inconsistent results (Andrieux & Proteau, 2013). In a study regarding central line insertion with medical students, the observation of a novice resulted in improved performance, however, only with feedback to the learner as specific errors occurred (Domuracki et al., 2015). Dyre, Tabor, Ringsted, and Tolsgaard (2017) found that students who were asked to deliberately make errors improved transfer of learning in comparison to a group of students instructed to traditionally avoid making errors ($n = 56$, $p < 0.001$). Additionally, Andrieux and Proteau (2013, 2014) suggested that knowledge of results contributes to improvement in execution after observational learning, however, not required after every trial. Later, Andrieux and Proteau (2016) supported that feedforward, or providing information to observers about what they are about to observe, has a role in how observers detect and learn from errors.

The results of these studies allude to the necessity of feedback or feedforward protocols in observational experiences as well as the potential impact that observing a previous performance or a flawed performance has on the future performance. Self-observation and novice observation, while not efficient for learning as a stand-alone method, contribute to observational learning retention of knowledge and future motor reproduction.

Mirroring behavior by expert observation and motor imagery. In contrast to the self and novice observation, the MNS and the action observation network are activated during the observation of an expert performance and is supported as a more proficient method to retain and apply knowledge (Anderson & Campbell, 2015; Andrieux & Proteau, 2013; Callan et al., 2013; Domuracki et al., 2015; Sakadjian et al., 2014; St-Onge et al., 2013). The observation of an expert contributes to the intent to imitate and understand the underlying actions resulting in a successful performance (Andrieux & Proteau, 2014; Callan et al., 2013). Further, when combined with feedback or other previously mentioned forms of observation, performance improvement occurred (Anderson & Campbell, 2015; Sakadjian et al., 2014). Observing an expert, as opposed to observing a novice, allows for the assimilation and accommodation of different performances for future execution. Research is needed to support that more cognitive tasks including the thinking behind observed actions are needed. This could be demonstrated through the previous discussion regarding thinking aloud while performing an action (Bandura, 2005; Meichenbaum, 1984; Tettamanti et al., 2005).

In addition, mental or motor imagery, or the internal rehearsal of previously observed and performed actions, unifies higher-level cognition with lower-level motor behavior (Bach et al., 2014). Both observing an action and motor imagery are supported to activate the MNS and contribute to the improved execution of strong cognitive tasks as compared to motor behavior alone (Bach et al., 2014; Gatti et al., 2013). Furthermore, the individual ability to produce an image of action is thought to moderate observational learning (Lawrence et al., 2013), leaving the question of whether observing an action or motor imagery results in better performance (Gatti et al., 2013; Gonzalez-Rosa et al., 2015). Therefore, the ability to mentally rehearse an observed or previously performed action is demonstrated to have a positive impact on skill performance. The inclusion of motor imagery into an observational experience needs further testing and should be combined with both novice and expert observational experiences for a potential performance improvement.

Mixed observation protocols. Evidence supports that a mixed observation protocol produced the most similar outcomes when compared to a group physically practicing a skill (Andrieux & Proteau, 2013, 2014; Cordovani & Cordovani, 2016; Domuracki et al., 2015; Welsher et al., 2018). Mixed observation groups viewed a novice and expert demonstration of a task allowing for both the intent to imitate and intent to reduce errors (Andrieux & Proteau, 2014). When compared to other observation and feedback protocols, including combinations of expert and novice observations, mixed observation significantly outperformed other groups (Andrieux & Proteau, 2013, 2014). Although Domuracki et al. (2015) found no differences among groups viewing expert, mixed, and mixed with feedback protocols, the results of the study concluded that physical and observational practice should be combined and that when learners are aware of what they are observing (erroneous or flawless), there is improved performance. More recently, Welsher et al. (2018) assigned medical students to either an expert observation, novice observation, of combination of both and found all learners ($n = 22$; $p < 0.0001$) improved with no significant differences between groups.

In summary, observational learning results in applied knowledge similar to or advantageous to physically practicing a skill through different forms of observation protocols. Previously stated, observational learning is supported to assist in the development of more than just overt actions, rather, the thinking behind the action. All of these concepts come together to support that Bandura’s hypothesis of observational learning is deeply rooted in brain-based learning evidence and that meticulously designed protocols for observational learning optimize outcomes. These observation protocols allow for learners to grasp an experience with the intention of understanding flawed demonstration and expert demonstration that would be available for transformation, thus, facilitating KELT.

Therefore, the relationship between observational learning and experiential learning needs to be explored.

Observational Experiential Learning

Observational experiential learning (OEL), building on both Bandura's social learning/cognitive theory and KELT, explains how both observation and hands-on experience results in significant and meaningful learning. Hoover and Giambatista (2009) are the first known authors to define vicarious experiential learning as an educational methodology that:

> Exists when a personally responsible participant(s) cognitively, emotionally, and behaviorally processes knowledge, skills, and/or attitudes through processes of observation in a learning situation characterized by a high level of active involvement despite absence of direct, personalized consequences (p. 36).

While Hoover and Giambatista (2009) and Hoover et al. (2012) do not advocate that all concrete experiences are replaced with observational ones or should be, their research demonstrates how concepts of observational learning have the ability to enhance experiential learning which expands on each concept within both theories.

Related to social cognitive theory, observational learners have the attentive ability to selectively observe and “separate the wheat from the chaff” compared to that experiential learners immersed in a direct experience do not have the luxury to because they must devote a majority of their attention to the task at hand (Hoover & Giambatista, 2009, p. 35). Observation occurs in an exocentric, third-person, frame of reference allowing for the understanding the bigger picture concepts whereas the active participant is associated with concrete skill learning in the egocentric frame of reference (Dede, 2009a; Salzman, Dede, & Loftin, 1999). Dede (2009b) discussed that optimal learning occurs when a bicentric frame of reference, or switching between egocentric and exocentric, is employed. Although evidence exists that alternating roles has benefit in the experience, research in simulation has focused on both the simulation paired with debriefing as opposed to what learners gain from being an observer or an active participant in the experience alone.

Moreover, related to retention processes, the observational learner has the ability to mentally rehearse or simulate their plan of action, even repeatedly with refinement (Hoover & Giambatista, 2009; Hoover et al., 2012). Motor imagery has the capability to activate the action-observation network through the MNS and although it is less effective than direct observation, it affords an additional opportunity that could enhance observational learning (Bach et al., 2014; Gatti et al., 2013; Gonzalez-Rosa et al., 2015; Lago-Rodriguez et al., 2013). A learner in an actual experience may be required to combine prior knowledge and skills while making immediate decisions, whereas an observational learner has time to contemplate a plan of action with *intention* and use *anticipation/forethought*; aspects of human agency (Bandura, 2001; Hoover & Giambatista, 2009; Hoover et al., 2012).

Contrary to social cognitive theory, Hoover and Giambatista (2009) related motivational concepts to Skinnerian rewards and recognized one negative aspect of OEL is that learners may focus on choosing the path that is most pleasing or rewarding to miss out on errors and negative consequences that may result in learning. Rather, instead of deviating from Bandura’s work, the experience should be carefully planned to address motivational and attention processes of human agency. As simulations are planned, the concepts of intention, forethought, self-reactiveness, and self-reflection that drive learners to set and execute a plan of action should be considered as opposed to simply seeking the positive reward of the past of least resistance (Bandura, 2001). By creating an environment with psychological safety for learners to make mistakes, learners are invited into to take risks with new thinking and action, fundamental to simulation (Rudolph et al., 2006).

Roberts (2010) examined social cognitive theory in nursing education and discussed that essential to observational learning is active and reflective thinking as well as the acknowledgment that fellow students they are observing have something worth observing. This would indicate that the learner’s attention and motivation for observing are *intentional* and highlights a need for specifically tailoring components of the prebrief towards observers, perhaps with feedforward techniques (Andrieux & Proteau, 2016). Moreover, Roberts (2010) and Northedge (2003) asserted that the concepts of attention and human agency are brought about by the teacher who opens up dialogue and helps derive meaning which enables learning. OEL becomes more than a passive watching of an event. Rather, OEL is proposed as an active form of learning that facilitates the grasping and transformation of an experience through observation (Chi, Roy, & Hausmann, 2008; Stegmann, Pilz, Siebeck, & Fischer, 2012).

Essential to this transformation is a concrete experience, which Hoover and Giambatista (2009) attested is never defined by Kolb as to whether it is experienced directly or through observation. Supportive of this notion, brain-based observational learning evidence was previously discussed and is suggestive that observation and concrete experiences share a common network in the brain (Monfardini et al., 2013) where others are able to “put themselves into other people’s shoes, vicariously experience the outcome of their actions, and learn from their experience, enabling them to later reproduce the behaviors and achieve the same goals” (Bach et al., 2014, pp. 1290-1291)

Therefore, the concrete experience in simulation, underpinned by OEL, becomes more than Kolb’s (2015) instantaneous concrete experience requiring no inquiry or analysis. Rather, attention and motivation from social learning theory which are deeply influenced by human agency (Bandura, 2001) help optimize the concrete experience into one that results in active and significant learning. Thus, in the model proposed for observational-experiential learning, two antecedents occur prior to the concrete experience: attention and motivation.

In simulation, the prebrief is a time before the scenario where learners are given a time for focused preparation regarding their objectives and role (INACSL Standards Committee, 2016b, 2016c). Page-Cutrara (2015) expanded on the INACSL definition and discussed prebriefing as a time where information and activities prior to the simulation are:

> Provided to learners in consideration of their level of knowledge, learning needs, and prior experiences; structured for anticipatory

> reflection and planning; and facilitated by qualified nursing simulation educator to support decision-making, psychological safety, and debriefing activities. (p. 339).

Page-Cutrara (2015) stated that the consequences of prebriefing, while yet to be empirically tested, should result in engagement and readiness of the learner. This would suggest that the prebrief is focused on increasing attention and motivation of the learner as opposed to passively watching or participating in the concrete experience that immediately follows.

Assuming that learners were attentive and motivated in both active and observer roles, based on previous discussion, once the concrete experience has occurred this information has activated the MNS and action-observation network and is now available for transformation. The debriefing immediately after the simulation then facilitates the reflective observation and abstract conceptualization of the experience (Dreifuerst, 2009; Forneris & Fey, 2016; INACSL Standards Committee, 2016a). This facilitates assimilative knowledge where both the thinking, or mental frames, and actions of the scenario are critically examined to help change existing mental frames of a situation which then changes future actions (Rudolph et al., 2006).

Finally, once this knowledge is grasped abstractly and transformed through reflection resulting in the changing of mental frames, this knowledge must be actively tested in a new situation, one that is “similar on the surface—but has a different deep structure” (Forneris & Fey, 2016, p. 249) Active experimentation, the final stage of KELT informing the next concrete experience, lacks research in nursing education literature (Chmil et al., 2015). Currently, this stage of KELT is incorporated into the debriefing where learners are guided to think about how information learned in a previous simulation informs thinking and actions in a future simulation (Chmil et al., 2015; Dreifuerst, 2009, 2015; Forneris & Fey, 2016; INACSL Standards Committee, 2016a). However, the assumption is that observers and active participants both grasp and transform the experience equivalently and that knowledge is retained over time. In addition, there is an assumption that observers do not need hands-on participation in a parallel experience and that they demonstrate similar knowledge over time. This assumption lacks empirical testing in nursing education research.

The transformation pole of knowledge consists of reflective observation and active experimentation, accomplished during the debrief creating tension with the abstract conceptualization, or the ability to describe, the previous experience. This expands on the changed frames during debriefing, allowing anticipation through reflection, where one can only look forward while looking back on previous experiences that inform the thinking and actions in a new situation (Dreifuerst, 2009; Rudolph et al., 2006; Schön, 1983).

Therefore, an assumption that learners experienced similar knowledge changes with different frames of reference needs empirical testing to further establish that knowledge demonstration and retention are similar when participating or observing in a simulation (Dede, 2009a, 2009b; Salzman et al., 1999). For observational learners, if simulations and instruments to measure knowledge outcomes are designed to parallel one another with similarities and differences; this knowledge, cognitive and behavioral, is testable in the OEL framework. Additionally, understanding and supporting how specific debriefing transforms knowledge experiences and assists in knowledge retention, for both active participant and observer, lacks research in nursing education. Therefore, to facilitate the testing of OEL, the grasped and transformed experiences must be examined empirically, as well as retention over time. The following section will discuss one method, Debriefing for Meaningful Learning© (DML), and how it will underpin this study to facilitate OEL by iteratively grasping and transforming the experience.

Facilitating OEL with Debriefing for Meaningful Learning©

While much attention has been paid in the literature on how “simulation works” and the outcomes of knowledge specific to simulation and the observer role, of utmost importance is that educators must not forget that debriefing is the most important component of simulation (Adamson & Rodgers, 2016). The NSS which provided evidence that simulation can replace up to 50 percent of patient care clinical experiences asserted that simulation must by accompanied by “theory-based debriefing” (Hayden et al., 2014, p. S38).

Debriefing for Meaningful Learning© (DML) is one theory-derived and evidence-based method of consistently structured debriefing for use in prelicensure nursing education to develop reflective thinking and advance learners from critical thinking to higher order reasoning (Decker & Dreifuerst, 2012; Dreifuerst, 2012; INACSL Standards Committee, 2016a). While reflective thinking may not be innate, educators can use DML to teach and model reflective thinking for prelicensure nursing students through different processes (Decker &

Dreifuerst, 2012; Dreifuerst, 2012). Through reflective observation, the debriefer facilitates the transformation of an experience and assists in fostering human agency. This is accomplished through the use of a consistent process of stages designed to advance thinking from inductive and deductive processes to more inferential and analytic thinking contributing to anticipation of the next encountered clinical situation (Dreifuerst, 2010, 2012). DML underpins this study and will be used as part of the simulation.

DML fosters clinical reasoning, assimilation, accommodation, and experiential learning through Socratic questioning, reflection, and the Biological Sciences Curriculum Study (BSCS) E5 Instructional Model that inform the framework that underpins the DML method (Bybee, 2015; Dreifuerst, 2010, 2012). Socratic questioning is used to engage nursing students in dialogue whereby the facilitator asks specific questions to gain an understanding of the thinking behind actions (Dreifuerst, 2010, 2015). Socratic questioning employs “who, what, when, where, how, and why” questions facilitating an ability to further explore assumptions, relationships, and thought processes during the experience. The debriefer answers questions with questions to continually develop and evaluate their thinking and actions (Bradley, 2016; Dreifuerst, 2010).

By engaging the learner in Socratic dialogue, the debriefer contributes to the abstract conceptualization of a concrete experience by continually having learners describe the actions of the experience while asking learners to reflect on those actions. Debriefing with DML develops, deepens, and guides the covert thinking that accompanied the overt experience creating tension between reflection and abstract conceptualization, resulting in assimilative knowledge, a defining attribute of debriefing (Dreifuerst, 2009).

Reflection is to purposefully and seriously revisit a subject and to become aware of the thinking and actions of the previous experience (Dewey, 1910; Mezirow, 1981; Pesut & Herman, 1999). Kolb (2015) included reflective observation in experiential learning theory as a means of transforming the experience. Through reflection, a higher order thinking termed metacognition, or thinking about thinking, is made possible (Kuiper & Pesut, 2004). Reflective thinking may need to be modeled or taught through a process of guided reflection that is supported to develop the ability to think like a nurse, or clinically reason through complex patient situations (Decker & Dreifuerst, 2012; Dreifuerst, 2009, 2010). The concept of reflective practice was advanced by Schön (1983) who argued that thinking and reflection-in and reflection-on action were more important than knowledge as the complexity of healthcare rises. However, while reflection may be more important, knowledge examinations can be designed with the intent in mind to help learners assimilate and accommodate based on previous experiences.

Schön (1983) proposed three reflective phases that have been adopted by the INACSL Standards Committee (2016b) for debriefing in nursing education to include awareness, analysis, and summary. Awareness brings the emotional thoughts and feelings, antecedents to debriefing, to the surface (Dreifuerst, 2009). During the analysis phase, guided reflection and Socratic questioning are used to link the thought processes to actions and whether those were right or wrong (Dreifuerst, 2010, 2015). The summarization phase involves new perspective and insight development (Bradley, 2016). Further, three types of reflection including reflection-in-action, reflection-on-action, and reflection-beyond-action are part of the DML process assisting in guiding and teaching reflective practice.

Reflection during practice, or reflection-in-action, and retrospective reflection-on-action are embedded within the DML framework (Bradley, 2016; Dreifuerst, 2010, 2015; Schön, 1983). Reflection-in-action occurs in the moment of the experience and is difficult to teach and learn (Bradley, 2016; Dreifuerst, 2015). Although debriefing occurs after the event, the debriefer can facilitate reflection-in-action by guiding the student group back to the moment it occurred or can use video-recording technology to revisit the actual moment where reflection-in-action is noticed. This is one method of helping learners grasp experiences through self-observation, known to activate the MNS, and why observational protocols need exploration into nursing education research.

This differentiates reflection-in-action from reflection-on-action because reflection-on-action occurs retrospectively after an action (Bradley, 2016; Dreifuerst, 2015; Schön, 1983). It is during reflection-on-action that the debriefer stimulates intentional thinking through Socratic questioning and learners discover the correctness or incorrectness of their actions and thinking. The debriefer assists in uncovering possible outcomes that could have occurred due to other decisions or actions (Bradley, 2016). Through this process, debriefing facilitates human agency. Human agency involves learners making intentional decisions to be proactively committed to learning and enact behavior change when necessary (Bandura, 2001). Essential to DML is a clinical teacher as facilitator that is knowledgeable of the care in the simulated experience (Dreifuerst, 2015). The clinical teacher, as facilitator, opens up the dialogue, helps create meaning, frames the experience together, and highlights the importance of how the debriefing process affects future practice (Northedge, 2003; Roberts, 2010). Further, even learners who observed the experience rather than directly experiencing it can experience rich reflective observation (Y. Kim & Silver, 2016). Therefore, the debriefer engages in conversation with learners to develop human agency by guiding reflection-in and reflection-on action, modeling the importance of the intentionality of being a reflective practitioner, a distinguishable trait of an expert nurse (Benner, 1984; Kuiper & Pesut, 2004).

Thus, using the INACSL Standards of Best Practice for Simulation and DML are supported to facilitate an intrinsic and proactive commitment to encounter each clinical experience as an opportunity for learning that will be challenged by the debriefer and guide observable behavior change. While observable behavior change may be noted in a future experience, it is important to recognize that enacting these concepts of reflection and intention shifts away from outcome-centered conventional pedagogy and begins to enable narrative pedagogy. Narrative pedagogy is a research-based nursing pedagogy that invites learners to think and learn together about nursing phenomena and is not centered around skill and content outcomes, rather, an understanding of experiences in nursing (Diekelmann & Diekelmann, 2009; Ironside, 2014, 2015).

Thus, the clinical teacher as debriefer, creates “a way for teachers and students to persist in questioning their current understanding of nursing, the ways they think about the situations they encounter, and how their practice can best be learned” (Dreifuerst, 2015; Ironside, 2015, p. 87).

While intentionality drives a proactive commitment to learning and a deeper understanding that may contribute to behavioral change, human agency also needs forethought or anticipation (Bandura, 2001). Therefore, building on Schön’s (1983) previous two concepts, reflection-beyond-action (Dreifuerst, 2009) extends reflection forward and links reflection to anticipation. Guiding reflection-beyond-action involves the “what if” style of question linking previous clinical contexts to broader scopes of patient care (Bradley, 2016; Dreifuerst, 2009). In turn, with each subsequent clinical situation, the student learner begins with previous knowledge and experience and begins to anticipate the beginning of the encounter and then “assimilates the components of the experience that fit the anticipated frame and accommodates. When assimilation is not possible, then accommodation or reframing must occur as the nurse adjusts thinking and actions to address the situation at hand” (Dreifuerst, 2015, p. 270). Therefore, assimilation and accommodation are two forms of knowledge constructed through OEL and facilitated through DML and the essence of nursing practice (Dreifuerst, 2009).

DML facilitates assimilation through guiding reflection and the use of Socratic questioning where understanding of meaning and emphasis of thinking are the focus (Kolb, 2015). The ability to accommodate lies within DML’s reflection-beyond-action where learners orient toward active experimentation and must respond to changing situations (Kolb, 2015). However, an underlying assumption regarding active experimentation through the use of DML is that the learner has a previous experience to actively experiment with their knowledge. Therefore, to facilitate the use of DML and also test if learners can assimilate and accommodate in the OEL cycle, a second experience that is “similar on the surface but different in deep structure” (Forneris & Fey, 2016, p. 49) needs to be presented and tested, which is the final stage of the DML method.

The ability to reflect-in, reflect-on, and reflect-beyond-action is operationalized in DML through use of the BSCS E5 Instructional model (Bybee, 2015; Dreifuerst, 2010). This model involves the phases of engagement, exploration, explanation, elaboration, and evaluation. Dreifuerst (2010) added a sixth E, extend, to foster anticipation, or an agentic component of forethought, into a model that was already designed to build on previous knowledge and facilitate significant learning.

Engaging the learner begins the debriefing process through the use of a worksheet to guide the initial emotional feelings that are immediately in mind as the scenario ends (Dreifuerst, 2015, p. 270). Questions regarding correct actions, incorrect actions, and what the learner would change next time facilitate the emotional release that can either bring about or limit learning. While engaging the learner is the beginning component of DML, the six E’s are iterative in nature as the grasping and transforming of experience through reflective observation and abstract conceptualization resulting in assimilative knowledge.

The debriefer can continue engaging learners through the use of active listening skills, inviting learners to participate, and exhibiting a spirit of inquiry and excitement regarding the learning experience to maintain attention.

Exploring options and *explaining* alternatives involves concept mapping and guiding the dialogue towards the focused key problem (Dreifuerst, 2015, pp. 272-273). Reflection-in-action and reflection-on action are facilitated by the debriefer guiding the learner to revisit in-the-moment decisions that were made and how alternative decisions might have impacted the experience. The debriefer seeks to connect thinking to action during these phases and uncover correct and incorrect thinking behind actions.

Elaborating on thinking and challenging assumptions facilitates higher order thinking and clinical reasoning designed to assist in thinking like a nurse (Dreifuerst, 2015, p. 273; Tanner, 2006b). Through guided reflection, the debriefer uncovers assumed relationships and facilitates metacognitive thinking by bringing awareness to the correct and incorrect thinking and actions through use of Socratic questioning.

Evaluating is encouraged as the debriefer guides reflection-on-action assisting in the re-framing of the experience to correctly construct the appropriate decisions and actions (Bradley, 2016; Dreifuerst, 2015, p. 274). As this abstract conceptualization is transformed through reflection, assimilation of experience develops providing a cognitive representation of how to understand a similar situation in the future.

Finally, through the process of *extending*, the debriefer broadens the previous encounter and guides reflection-beyond-action where anticipation and forethought to future experiences are discussed (Dreifuerst, 2015, p. 274). Through the use of 'what if' questions, the debriefer facilitates how to think through situations that may contrast from the previous one but share a comparable concepts. Anticipation helps learners adapt to new situations that share related traits, but require accommodation to guide thinking and actions in future events. Therefore, the *extend* concept in DML completes the experiential learning process by having learners test their knowledge in a new situation (Kolb, 2015), one that is "similar on the surface but difference in deep structure" (Forneris & Fey, 2016, p. 49), through asking students to "consider a parallel case in which the clinical frame is different" (Dreifuerst, 2015, p. 274). This supports the current assumption of the INACSL Standards of Best Practice: Simulation^{SM} Debriefing that the debrief completes the active experimentation phase for active participants and observers by helping learners apply knowledge to future and different clinical situations (INACSL Standards Committee, 2016a). This will be tested in this study.

In summation, DML is an appropriate method of debriefing to guide this study underpinned by observational experiential learning. DML facilitates aspects of social cognitive theory through and contributes to the underlying human agency that motivates learners to think like nurses and reflect in practice. This is accomplished through formulating future plans of action through guiding intention, as well as guiding self-reflection through reflection-in-action and reflection-on-action, as well as using forethought, or anticipation, with reflection-beyond-action. Further, through the iterative processes of DML experiential learning and meaningful learning in OEL is facilitated by creating tension between the grasping pole of abstract conceptualization and transforming pole of reflective observation, developing assimilated knowledge related to the previously observed or experienced concrete experience. In addition, DML extends learning to new situations facilitating active experimentation and accommodation. While the overt outcomes of DML may be seen through knowledge retention and application of knowledge, the underlying covert outcome is the development of clinical reasoning, or thinking like a nurse (Dreifuerst, 2015).

Nursing education research regarding the use of DML is limited. Research demonstrates that DML develops the ability to clinically reason, or think like a nurse, despite role (Dreifuerst, 2012; Forneris et al., 2015). Students enjoy DML because it involves learner-focused methods that connect right and wrong actions through reflection rather than performance critique (Cheng et al., 2014; Foronda et al., 2016; Mariani, Cantrell, Meakim, Prieto, & Dreifuerst, 2013). DML was also used in the NSS that determined that up to 50 percent of traditional patient care clinical experiences could be substituted with simulation (Hayden et al., 2014). As a result, DML is the most used structured debriefing method (Waznonis, 2015). DML was selected as the debriefing method for this study as it theoretically is supported to assist in the grasping and transforming of experience in future situations, where active participants and observers have an opportunity to demonstrate knowledge an immediate past concrete experience (assimilation) and apply knowledge based on previous experiences to a new parallel case extending knowledge to new situations (accommodation).

Summary

Nursing students may experience more time in observational roles than active participant roles in simulation (Hayden et al., 2014). Simulation is supported with experiential learning theory; yet, the literature has failed to demonstrate that observers are going through the same processes as those actively participating. Additionally, literature surrounding simulation is lacking research regarding observational learning theories and how learners in different roles grasp and transform knowledge in experiential learning. Little is known about the differences between observers and active participants and how the experience of the simulation scenario and specific debriefing methods inform knowledge retention.

Nursing education literature is devoid of evidence-based observational learning protocols that have resulted in significant learning experiences for observers when observing the experience alone. Also, the INACSL Standards of Best Practice: Simulation^{SM} incorporate minimal evidence for best practices for students in different roles, yet equate that all students are experientially learning with a lack of empirical testing to this assumption. For this reason, a new framework, Observational-Experiential Learning, is introduced. This framework incorporates the INACSL Standards of Best Practice and Debriefing to facilitate OEL to best grasp and transform experiences through observational and experiential learning, also providing testable knowledge outcomes including knowledge retention.

Ongoing evidence supports that debriefing is the most important component of simulation (Adamson & Rodgers, 2016; Bradley, 2016; Shinnick, Woo, & Mentes, 2011). The focus of debriefing is to reflectively observe, abstractly conceptualize, and begin to anticipate future action by actively experimenting with knowledge in a new situation. However, what remains to be explored is whether cognitive knowledge differs during, after, and over time between active participant and observer when actively experimenting with a parallel situation.

Since there are many unanswered questions regarding what observers and active participants retain from two similar simulations, this study explored the differences in cognitive knowledge demonstration, knowledge retention, and knowledge application to similar situations between active participant and observer roles. Knowledge demonstration was examined after the concrete experience (CE) of the scenario and again after debriefing with DML. A hypothetical parallel situation was presented at the end of DML and knowledge demonstration was examined to assess knowledge application (assimilation and accommodation) and test the active experimentation (AE) phase of OEL. After four weeks of time, knowledge retention was evaluated about the care of the patient presented through the actual simulation scenario (CE) and the parallel case (AE).

CHAPTER 3 METHODS

The purpose of this study was to explore the relationship between prelicensure, baccalaureate, nursing students' roles in simulation (active participant or observer) and cognitive knowledge demonstration and knowledge retention in simulation and debriefing with Debriefing for Meaningful Learning$^{©}$ (DML) (Dreifuerst, 2010). Participants in this study either observed or actively participated in a simulation about the care of a patient with respiratory distress related to opioid-induced respiratory depression. Following the simulation, both active participants and observers were assessed regarding the care of the patient with opioid-induced respiratory depression. Afterwards, debriefing with DML facilitated knowledge transformation and at the end of the structured process, all learners were presented with a different yet contextually similar patient situation involving respiratory distress (anaphylaxis). This second patient situation represents a parallel case which was used to examine how well knowledge was learned and applied (assimilated/accommodated) from one situation to another and to test the Observational Experiential Learning (OEL) framework facilitated through a simulation with DML debriefing. All learners were tested about the care of both patients to assess assimilation and accommodation after debriefing. Finally, all learners were tested four weeks later about the care of both patients again to assess knowledge retained. This chapter summarizes the methodology implemented in this study and is organized into seven sections: (a) study design, (b) setting, (c) selection of participants, (d) protection of human participants, (e) instrumentation, (f) procedures, (g) research questions and null hypotheses, (h) data analysis and (f) reliability and validity of the study.

Study Design

This study used an experimental, pretest-multiple posttest, repeated measures research design to explore the relationship between student role in simulation (active participant or observer), knowledge demonstration, and knowledge retention about the care of patients with two different types of respiratory distress. Knowledge was tested using two instruments designed for this study that included similar questions; however, the clinical presentation differed resulting in some questions having different answers. Scores on these knowledge instruments from pretest to the multiple posttests were compared between the types of treatment (active participant versus observer) over time.

All criteria of a basic experimental design including random assignment, manipulation of the independent variable, and control of the experiment were present in this study (Grove, Burns, & Gray, 2013; Shadish, Cook, & Campbell, 2002). The independent variable (student role in simulation) was manipulated by type of treatment, rather than through presence or absence of the intervention as commonly seen in a treatment-control study (Johnson & Christensen, 2017).

Setting

This study occurred at a multi-campus health sciences university school of nursing in the southwest region of the United States. Two sites were used including the major university campus and a regional campus approximately two hours away from the major university. All simulations occurred in a simulation center affiliated with the school of nursing. The simulation centers, despite location differences, operate under the same mission, vision, are designed to provide equivalent experiences despite location. This simulation center is accredited by the Society for Simulation in Healthcare.

Selection of Participants

Nursing students in an advanced adult health course using simulation as a form of clinical learning were the target population for this research study. This population was selected because they had prior experience with simulation, previous coursework in the care of patients with respiratory conditions, and current coursework regarding management of underlying causes of acute respiratory distress. A convenience sample of students in their third semester of a four-semester prelicensure, baccalaureate nursing program represented this population. These students were enrolled in theory and clinical courses designed to integrate components of complex and crisis care into simulation.

A priori, G-Power Analysis 3.1 (Faul, Erdfelder, Buchner, & Lang, 2009) was used for sample size estimation based on pilot study findings and recommendations by Cohen (1992) for both the repeated-measures analysis and an independent-samples t-test. A power analysis for F tests with repeated measures and a within-between interaction was ran with alpha = 0.05, power = 0.9, a medium effect size = 0.5 according to Cohen (1992) for four measurements with two groups projected a total sample size of N = 60. Also, for differences in means for independent-sample t-tests, a one-tailed test was selected based on the reviews of literature that simulation increases knowledge retention (Adamson & Rodgers, 2016; Cant & Cooper, 2009) and pilot study findings were directional indicating that simulation and debriefing, despite role, would not result in a decrease in knowledge from pretest. In the pilot study, the effect size was considered to be medium (0.47) using Cohen's (1992) criteria. With an alpha = 0.05 and power = 0.8, the projected sample size needed with this effect size is approximately N= 114 with 57 in each group for the between-group mean comparisons.

Following IRB approval, 121 students were invited to participate in this research study and 121 agreed to participate in the study. Two students were excluded because they were auditing the course resulting in 119 participants with *n* = 76 participants at the major university campus and *n* = 43 participants at the regional campus meeting the desired sample size.

The total participant sample (*n* = 119) was representative of the undergraduate population attending this Southwestern health sciences university baccalaureate program in nursing. The majority of the participants were female (84%; *n* = 100) with 16% as male (*n* = 19). The mean age of participants was 21.9 years (min-max=19-43 years). Sixty-nine percent of the participants self-reported as Caucasian (*n* = 82), 14% as Hispanic (*n* = 17), 7.6% as Asian/Pacific Islander (*n* = 9), 5.9% as African American (*n* = 7), and 3.4% reported their ethnicity as one other than the above (*n* = 4). A majority of participants reported no previous college degree (86.6%; *n* = 103). Additional demographics including healthcare experience and time in healthcare were also collected (Table 2).

The 119 participants were randomly assigned upon arrival to the simulation experience to either the active participant or observer role at their site resulting in *n* = 59 active participants (*n* = 38 at the major university campus and *n* = 21 at the regional campus) and *n* = 60 observers (*n* = 38 at the major university campus and 22 at the regional campus). The participants assigned to the active participant group (*n* = 59) consisted of 81% female (*n* = 48) and 19% male (*n* = 11) participants. They self-reported as 64% Caucasian (*n* = 38), 17% Hispanic (*n* = 10), 9% Asian/Pacific Islander (*n* = 5), 5% African American (*n* = 3), and 5% other (*n* = 3). The ages for this group of participants ranged from 19 to 43 with a mean of 22 (*SD* = 3.58) years old (Table 2).

The participants assigned to the role of observer (*n* = 60) were similar to the active participant group and consisted of 87% female (*n* = 52) and 13% male (*n* = 8) participants. They self-reported as 73% Caucasian (*n* = 44), 12% Hispanic (*n* = 7), 7% Asian/Pacific Islander (*n* = 4), 7% African American (*n* = 4), and 2% other (*n* = 1). The ages for this group ranged from 20 to 33 with a mean of 22 (*SD* = 2.41) years old (Table 2).

Table 2

Descriptive Statistics, Frequencies, and Percentages of Demographic Characteristics

Measure	**Active Participant (*n*=59)**	**Observer (*n*=60)**	**Total (*n* = 119)**
Age			
Mean *(SD)*	22.14 *(3.58)*	21.78 *(2.41)*	21.96 *(3.04)*
Gender*			
Female	48 (81.4%)	52 (86.7%)	100 (84%)
Male	11 (18.6%)	8 (13.3%)	19 (16%)
Race*			
African American	3 (5.1%)	4 (6.7%)	7 (5.9%)
Asian/Pacific Islander	5 (8.5%)	4 (6.7%)	9 (7.6%)
Caucasian	38 (64.4%)	44 (73.3%)	82 (68.9%)
Hispanic	10 (16.9%)	7 (11.7%)	17 (14.3%)
Other	3 (5.1%)	1 (1.7%)	4 (3.4%)
Highest Degree*			
High School/GED	49 (83.1%)	54 (90%)	103 (86.6%)
Associates Degree	2 (3.4%)	0 (0%)	2 (1.7%)
Bachelors Degree	8 (13.6%)	5 (8.3%)	13 (10.9%)
Masters Degree	0 (0%)	1 (1.7%)	1(0.8%)
Healthcare Experience*			
None	24 (40.7%)	23 (38.3%)	47 (39.5%)
Certified Nurse Aide	29 (49.2%)	29 (48.3%)	58 (48.7%)
EMT	1 (1.7%)	3 (5%)	4 (3.4%)
Other	5 (8.5%)	5 (8.3%)	10 (8.4%)
Time in Healthcare*			
None	24 (40.7%)	23 (38.3%)	47 (39.5%)
<1-year experience	22 (37.3%)	22 (36.7%)	44 (37%)
>1-year experience	13 (22%)	15 (25%)	28 (23.5%)

Note. *Format is *n* (%). EMT = Emergency Medical Technician

Protection of Human Participants

Protection of the human participants in this study followed Institutional Review Board policies and procedures for exempt research at both Indiana University and the study site; however, only the approval from Indiana University is attached to protect confidentiality for participants (Appendix B). Approval for the proposal was secured prior to the initiation of this study.

There were no anticipated adverse events for this study. Participant risk was minimal considering this study examined ungraded learning activities that were existing components of a course; however, there was potential loss of personal data. The demographic survey was important to describe the sample and examine similarities and differences between groups. The demographic survey was the only instrument not required in the course. All other instruments were completed as part of the course in the learning management system and linked to individual usernames. Upon completion of all activities and after final grades were entered, the course facilitator downloaded results into Microsoft Excel from the learning management system and assigned a unique number to each participant, recorded the student's role in simulation, and removed students meeting exclusion criteria. The data was then transferred to the Investigator. Therefore, the Investigator only received de-identified information after the completion of the learning activities.

Instrumentation

Demographic Survey

A demographic survey was administered in paper and pencil format to all participants on the day of simulation after role was assigned and learning activities were completed. The survey was coded and administered based on role in the simulation and study site. The survey consisted of gender, age, ethnicity, healthcare experience, highest degree earned, and auditing status for the course (Appendix C).

Knowledge Instruments

Pilot study 1. Two knowledge instruments were developed by the Investigator using multiple-choice questions to measure knowledge about the care of two different kinds of respiratory distress. Twenty-four questions were developed about the care of a patient experiencing respiratory distress due to opioid intoxication and administered to students pre and post simulation and debriefing of an opioid-induced respiratory distress scenario. Additionally, 24 questions were developed about the care of a patient experiencing respiratory distress due to anaphylaxis and administered to students pre and post simulation and debriefing of an anaphylaxis scenario. Considering the opioid-induced respiratory distress is the first scenario students were exposed to related to respiratory distress and to coincide with the study procedures, this instrument will be referred as the Concrete Experience (CE) instrument from this point forward. Further, the anaphylaxis case represents the parallel case that is contains similarities and differences to the previous simulation scenario, operationalizing the accommodative knowledge facilitated through the Active Experimentation phase in OEL and will be referred to as the Active Experimentation (AE) instrument from this point forward.

These instruments consisted of newly developed items written by the Investigator as well as items adapted from Assessment Technology Institute (ATI) Content Mastery Series (Assessment Technologies Institute LLC, 2016) and NCLEX-RN review material (Silvestri, 2014). Both instruments were developed to measure equivalent knowledge domains based on Bloom's

Taxonomy (Bloom, Englelhard, Furst, Hill, & Krathwohl, 1956; Krathwohl, 2002). Further, each question was coded with an NCLEX-RN Integrated Process to align with the NCLEX-RN 2016 Test Plan (National Council of State Boards of Nursing, 2015). Each of the two instruments was designed with equivalent knowledge domains and NCLEX-RN Integrated Processes to, yet again, operationalize similar cases with different underlying structure (Forneris & Fey, 2016) (Table 3).

Table 3

Pilot Study 1 CE and AE Instrument Taxonomies

Question	**Bloom's**	**Nursing Process**
1	Analysis	Assessment
2	Analysis	Plan
3	Knowledge	Assessment
4	Analysis	Plan
5	Analysis	Assessment
6	Evaluation	Evaluation
7	Comprehension	Teach/Learn
8	Analysis	Assessment
9	Analysis	Intervention
10	Analysis	Plan
11	Comprehension	Plan
12	Analysis	Assessment
13	Analysis	Assessment
14	Analysis	Plan
15	Knowledge	Assessment
16	Comprehension	Plan
17	Analysis	Assessment
18	Analysis	Evaluation
19	Knowledge	Teach/Learn
20	Analysis	Assessment
21	Analysis	Intervention
22	Analysis	Plan
23	Knowledge	Plan
24	Analysis	Assessment

During the pilot study, the 48 questions were piloted with N = 77 students in one semester and N = 90 students in the subsequent semester at the same site and in the same population of students. All questions were scored according Haladyna and Rodriguez's (2013, p. 350) item analysis criteria (Table 4).

Table 4

Item Analysis Criteria

Type	Difficulty	Discriminant	Comment
1	.60 to .90	>.15	Ideal item. Moderate difficulty and high discrimination
2	.60 to .90	< .15	Poor discrimination
3	Above .90	Disregard	High performance item; usually not very discriminating
4	< .60	> .15	Difficult but very discriminating
5	< .60	< .15	Difficult and non-discriminating
6	< .60	< .15	Identical to type 5 except one distractor has a pattern like type 1, which signifies a key error

A doctorally prepared nursing education researcher who also serves as an NCLEX-RN item writer established content validity of the items. Once the pilot tests were completed, item analysis procedures including the item difficulty (*p* value) and item discrimination were performed as a measure of norm-referenced validity (Waltz et al., 2017). Item difficulty was measured as a percentage of students getting the item correct on a particular test (McDonald, 2014; Waltz et al., 2017). Easier items resulted in higher *p* values; however, the item difficulty was limited to the participants in the pilot study and how and where the item was in the test administration (McDonald, 2014). The item discrimination was determined by calculating differences between the top and bottom percentages of students that correctly answered the question. The item discriminant is considered one of the best indicators of item quality and has a direct relationship with the reliability of test scores (McDonald, 2014).

Additionally, as a measure of criterion validity, the items were evaluated for instructional sensitivity through evaluation of the Pre-Post Discrimination Index (PPDI) and the Individual Gain Index (IGI). The PPDI assesses the instructional sensitivity (simulation and debriefing) providing support for the instructional intervention by calculating the proportion of students answering the item correctly on the posttest minus the proportion of students answering the item correctly on the pretest (Haladyna & Rodriguez, 2013; Waltz et al., 2017). The PPDI is measured on a -1.00 to 1.00 scale with higher numbers closer to 1.00 indicating the intervention resulted in a positive change in difference scores, demonstrating the validity of the intervention and the criterion-validity related to the content of the knowledge instrument. Further, the IGI determines the proportion of respondents who answered the item incorrectly on the pretest and correctly on the posttest (Waltz et al., 2017). The IGI is measured on a 0 to 1.00 scale. A high positive index is desirable indicating the item's discriminatory ability (Waltz et al., 2017).

The CE instrument demonstrated that 14 questions over both semesters were Type 1 (ideal questions) or Type 4 (difficult but discriminating questions) on the pretest with an improvement to a Type 3 (easy question) on the posttest or had positive PPDI and IGI scores indicating sensitivity to the scenario. Six questions were Type 3 (easy) questions on all administrations indicating the knowledge was previously mastered prior to the simulation. Four questions obtained Type 2 or Type 5 scores indicating a lack of discriminatory ability and a high level of difficulty. The AE instrument demonstrated that *n* = 17 questions over both semesters were Type 1, Type 4, on the pretest with an improvement to a Type 3 question on the posttest or had positive PPDI and IGI scores. Two questions were Type 3 (easy) questions indicating knowledge mastery prior to the simulation. Five questions obtained Type 2 or Type 5 scores.

To measure reliability, Küder-Richardson 20 (*KR 20*) tests were performed to assess the internal consistency of the knowledge instruments. The *KR 20* is a special case of Cronbach's alpha for dichotomous data and when item difficulty levels are not assumed to be the same (DeVellis, 2017; McDonald, 2014; Waltz et al., 2017). The closer the *KR 20* test is to 1.0, similar to Cronbach's alpha, the better the internal consistency. The pilot study instruments demonstrated low internal consistency. The CE instrument was found to have poor reliability (24 items; *KR 20* = .49) and the AE instrument was found to have poor reliability (24 items; *KR 20* = .31). Items impacting internal consistency negatively were considered for removal. Items with Type 2 and/or Type 5 scores were removed. Further, questions that had *p* > 95% on the pretest (Type 3) with low PPDI and/or IGI, indicating the item was easy, were also removed for future administrations of the knowledge instrument. Therefore, a total of 14 questions on the CE instrument and 17 questions on the AE instrument were considered to have acceptable difficulty and discriminatory levels with sensitivity to the simulation scenario.

Pilot study 2. Although using NCLEX-RN type questions is a common practice to evaluate knowledge outcomes, this method is critiqued as a passive method of knowledge assessment in an active learning environment (O'Donnell et al., 2014). Moreover, administering two different 24-question instruments multiple times in the research study was considered overwhelmingly burdensome, time consuming, and shifted the focus from active learning and simulation to one that mimicked traditional passive testing. Therefore, the knowledge instruments were shortened and adapted to closely align with knowledge gained by the scenario demonstrated in Pilot Study 1. Two 11-question instruments were developed to measure knowledge about the care of patients with different kinds of respiratory distress.

The two knowledge instruments were informed by and adapted from the acceptable questions from the CE instrument (14 items) and AE instrument (17 items) in Pilot Study 1 to further operationalize the constructs of the concrete experience and active experimentation of OEL, thereby facilitating assimilation and accommodation. The questions used in the adapted instruments were determined according to a variety of strategies including the previously mentioned item difficulty, item discrimination, Haladyna and Rodriguez’s (2013) item analysis criteria, and the PPDI and IGI indices. Similar to Pilot Study 1, one instrument was designed to assess knowledge related to the opioid-induced respiratory distress, concrete experience (CE), scenario. The other instrument was designed to assess knowledge related to the anaphylaxis, active experimentation (AE), scenario.

Both modified CE and AE instruments were changed to 1) provide a brief overview of the patient's status while the student was completing the assessment, 2) have nearly identical questions with minimal differences in question stems, and 3) have identical multiple-choice options. This provided an ability to further operationalize the OEL concepts of assimilation and accommodation by having similar questions for two different scenarios that may or may not have different answers (Table 5).

Table 5

Similarity of Two Instruments

Modified CE Instrument	**Modified AE Instrument**
Which of the following medications should the nurse prepare to administer?	**Which of the following medications should the nurse prepare to administer?**
a. Naloxone—CORRECT b. Flumazenil c. Dantrolene d. Epinephrine	a. Naloxone b. Flumazenil c. Dantrolene d. Epinephrine—CORRECT

The CE instrument was prefaced with previously provided prebrief information about a client experiencing opioid-induced respiratory distress, the scenario actively participated in or observed by students. The AE instrument was prefaced with information about a client beginning to experience anaphylaxis to coincide with the parallel situation presented in the reflection-beyond-action phase of DML (Table 6).

Table 6

Pilot Study 2 CE and AE Instrument Taxonomies

	Modified CE and AE Instruments	
Question	**Bloom's Taxonomy**	**Nursing Process**
1	Evaluation	Assessment
2	Analysis	Assessment
3	Comprehension	Plan
4	Analysis	Plan
5	Knowledge	Assessment
6	Analysis	Plan
7	Analysis	Plan
8	Analysis	Plan
9	Analysis	Intervention
10	Comprehension	Assessment
11	Evaluation	Evaluation

These two modified instruments were pilot tested at the same study site with 135 students in the desired population of students in a subsequent semester. Similar to Pilot Study 1, a PhD prepared nursing education researcher and NCLEX-RN item writer established content validity. Norm-referenced and criterion-referenced validity were examined again based on Haladyna and Rodriguez (2013) (Table 4) and Waltz et al. (2017). To measure reliability, *KR 20* tests were performed to assess the internal consistency of the knowledge instruments. The modified CE instrument was found to have poor reliability (11 items; *KR 20* = .14) and the modified AE instrument also was found to have poor reliability (11 items; *KR 20* = .26). Despite using well-discriminating items, the reliability of both instruments decreased from Pilot Study 1.

Factors known to affect reliability coefficients include item quality, item difficulty, item discrimination, test length, homogeneity of content, homogeneity of the test group, sample size, speed, and test design (McDonald, 2014). Thus, longer tests and better discriminating items will result in improved internal consistency reliability coefficients (McDonald, 2014). Considering the knowledge instruments used in this study were each 11 questions and represented different knowledge domains, difficulty, and different levels of the nursing process, the *KR 20* was anticipated to be poor. The length is short by design and although the items are validated to represent respiratory distress, the homogeneity of the content is questionable due to the different knowledge domains.

Frisbie (1988) discussed that a teacher-made test averages around a 0.50 internal consistency coefficient. Additionally, McGahee and Ball (2009) asserted that nursing exams are acceptable at a 0.50 reliability coefficient due to the multiple topics and concepts covered within an exam. However, exams are typically much longer than 11 questions. Haladyna (2016) further stated:

> Given that the test is long enough, the test items have desirable difficulty and high discrimination, the sample of examinees is diverse and representative of the population, and the construct is *unidimensional*, then alpha should be very high. If alpha is not high, . . . question if construct-irrelevant factors influenced alpha or [consider] multidimensionality (p. 393, emphasis added).

Therefore, the *KR* 20 was calculated, but it was anticipated a priori to be at or below what is commonly considered acceptable (0.50) considering the final CE and AE knowledge instruments used in the study will be brief to keep the focus on active learning in simulation.

The calculation of a PPDI and IGI with the low internal consistency demonstrated in the both pilot study analyses brought to the forefront a dilemma between validity and reliability. A trade-off may occur between validity and reliability based on all previous factors above. For example, a high performance (Type 3), or easy (*p* value >0.9) item impacted the reliability coefficient negatively (Haladyna, 2016; McDonald, 2014). However, if 10% of students answered the item incorrectly on the pretest but then correctly on the posttest, it indicated validity to the intervention. This example results in a high PPDI and IGI demonstrating instructional sensitivity and criterion-related validity; however, negatively impacts the reliability coefficient. This dilemma was apparent in both pilot studies. Additionally, due to the knowledge instruments measuring different domains of the nursing process including assessment, planning, intervention, and evaluation, the unidimensionality of the knowledge instruments remain suspect, potentially impacting the reliability.

Therefore, no single statistic was used to determine validity and reliability of the knowledge instruments (McDonald, 2014) as numerous limitations were identified. The administration of short NCLEX-style knowledge tests is common practice in simulation and the results of these pilot studies confirm that due to the brevity and potential multi-dimensionality of the instruments, the reliability analysis may be poor. By administering a pretest, a posttest after the simulation scenario, a posttest after the debrief, and a posttest four weeks later in addition to controlling the delivery of the simulation and debrief to minimize treatment variability, the analysis can help discern if the knowledge outcomes were directly attributable to the simulation (O'Donnell et al., 2014).

As a result, two Type 4 (difficult and discriminating) questions were retained for the final knowledge instruments in this study. These were select-all-that-apply questions that are commonly agreed to be difficult. One Type 3 (easy) question was retained because it assessed knowledge critical to a positive patient outcome in the scenario and had a positive, yet small, PPDI and IGI. One Type 2 (difficult and non-discriminating) question was retained due to the item difficulty (*p* = .13) as it was only deficient by 0.02 points to increase to a Type 1 (ideal) question. One question was removed due to a negative PPDI and IGI score indicating more students answered correctly on the pretest than the posttest. It was determined this question had contradictory information in another resource provided for students. All six other questions were scored as a Type 1 (ideal) question and had mild to moderate positive PPDI and IGI scores. Therefore, a total of 10 questions met criteria for valid questions that were used in the final study to answer the research questions.

Final knowledge instruments. The final CE and AE instruments used in this study were 10 question multiple-choice assessments. Each question was scored with 10 points for a correct answer; therefore, the instrument had a minimum score of zero and a maximum score of 100. Tests and quizzes at this university commonly use a 0-100 scale on all NCLEX-RN style assessments. Changes to the questions from Pilot Study 2 were minor including changing “The client” to the actual name in the simulation scenario to align with the prebrief for the scenario and the parallel situation in the reflection-beyond-action phase. The knowledge instrument's domain and taxonomy alignments are provided in Table 7 and the complete instruments are in Appendix D and Appendix E.

Table 7

Final CE and AE Instrument Taxonomies

	Final CE and AE Instruments	
Question	**Bloom's Taxonomy**	**Nursing Process**
1	Evaluation	Assessment
2	Analysis	Assessment
3	Comprehension	Plan
4	Knowledge	Assessment
5	Analysis	Plan
6	Analysis	Plan
7	Analysis	Plan
8	Analysis	Intervention
9	Comprehension	Assessment
10	Evaluation	Evaluation

Study Procedure

Potential study participants were informed of the research study using a process approved by the Institutional Review Board. The information they received included a Study Information Sheet informing them of their eligibility to participate in the voluntary study (Appendix F). In the event of a declination, students participated in the course activities but data was not transferred to the Investigator. No students declined participation in this study, however, as previously mentioned, two did not meet inclusion criteria.

Participants on the course roster were identified with their study site. Based on the course roster convenience sample by site, participants were randomly assigned to small groups for simulation experience by the facilitator of the course. This is a common practice in simulation. Simulation small group size was capped at a maximum of 6 participants (3 active participants and 3 observers). This resulted in 13 groups in the major university campus and 7 groups in the regional campus. After random groups were assigned, a schedule with the randomly assigned simulation groups was posted in the learning management system by the course facilitator. All simulations were conducted within 5 business days.

All study participants received preparatory assignments one week prior to the simulation per the course syllabus as a standard in the course. These assignments provided the participants with the objectives of the scenario, the patient's story, as well as medications, laboratory values, and diagnostic procedures that would be necessary for successful completion for the scenario.

The simulation centers at both sites are part of the same academic institution. All simulations occurred with a high-fidelity simulator in rooms set up identically at each site. A high-fidelity simulator was selected due to the potential respiratory failure that occurs in this scenario requiring basic life support measures for respiratory arrest. Upon arrival to the simulation center, all participants completed the Concrete Experience (CE) pretest instrument in electronic format approximately 10 minutes via the online learning management system. Once all participants completed the CE Pretest, the Investigator randomly assigned participants to their role for the simulation by asking study participants to draw slips of paper designating the role for the simulation. This is a common practice in simulation. Participants were either assigned to the role of an active participant or observer in the simulation. The facilitator recorded the participant’s role in simulation for inclusion in data transmission.

All participants were prebriefed according to the objectives of the scenario as well as the current state of the patient for the scenario beginning point. Participants in the observer role were asked not to talk to one another during the scenario and were proctored by course faculty. Observers viewed the simulation from an audio-visual room in a different location from the active participants, consistent with literature supporting experiences in the observer role (O'Regan et al., 2016). One group of observers (*n* = 3) experienced audio difficulties and observed from the control room, which is also a technique for observation supported by the literature (O'Regan et al., 2016). The scenario was timed to unfold over 15 minutes. When the simulation was complete, active participants returned to the audio-visual room with observers where both groups completed the CE Posttest 1 in electronic format requiring about 10 minutes.

After all participants completed CE Posttest 1, the Investigator facilitated the DML debriefing method. All debriefing sessions began with a discussion of psychological safety and attempted to engage the attention of all participants, both the active participant and observer. Debriefing sessions ranged from 40 to 50 minutes and were conducted similarly each time following the iterative, structured process of DML. In the final phase of debriefing with DML, participants were asked to apply the learning from the previous experience to a parallel case involving the care for a young child who is stung by a bee and begins to cough and wheeze. In this hypothetical situation of anaphylaxis, students were guided through the reflection-beyond-action phase where the care is similar in some aspects, but different in others. This phase operationalizes the debriefing assumption that care can be contextualized and transferred to different clinical situations (INACSL Standards Committee, 2016a). When DML was completed, students took the exact same posttest again (CE Posttest 2) in addition the Active Experimentation (AE) instrument (AE Posttest 1). Demographic surveys were administered prior to students leaving the simulation. Four weeks after the simulation experience, students completed the same posttests, CE Posttest 3 and AE Posttest 2, a final time to assess knowledge retention. The four-week time period coincided with the student schedule (see Figure 3 for a schematic of the study design). This concluded the study procedure and data collection time points.

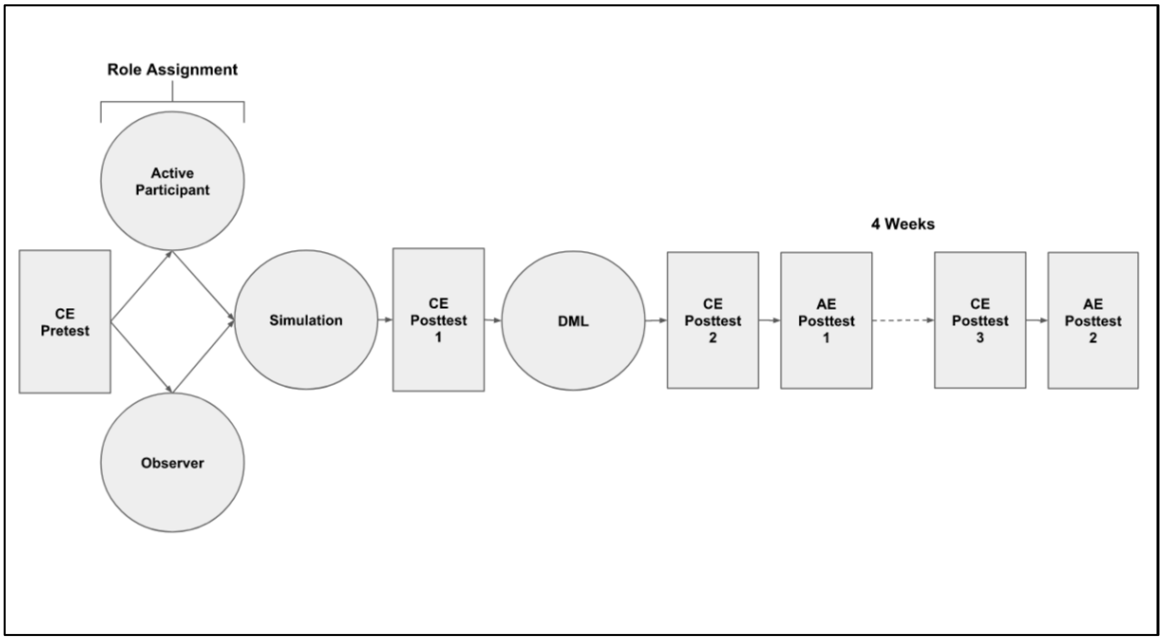


Figure 3. Study Schematic.

After data was collected, analyses were performed to ensure the participants in each group and campus were similar enough to be combined into one sample. This was examined in several ways. First, the sampling method was examined through the chi-square test of homogeneity to discern if there were any statistically significant differences between the proportions of participants assigned to active participant (n = 59) and observer roles (n = 60) through randomization. The difference between the two groups was not statistically significant (χ^2 = .008, p = .927) and therefore resulted in a failure to reject the null hypothesis that the difference between the population proportion in active participant and observer roles is zero. Thus, the sampling method resulted in equal proportions assigned to each role between the two sites. Moreover, all of the demographics in the sample were represented in both treatment groups with the exception of highest degree (Table 2).

Participants from both sites were admitted at the same time, in the same way, to the same school of nursing regardless of the campus they attended. Furthermore, they attended the same classes that were taught by the same faculty using synchronous distance-education teaching strategies and they were exposed to the same exams and simulations throughout the curriculum. Additional statistical analyses to determine normality and homogeneity were used to support that both sites could be combined into one sample and to assess the distribution of scores to determine appropriate statistical measures to be used to answer the research questions.

The CE Pretest instrument was examined to discern normality and homogeneity at baseline between active participant and observer. Pretest scores were assessed for normality using criteria established by Tabachnick and Fidell (2013) and Field (2013) requiring examination of the Kolmogorov-Smirnov test, the Shapiro-Wilk test, histograms, Normal Q-Q plots, and skewness and kurtosis. Pretest scores were not normally distributed as assessed by the Kolmogorov-Smirnov test ($p < .05$) and Shapiro-Wilk's test ($p < .05$); however, upon visual examination of the histograms and Normal Q-Q plots, the scores were normally distributed. Skewness and kurtosis were then examined for z scores less than -2.58 or greater than 2.58 indicating normality. The pretest scores were normally distributed for the total sample with a skewness of -0.260 (SE = 0.222) and kurtosis of -0.450 (SE = 0.440). The pretest scores were also normally distributed for participants in the active participant role with a skewness of -0.220 (SE = 0.311) and kurtosis of -0.461 (SE = 0.613) and for participants in the observer role with a skewness of -0.240 (SE = 0.309) and kurtosis of -0.498 (SE = 0.608). All z scores were between –2.58 and 2.58 indicating normality of the distributions. Large sample sizes greater than the central limit theorem are known to result in a significant Kolmogorov-Smirnov test and Shapiro-Wilk test, and therefore, visual inspection of histograms and the Normal Q-Q plots as well examination of skewness and kurtosis are appropriate to determine normality (Field, 2013). Therefore, due to these analyses, the sample was considered normally distributed.

The Levene's statistic for homogeneity was examined through Analysis of Variance (ANOVA) with both site and role included in the analysis. A significant Levene's statistic ($p = .039$) showed no homogeneity of variance. Therefore, separate ANOVAs were initiated to test for interactions that may have impacted the variance and contributed to the significant Levene's statistic. When using Levene's test for site and role in separate ANOVAs, evidence was found for homogeneity of variance ($p > .05$).

Furthermore, it should be noted that parametric *F* tests, t-tests, and ANOVA are robust to mild deviations in normality and homogeneity when sample size increases above that of the central limit theorem, when normality is not grossly violated, and when sample sizes are equal (Field, 2013). Therefore, the decision to combine both sites into one sample was confirmed for the independent-samples t-test.

Research Questions and Null Hypotheses

The aims of this study were to explore the relationship between student role and cognitive knowledge demonstration and knowledge retention in simulation and debriefing. This study focused on two research questions:

1. Is there a difference in knowledge demonstrated and knowledge retained by nursing students in active participant versus observer roles after a simulation about the care of a patient with respiratory distress (opioid-induced respiratory depression) at baseline, before and after debriefing with DML, and four weeks later?

Associated null hypotheses listed:

   a. H_1a: There is no difference in knowledge demonstrated by nursing students in active participant versus observer roles after a simulation about the care of a patient with respiratory distress (opioid-induced respiratory depression) at baseline.
   b. H_1b: There is no difference in knowledge demonstrated by nursing students in active participant versus observer roles after a simulation about the care of a patient with respiratory distress (opioid-induced respiratory depression) before debriefing with DML.
   c. H_1c: There is no difference in knowledge demonstrated by nursing students in active participant versus observer roles after a simulation about the care of a patient with respiratory distress (opioid-induced respiratory depression) after debriefing with DML.
   d. H_1d: There is no difference in knowledge retained by nursing students in active participant versus observer roles after a simulation about the care of a patient with respiratory distress (opioid-induced respiratory depression) four weeks after the simulation.

2. Is there a difference in knowledge demonstrated and knowledge retained by nursing students in active participant versus observer roles when applied (assimilated/accommodated) to a parallel case about a

patient with a different kind of respiratory distress (anaphylaxis) after DML and 4 weeks later?

Associated null hypotheses listed:

a. H_2a: There is no difference in knowledge demonstrated by nursing students in active participant versus observer roles when applied (assimilated/accommodated) to a parallel case with a different kind of respiratory distress (anaphylaxis) after DML.
b. H_2b: There is no difference in knowledge retained by nursing students in active participant versus observer roles when applied (assimilated/accommodated) to a parallel case with a different kind of respiratory distress (anaphylaxis) four weeks after the simulation.

Data Analysis

Using SPSS version 24, parametric tests were used to analyze the scores on the CE pretest and posttests and AE posttest instruments in this study. The first question, “Is there a difference in knowledge demonstrated and knowledge retained by nursing students in active participant versus observer roles after a simulation about the care of a patient with respiratory distress (opioid-induced respiratory depression) at baseline, before and after debriefing with DML, and four weeks later?” was tested with a mixed repeated measures-analysis of variance (RM-ANOVA) on the mean scores from the four administrations of the CE instrument.

The second question, “Is there a difference in knowledge demonstrated and knowledge retained by nursing students in active participant versus observer roles related to a parallel case about a patient with a different kind of respiratory distress (anaphylaxis) after DML and four weeks later?” was tested with an independent-samples t-test on the mean scores from each administration of the AE instrument. The data analysis and statistical tests used to address each of the research questions are summarized in Table 8. The findings of those analyses are described in Chapter IV.

Table 8

Relationship between Research Questions, Instruments, and Analysis

Research Question	Null Hypotheses	Instrument	Variables	Method
1. Is there a difference in knowledge demonstrated and retained by nursing students in active participant versus observer roles after a simulation about the care of a patient with respiratory distress (opioid-induced respiratory depression) at baseline, before and after debriefing with DML, and four weeks later?	H_1a H_1b H_1c H_1d	CE Instrument	Knowledge mean scores Student role	Mixed Repeated Measures Analysis of Variance (RM-ANOVA)
2. Is there a difference in knowledge demonstrated and knowledge retained by nursing students in active participant versus observer roles when applied (assimilated/accommodated) to a parallel case about a patient with a different kind of respiratory distress (anaphylaxis) after DML and 4 weeks later?	H_2a H_2b	AE Instrument	Knowledge mean scores Student role	Independent sample *t*-tests

Establishing Validity and Reliability of the Study

This experimental study required optimal control to reduce the risk of confounding variables. Based on observations during the pilot studies, the following methods were used to establish treatment fidelity indicating validity and reliability of the study procedures.

Simulation Scenario—The Concrete/Grasped Experience

The simulation scenario used in this study involved a female patient experiencing opioid-induced respiratory depression after a total abdominal hysterectomy. The patient becomes lethargic with a low respiratory rate after morphine administration and if the antidote is not administered quickly, the patient experiences respiratory failure. The scenario is a National League for Nursing scenario retrieved from the Laerdal© SimStore library (National League for Nursing, 2018). Content validity was established by the developer for this scenario and a list of the reviewers are provided in the scenario documents. Additionally, course faculty at the study site further established content validity by determining that the simulation was designed to examine knowledge for a patient experiencing respiratory distress.

The Investigator conducted a pilot study using this scenario with different faculty facilitating the scenario for participants. This revealed differences in scenario facilitation that could be considered a confounding variable. For this reason, during this research study, the Investigator facilitated all simulation experiences to establish that all concrete experiences were replicated similarly. The Investigator is currently a Certified Healthcare Simulation Educator through the Society of Simulation in Healthcare (SSH) and facilitated all simulations based on the INACSL Standards of Best Practice: Simulation^{SM} (INACSL Standards Committee, 2016b, 2016c) for treatment fidelity.

Debriefing for Meaningful Learning©—Transforming the Experience

Debriefing is considered the most significant component of simulation and where learning occurs (Adamson & Rodgers, 2016). The studies comparing student roles demonstrated that when debriefing is part of simulation there are positive increases in outcomes despite role (Kaplan et al., 2012; Rode et al., 2016; Scherer et al., 2016; Thidemann & Soderhamn, 2013). Based on these findings, while debriefing is a standard in simulation (INACSL Standards Committee, 2016a, 2016b), for the purposes of this study, it was important to establish whether it would confound the results when attempting to isolate the knowledge demonstrated and retained between active participant and observer. Although the assumption is that debriefing is where learning occurs for the observer and active participant, research has yet to demonstrate if a different frame of reference (egocentric vs. exocentric) (Dede, 2009a) results in a difference in knowledge demonstration and retention or if debriefing is primarily responsible for the positive change regardless of role in simulation in nursing education.

While DML is part of the theoretical model, it is also considered a control in this study. The pilot study demonstrated stark contrasts in debriefing methods among facilitators therefore confounding the data and outcomes. In the pilot study, Plus-Delta was the most common debriefing method used. DML is fundamentally different than the Plus-Delta. Plus-Delta debriefing has a focus on the positive actions and actions needing change and is commonly used in aviation and interdisciplinary simulation because it is quick and does not require a facilitator (Dreifuerst & Decker, 2012).

Conversely, DML is a consistently structured process that is theoretically derived and evidence based to foster experiential learning, significant learning, and meaningful learning (Dreifuerst & Decker, 2012). Additionally, it is theoretically supported to facilitate OEL. DML uses reflection-in-action, reflection-on-action, and reflection-beyond-action to teach nursing students to think like a nurse (Dreifuerst, 2009; Dreifuerst & Decker, 2012; Schön, 1983; Tanner, 2006b). This method necessitates a clinical teacher as facilitator, with knowledge about the patient, to challenge taken-for-granted assumptions by using Socratic questioning to examine student actions and the thinking accompanying the action in simulation and clinical situations (Dreifuerst, 2015; Dreifuerst & Decker, 2012).

Thus, the Investigator conducted all debriefings in this study using DML as an additional measure of treatment fidelity. In the reflection-beyond-action phase of DML, learners were guided to actively experiment with a parallel clinical situation with ‘what if’ Socratic questioning to facilitate anticipation through reflection (Dreifuerst, 2009, 2015). For the purposes of this study and to maintain consistency, the parallel situation presented to all learners was about a patient experiencing respiratory distress due to anaphylaxis. Anaphylaxis results in respiratory distress, however, it has a different clinical presentation, antidote, and underlying pathophysiological structure than opioid-induced respiratory distress. This operationalized the final phase of Kolb’s Experiential Learning Theory (KELT), active experimentation, or testing the knowledge of the concrete experience in a new situation that “presents similar on the surface but different in deep structure” (Forneris & Fey, 2016, p. 249; Kolb, 2015).

The current assumption of debriefing according to the INACSL Standards of Best Practice: Simulation^{SM} Debriefing (INACSL Standards Committee, 2016a), is that the debriefer helps learners conceptualize how knowledge is applied from one clinical situation to one in the future; a component of the DML method. This study examined whether the debriefing facilitates all stages of KELT for the learner, despite role. The Investigator received formal training from the developer of DML, Dr. Kristina Thomas Dreifuerst PhD, RN, CNE, ANEF.

Summary

This chapter restated the purpose of this research and presented the research questions and study design. The sample of 119 students in the selected population was discussed. The study procedure including the analysis for combining both sites into one sample and an overview of the simulation scenario and debriefing facilitation in this study were provided. Each of the instruments used in this study was described including pilot data that informed the development of the two knowledge instruments. Finally, the justification for the planned statistical approaches based on an analysis of sample normality and homogeneity was presented. Results and implications for the research questions are presented in the following chapter.

CHAPTER 4 RESULTS

This study investigated the differences in knowledge demonstration and knowledge retention for students in both the active participant role and observer role in a simulation and a parallel case presented by the Debriefing for Meaningful Learning© debriefing method. By examining knowledge demonstrated and retained from both the concrete experience and alternative parallel case, the assumptions of debriefing and operationalized Observational-Experiential Learning (OEL) concepts were explored. This chapter describes the results from this study and addresses each of the two research questions.

Descriptive Statistics

The Concrete Experience (CE) instrument was used to measure the knowledge demonstrated and the knowledge retained after the participants either actively participated in or observed in the simulation. The CE instrument was administered as a pretest before the simulation experience, once immediately after the scenario (CE Posttest 1), immediately after DML (CE Posttest 2), and four weeks later (CE Posttest 3) for a total of four administrations. One hundred nineteen participants took the pretest and 119 participants completed all 3 posttests. The pretest data for the total sample (*N* = 119, *M* = 64.8, *SD* = 13.3) depicts the baseline knowledge for all participants and is comprised of the scores of the group of students in the active participant role (*N* = 59, *M* = 65.9, *SD* = 12.5) and in the observer role (*N* = 60, *M* = 63.7, *SD* = 14.1). The CE Posttest 1 data for the total sample (*N* = 119, *M* = 75, *SD* = 12.7) depicts the scores after actively participating or observing in the simulation experience and is comprised of scores of the group of students in the active participant role (*N* = 59, *M* = 74.4, *SD* = 11.8) and in the observer role (*N* = 60, *M* = 75.7, *SD* = 13.7). The CE Posttest 2 data for the total sample (*N* = 119, *M* = 85.7, *SD* = 12) depicts the scores after all participants were debriefed with DML and is comprised of scores of the group of participants in the active participant role (*N* = 59, *M* = 86.1, *SD* = 10.7) and in the observer role (*N* = 60, *M* = 85.3, *SD* = 13.3). Finally, the CE Posttest 3 data for the total sample (*N* = 119, *M* = 72.2, *SD* = 13.2) depicts knowledge retention and is comprised of scores of the group of students in the active participant role (*N* = 59, *M* = 73.1, *SD* = 12.4) and in the observer role (*N* = 60, *M* = 71.3, *SD* = 13.9). Table 9 reports the mean percentages and standard deviations for each administration of the CE instrument.

Table 9

CE Instrument Descriptive Statistics

Element	**Active Participant (*N* = 59)**	**Observer (*N* = 60)**	**Total (*N* = 119)**
CE Pretest			
M (*SD*)	65.9 (*12.5*)	63.7 (*14.1*)	64.8 (*13.3*)
Minimum	40	30	30
Maximum	90	90	90
CE Posttest 1			
M (*SD*)	74.4 (*11.8*)	75.7 (*13.7*)	75 (*12.7*)
Minimum	40	40	40
Maximum	100	100	100
CE Posttest 2			
M (*SD*)	86.1 (*10.7*)	85.3 (*13.3*)	85.7 (*12*)
Minimum	50	50	50
Maximum	100	100	100
CE Posttest 3			
M (*SD*)	73.1 (*12.4*)	71.3 (*13.9*)	72.2 (*13.2*)
Minimum	40	30	30
Maximum	100	100	100

The Active Experimentation (AE) knowledge instrument was used to measure the knowledge demonstrated and the knowledge retained based on the parallel case that is presented in the reflection-beyond-action phase of DML. This instrument was designed to operationalize the assumption that debriefing facilitates knowledge applied to a contextually similar situation with different underlying pathophysiological structure, thereby representing the Active Experimentation phase of OEL and Kolb's Experiential Learning Theory (KELT) where knowledge is tested in a new situation (Dreifuerst, 2012; Forneris & Fey, 2016; INACSL Standards Committee, 2016a; Kolb, 2015).

AE Posttest 1 was administered directly after the DML debriefing of the simulation immediately after CE Posttest 2. The AE Posttest 1 data for the total sample (*N* = 119, *M* = 86.9, *SD* = 11.5) depicts the scores after participants were debriefed with DML and is comprised of scores of the group of participants in the active participant role (*N* = 59, *M* = 86.1, *SD* = 12) and in the observer role (*N* = 60, *M* = 87.7, *SD* = 10.9).

AE Posttest 2 was administered four weeks after the simulation experience directly after CE Posttest 3. The AE Posttest 2 data for the total sample (*N* = 119, *M* = 71.4, *SD* = 15.4) depicts knowledge retention and is comprised of scores of the group of students in the active participant role (*N* = 59, *M* = 70.3, *SD* = 13.9) and in the observer role (*N* = 60, *M* = 72.5, *SD* = 16.8). Table 10 reports the mean percentages and standard deviations for each administration of the AE instrument.

Table 10

AE Instrument Descriptive Statistics

Element	**Active Participant (*N* = 59)**	**Observer (*N* = 60)**	**Total (*N* = 119)**
AE Posttest 1			
M (*SD)*	86.1 (*12*)	87.7 (*10.9*)	86.9 (*11.5*)
Minimum	60	60	60
Maximum	100	100	100
AE Posttest 2			
M (*SD)*	70.3 (*13.9*)	72.5 (*16.8*)	71.4 (*15.4*)
Minimum	20	40	20
Maximum	100	100	100

Validity and Reliability of Final CE and AE Instruments

Validity

The final instruments were examined a last time for content validity by a PhD prepared NCLEX-RN item writer as well as course faculty. Using item response criteria by Haladyna and Rodriguez (2013) (Table 4), the CE pretest scores demonstrated that 60% (*n* = 6) were ideal Type 1 questions (moderate difficulty and ideal discrimination); 30% (*n* = 3) were Type 4 questions (very difficult questions but highly discriminating); and 10% (*n* = 1) was a Type 3 question (90% or greater answered correctly). There were no Type 2 or Type 5 questions, which are the least desirable due to the level of difficulty and inability to discriminate. Table 11 provides the item difficulty level for the total sample

Table 11

Item Difficulty for Knowledge Instruments

Question	CE Pretest	CE Posttest 1	CE Posttest 2	CE Posttest 3	AE Posttest 1	AE Posttest 2
1	12%	43%	73%	17%	81%	65%
2	71%	91%	95%	83%	96%	83%
3	97%	100%	100%	100%	100%	100%
4	57%	63%	94%	84%	93%	84%
5	68%	73%	83%	73%	91%	84%
6	57%	93%	94%	62%	92%	66%
7	76%	80%	87%	89%	82%	56%
8	78%	89%	89%	84%	81%	42%
9	66%	70%	88%	77%	88%	78%
10	61%	44%	50%	50%	61%	52%

N = 119

The CE Posttest 1 after the scenario demonstrated improvement except for item 10 which showed a smaller percentage of the entire group getting the question correct as opposed to the pretest. This may indicate the intervention confused the participants. Again, all questions scored as Type 1, 3, and 4 with no Type 2 or 5 questions. The CE Posttest 2 after debriefing demonstrated the best analysis and discriminants. Item 10 improved from the CE Posttest 1 after the scenario; however, did not return to baseline indicating that the question needs to be examined for clarity, perhaps through asking students about the item itself. Item 10 from CE Pretest to CE Posttest 1 to CE Posttest 2 demonstrated an increase in the upper and lower percentages of students answering the question correctly. However, it appeared that students in between the upper and lower percentages were confused. Again, all questions were scored as Type 1, 3, and 4 questions indicating there were primarily ideal, easy, or well discriminating and difficult questions as should be expected as the intervention of simulation and debriefing unfolded (Appendix G).

The CE Posttest 3 was administered four weeks after the simulation showed a stark drop in item performance regarding difficulty and discriminants. The questions still scored as Type 1, 3, and 4; however, by item analysis examination alone, performance decreased. At no point were there more than four Type 3 (easy) questions on any iteration of the CE instrument. Four Type 3 questions were demonstrated after debrief which is supported to be where the most learning occurs based on the previous literature review (Appendix G).

The AE Posttest 1 was first administered after the participants were debriefed with DML and guided through the reflection-beyond-action case for anaphylaxis. The AE instrument item analysis was significant because 100% of the upper percentage of students answered all items correctly; however, the lower percentage of students did not perform as well resulting in five Type 1 questions and five Type 3 questions. The AE Posttest 2 was administered after four weeks and showed knowledge decay in item performance as the whole. Similarly to the CE instrument, there were no Type 2 or Type 5 items indicating poor discrimination or difficulty (Appendix H).

As a measure of criterion validity, the PPDI and IGI were calculated to report sensitivity of the intervention. Because all students were exposed to the scenario and debriefing, the PPDI and IGI were calculated based on CE Pretest and CE Posttest 2 after debrief scores to demonstrate that CE instrument used to measure knowledge was sensitive to the simulation and debriefing (Table 12).

Only one question (Item 10) needed further review for reasons previously discussed. All other items have positive PPDI scores indicating sensitivity of the instrument to the intervention. All items have positive IGI scores indicating there was a positive proportion of students who answered the question incorrectly on the CE Pretest and correctly on the CE Posttest 2 after debriefing. Therefore, while there are limitations around assessments with only 10 questions, the above information provides substantial information that the instrument is valid for this simulation but may need face validity for one item (Question 10).

Table 12

Instructional Sensitivity from CE Pretest to CE Posttest 2

Question	PPDI	IGI
1	.61	.60
2	.24	.26
3	.03	.03
4	.37	.38
5	.15	.18
6	.37	.39
7	.11	.16
8	.11	.16
9	.22	.25
10	-.11	.11

Reliability

As expected from the limitations previously discussed in the pilot study, Küder-Richardson 20 (*KR 20*) tests for internal consistency reliability were performed and were poor across all administrations of the CE and AE tests (Table 13). It is highly suspected that this is due to the brevity and threat to unidimensionality of the knowledge instruments. These 10 question instruments were developed and piloted to assess knowledge gained by the simulation. The simulation involves all elements of the nursing process including assessment, planning, intervention, and evaluation and therefore tests multiple domains of knowledge. Therefore, while the *KR 20* tests of internal consistency were poor, increasing the length of the instruments would distract from the desired outcome of simulation: active learning.

Table 13

Internal Consistency Reliability Scores

Instrument	***KR 20***
CE Pretest	-.06
CE Posttest 1	.06
CE Posttest 2	.31
CE Posttest 3	.12
AE Posttest 1	.24
AE Posttest 2	.29

As an indicator of test-retest reliability, Pearson's product-moment correlations were examined for stability of the instrument over time. There was a strong positive correlation between the CE Posttest 1 and CE Posttest 2 that were administered immediately after the simulation scenario and after DML, r (119) = .549, $p < .0005$. There was a moderate positive correlation between the CE Pretest and the CE Posttest 1 after the simulation scenario, r (119) = .495, $p < .0005$. Additionally, there was a moderate positive correlation between the CE Posttest 2 and AE Posttest 1 that were delivered immediately after DML, r (119) = .326, $p < .0005$ and between the CE Posttest 3 and AE Posttest 2 delivered after 4 weeks of time had lapsed, r (119) = .381, $p < .0005$. These analyses indicate that the instruments were moderately stable over time.

Testing the Research Questions

Descriptive and inferential statistics were used to examine the two research questions for this study. Prior to data analyses for both questions, data were examined for the following assumptions that are required for both the parametric tests used in this study. The assumptions addressed for this study included: (a) determination that one continuous dependent variable was present, (b) recognition that there was a categorical between-subjects independent variable and (c) independence of observations. The continuous dependent variable included the pretest and posttest administered at each point in time and the categorical variable of primary interest was student role in the simulation experience. The assumption of independence of observations was met as no student could be in both groups. Therefore, parametric statistical tests were used in this data analysis.

Research Question One

Research question 1 asked: Is there a difference in knowledge demonstrated and knowledge retained by nursing students in active participant versus observer roles after a simulation about the care of a patient with respiratory distress (opioid-induced respiratory depression) at baseline, before and after debriefing with DML, and four weeks later? The CE pretest and posttests were the instruments used to measure participant knowledge demonstration and knowledge retention.

A mixed RM-ANOVA by role and site was used to answer this first research question and required additional assumptions to be met prior statistical analysis. Time was the within-subjects factor as the CE instrument was administered four times in the study. Across the four time points, the overall "CE Knowledge" score was aggregated. Role was the between-subjects factor of interest; however, considering the data was obtained from two sites, the between-subjects factor of site was added into the model to examine for any potential interactions even though homogeneity of variance had been established so the data from both sites could be pooled into one sample. However, using an abundance of caution, analyses were ran separately resulting in no change to the inferences. Therefore, it was determined that the most statistically conclusive results would occur by examining both role and site in the model. In addition to the previous assumptions, a RM-ANOVA also required: (a) examination of outliers, (b) normally distributed data, (c) homogeneity of variance for the dependent variable between the groups, (d) homogeneity of covariance, and (e) sphericity, the equal variance of differences between groups, considering more than two repeated measures occurred (Tabachnick & Fidell, 2013).

Outliers were examined as they can lead to both Type I and Type II errors (Tabachnick & Fidell, 2013). There were two outliers, as indicated by studentized residuals for values less than -3 and greater than 3. To determine the impact of these outliers, the analysis was performed again without the data of either outlier and the interpretation of results were not impacted. Therefore, after consideration of both individual outliers for accuracy, it was determined that both outliers should be included in the final model.

Normality was assessed by looking at the skewness and kurtosis of the dependent variable with the pretest data and is summarized in Table 14. Considering that the significance for skewness and kurtosis were within the *z* score range of -1.96 to +1.96 ($p < .05$) for all time-points except after DML for all participants and -2.58 to +2.58 ($p < .01$) for that time-point between active participant and observer, data was considered normal. Additionally, the Normal Q-Q plots for each of the four time points were visually inspected for normality, and the data was confirmed as normally distributed. The Shapiro-Wilk test of normality was significant indicating a violation of normality ($p < .05$); however, as sample size increases beyond that of the central limit theorem, there is a higher likelihood of significant normality tests such as the Shapiro-Wilk and therefore multiple modes of examining normality should be examined (Field, 2013). Therefore, considering the large sample above the central limit theorem, equal group sizes, and ANOVA procedures that are robust to small violations in normality (Field, 2013; Tabachnick & Fidell, 2013), it was determined to continue with the RM-ANOVA.

Table 14

CE Instrument Normality Statistics

Time	**Active Participant (*N* = 59)**	**Observer (*N* = 60)**
CE Pretest		
Skewness (*SE*)	-.22 (*.31*)	-.24 (*.31*)
Kurtosis (*SE*)	-.46 (*.61*)	-.49 (*.61)*
CE Posttest 1		
Skewness (*SE*)	-.41 (*.31*)	-.19 (*.31*)
Kurtosis (*SE*)	.31 (*.61*)	-.30 (*.61)*
CE Posttest 2		
Skewness (*SE*)	-.83 (*.31*)	-.89 (*.31*)
Kurtosis (*SE*)	1.23 (*.61*)	.28 (*.61)*
CE Posttest 3		
Skewness (*SE*)	-.22 (*.31*)	-.48 (*.31*)
Kurtosis (*SE*)	-.11 (*.61*)	-.28 (*.61)*

Homogeneity of variance was assessed using the Levene statistic. On the mixed RM-ANOVA including site and role, Levene's test was significant for CE Pretest data $F(3,115) = 2.89$, $p = .039$ and for CE Posttest 1 $F(3, 115) = 2.74$, $p = .047$. However, the CE Posttest 2 $F(3, 115) = 2.63$, $p = .053$ and CE Posttest 3 $F(3, 115) = .533$, $p = .660$ were not significant (Table 15). Therefore, this finding violated the assumption of homogeneity of variance. However, it should be noted that this model contains the intercept, role, site, and role by site interaction which can result in violations to the assumption of homogeneity (D. Spurlock, personal communication, April 26, 2018). Although site was not a variable of interest in the hypothesis testing, this concept was informational and a variable in the study, therefore, the RM-ANOVA analysis was performed to examine role and site alone without the interaction to assess for homogeneity.

The Levene's statistic was examined on all four time-points for role and all four time-points for site and there was homogeneity of variances ($p < .05$) (Table

15) and there was not a change in the interpretation for hypothesis testing. Thus, a decision was made to continue using the mixed RM-ANOVA examining the interaction for role and site because it provided the most accurate data for all the interactions while still examining the hypothesis of interest. Again, homogeneity of variance, similarly to normality, is more of a concern to the robustness of RM-ANOVA if sample sizes are small and unequal (Field, 2013).

Table 15

Levene's Tests of Homogeneity of Variance

Element	**CE PreTest**	**CE Posttest 1**	**CE Posttest 2**	**CE Posttest 3**
RM-ANOVA by Site/Role				
F statistic	2.89	2.74	2.63	.660
Df1	3	3	3	3
Df2	115	115	115	115
Significance (*p*)	.039*	.047*	.053	.660
RM-ANOVA by Role				
F statistic	1.08	1.92	2.95	.410
Df1	1	1	1	1
Df2	117	117	117	117
Significance (*p*)	.300	.169	.089	.523
RM-ANOVA by Site				
F statistic	.058	.175	2.976	.728
Df1	1	1	1	1
Df2	117	117	117	117
Significance (*p*)	.810	.676	.087	.395

*$p < .05$

Homogeneity of covariances was assessed with Box's test of equality of covariance matrices for the RM-ANOVA by site and role. Box's *M* (36.37) was not significant ($p = .288$) indicating that there were no significant differences between the covariance matrices. Moreover, the assumption of sphericity was examined with Mauchly's test of sphericity. Mauchly's test indicated that the assumption of sphericity had been violated for time ($\chi^2(5) = .906$, $p = .048$), therefore the degrees of freedom were corrected using Huynh-Feldt estimates of sphericity ($\varepsilon = .993$). The Huynh-Feldt correction estimated epsilon by correcting the degrees of freedom and is recommended when the epsilon is greater than 0.75 (Field, 2013; Huynh & Feldt, 1976).

For the within-subjects effects, the interaction effect between time, role, and site was not statistically significant, $F(2.978, 342.524) = .990$, $p = .397$, partial $\eta^2 = .009$, $\varepsilon = .993$. Additionally, the two-way interaction effect between time and role was not statistically significant, $F(2.978, 342.524) = 1.089$, $p = .354$, partial $\eta^2 = .009$, $\varepsilon = .993$, nor was the two-way interaction effect between time and site, $F(2.978, 342.524) = 1.266$, $p = .286$, partial $\eta^2 = .011$, $\varepsilon = .993$. The main effect of time showed a statistically significant difference in the mean CE instrument scores at the different time points the overall “CE Knowledge” scores, $F(2.978, 342.524) = 78.704$, $p < .0005$, partial $\eta^2 = .406$, $\varepsilon = .993$ (Table 16). This analysis indicated that role and site did not result in a significant difference on the knowledge scores; however, the events between each of the four points in time were significantly different with a large effect size.

Table 16

Tests of Within-Subjects Effects

Source	***SS***	***df*** ^{a}	***MS***	***F***	***p***	**Partial η^2**
Time	23163.06	2.978	7776.836	78.704	.000*	.406
Time * Role	320.457	2.978	107.591	1.089	.354	.009
Time * Site	372.477	2.978	125.057	1.266	.286	.011
Time * Role * Site	291.254	2.978	97.787	.990	.397	.009
Error (time)	33845.18	342.52	98.811			

Note. η^2 = effect size. $^{a}\varepsilon = .993$.
*$p < .0005$

After examining within-subject effects, next the between-subjects effects were examined. The main effect of role showed that there was not a statistically significant difference in CE Knowledge scores over time $F(1, 115) = .083$, $p = .773$, partial $\eta^2 = .001$. Additionally, the effect of site showed that there was not a statistically significant difference in CE Knowledge scores over time $F(1, 115) = 3.204$, $p = .076$, partial $\eta^2 = .027$, nor was there a statistically significant difference in CE Knowledge scores over time in the role by site between-subjects effect $F(1, 115) = .583$, $p = .447$, partial $\eta^2 = .005$ (Table 17). A student's score in the active participant role (M =75.141, SE = 1.29) was associated with a CE Knowledge score of .524, 95% CI [-3.067, 4.115] points higher than a student's score in the observer role (M = 74.617, SE = 1.27), which was not statistically significant (p = .773).

Table 17

Tests of Between-Subjects Effects

Source	**Type III *SS***	***df***	***MS***	***F***	***p***	**Partial η^2**
Intercept	2462783.59	1	2462783.59	6824.663	.000*	.983
Role	30.123	1	30.123	.083	.773	.001
Site	1156.342	1	1156.342	3.204	.076	.027
Role * Site	210.381	1	210.381	.583	.447	.005
Error	41499.504	115	360.865			

Note. η^2 = effect size.
*$p < .0005$

In conclusion, the analysis of the data to answer Research Question 1 results in a failure to reject the null hypothesis, and the conclusion that there is no statistically significant difference between participants in active participant and observer roles after a simulation about the care of a patient with respiratory distress (opioid-induced respiratory distress) at baseline, before DML, after DML, and after four weeks of time. All interactions and main effects support that there were no significant differences in the mean scores by role, the variable of interest in this study (Figure 4).

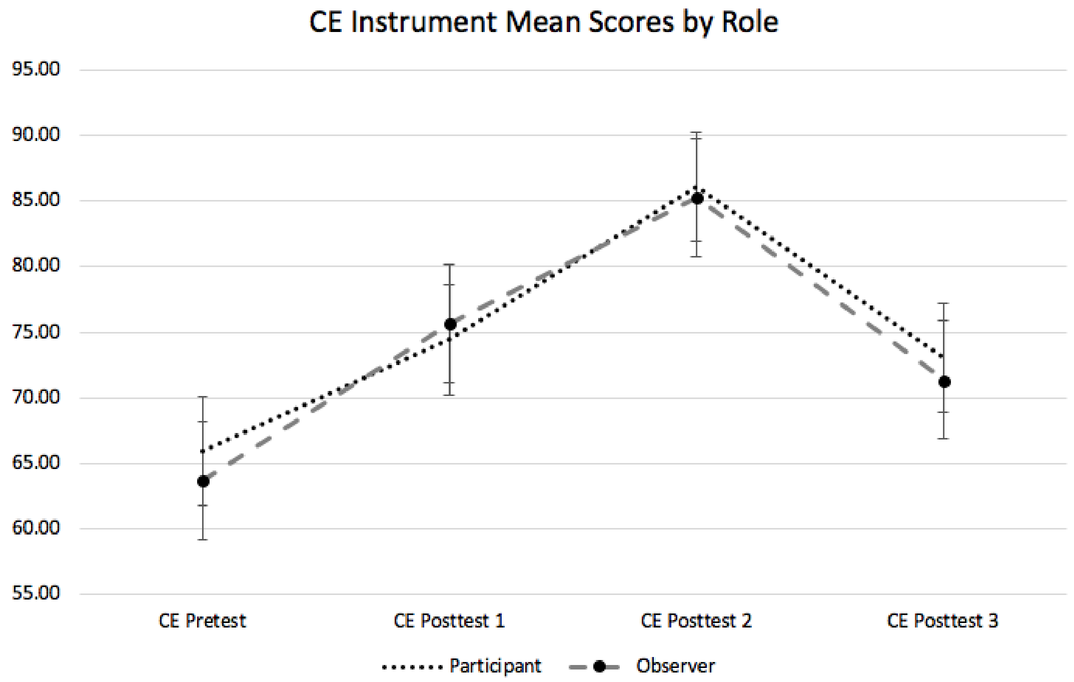


Figure 4. CE Instrument Mean Score Differences by Role.

Research Question Two

Research question 2 asked: Is there a difference in knowledge demonstrated and knowledge retained by nursing students in active participant versus observer roles when applied (assimilated/accommodated) to a parallel case about a patient with a different kind of respiratory distress (anaphylaxis) after DML and 4 weeks later?

An independent-samples t-test was used to determine if there were differences in scores on the AE instrument immediately after debriefing with DML between role of active participant and observer. There were no outliers in the data, as assessed by inspection of a boxplot for values greater than 1.5 box lengths. Knowledge scores for each role were normally distributed, as assessed by skewness, kurtosis (Table 18), and Normal Q-Q plots. Shapiro-Wilk's test for normality was violated (p > .05); however, the independent-samples t-test is considered robust when sample sizes are large and equally grouped (Tabachnick & Fidell, 2013). There was homogeneity of variances for AE instrument knowledge scores for active participants and observers, as assessed by Levene's test for equality of variances (*p* = .459). There were no statistically significant differences in knowledge scores when comparing participants in the observer role (*M* = 87.67, *SD* = 10.95) to those in the active participant role (*M* = 86.1, *SD* = 12). This difference, 1.56, 95% CI [-2.61, 5.74,] was not statistically significant, *t*(117) = .742, *p* = .459, with a small-sized effect, *d* = .14 (Figure 5).

Table 18

AE Instrument Normality Statistics

Time	**Active Participant (*N* = 59)**	**Observer (*N* = 60)**
AE Posttest 1		
Skewness (*SE*)	-.61 (*.31*)	-.48 (*.31*)
Kurtosis (*SE*)	-.48 (*.61*)	-.74 (*.61)*
AE Posttest 2		
Skewness (*SE*)	-.78 (*.31*)	-.45 (*.31*)
Kurtosis (*SE*)	1.93 (*.61*)	-.83 (*.61)*

For the four-week retention test, an independent-samples t-test was used to determine if there were differences in scores on the AE instrument between role of active participant and observer. There was one outlier in the data, as assessed by inspection of a boxplot for values greater than 1.5 box lengths. Analysis was performed with and without the outlier resulting in no difference in inference and therefore, after examining the outlier for accuracy it was determined to retain the outlier in the analysis. There was insufficient evidence for normally distributed data with the outlier included, as assessed by kurtosis for students in the active participant role (Table 18) and Normal Q-Q plots. Shapiro-

Wilk's test for normality was violated (*p* > .05); however, as previously mentioned, the independent-samples t-test is considered robust when sample sizes are large and equally grouped (Tabachnick & Fidell, 2013). There was not homogeneity of variances for AE instrument knowledge scores for active participants and observers, as assessed by Levene's test for equality of variances (*p* = .020). Therefore, the unequal variance t-test, also known as the Welch t-test, was used for significance testing. There were no statistically significant differences in knowledge scores when comparing participants in the observer role (*M* = 72.5, *SD* = 16.84) to those in the active participant role (*M* = 70.34, *SD* = 13.89). This difference, 2.16, 95% CI [-3.44, 7.76], was not statistically significant, *t*(113.59) = .764, *p* = .446, with a small-sized effect, *d* = .14 (Figure 5).

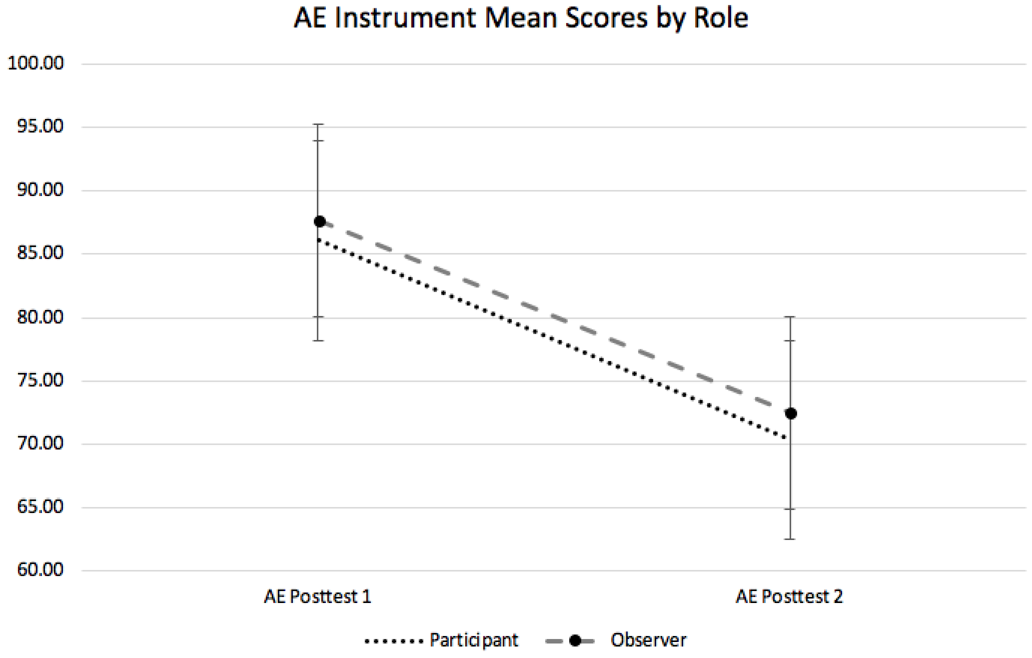


Figure 5. AE Instrument Mean Score Differences by Role.

In conclusion, the analysis of the data pertaining to Research Question 2 results in a failure to reject the null hypothesis and the conclusion that there is no significant difference between students in active participant and observer roles when knowledge is applied (assimilated/accommodated) to a parallel case about a patient with a different kind of respiratory distress (anaphylaxis) immediately after debriefing with DML and after four weeks of time. Therefore, there was no statistically significant difference in knowledge demonstrated and knowledge retained by nursing students in active participant versus observer roles when applied to a parallel case about a patient with a different kind of respiratory distress (anaphylaxis) after DML and four weeks later.

Additional Analyses

Using the RM-ANOVA method provided additional analyses that should be considered for discussion. Although time was not the variable of interest in this study, this significant main effect of time indicates the events had a significant impact on the group at each point in time. The main effect of time showed a statistically significant difference in the mean CE instrument scores at the different time points for the overall “CE Knowledge” scores, $F(2.978, 342.524) = 78.704$, $p < .0005$, partial $\eta^2 = .406$, $\varepsilon = .993$ (Table 16). Between each point in time, a variable in the study was performed including the scenario participation or observation, debriefing with DML, or 4 weeks of time passing. Therefore, all pairwise comparisons were run for each simple main effect with reported 95% confidence intervals and *p*-values Bonferroni-adjusted within each simple main effect. The marginal means for the CE Pretest, CE Posttest 1, CE Posttest 2, and

CE Posttest 4 scores were 65.49 (*SE* = 1.26), 75.59 (*SE* = 1.21), 85.72 (*SE* = 1.16), and 72.72 (*SE* = 1.25), respectively.

A CE Posttest 1 score was associated with a mean CE Knowledge score 10.095, 95% CI [6.77, 13.43] points higher than a CE Pretest score, a statistically significant difference, $p < .0005$. A CE Posttest 2 score was associated with a mean CE Knowledge score 10.138, 95% CI [7.1, 13.18] points higher than a CE Posttest 1 score, a statistically significant difference, $p < .0005$. Finally, the CE Posttest 3 score was associated with a mean CE Knowledge score that was -13.01, 95% CI [-16.81, -9.21] points lower than the CE Posttest 2 score, a statistically significant difference, $p < .0005$.

Summary

In this chapter, descriptive statistics for the instruments (the CE Instrument and the AE Instrument) were provided for each time the instruments were administered. Both of the research questions were then addressed. Results from the first question demonstrated that there was no significant difference between participants in active participant and observer roles for scores on the CE instrument that demonstrated knowledge about the care of a patient with opioid-induced respiratory distress. There was failure to reject the null hypothesis as there was no significant difference in active participant and observer roles for knowledge demonstration and retention.

Results from the second question demonstrated that there was no significant difference in applied (assimilated/accommodated) knowledge between participants in active participant and observer roles for scores on the AE instrument that demonstrated knowledge about parallel case for the care of a patient with a different kind of respiratory distress (anaphylaxis). Again, there was failure to reject the null hypothesis as there was no significant difference in active participant and observer roles for knowledge demonstration and retention. The next chapter will summarize and discuss these findings in the context of simulation and provide implications for nursing education.

CHAPTER 5 SUMMARY, DISCUSSION, AND CONCLUSIONS

Chapter V consists of a summary of this study, discussion and contextualization of the findings, implications for simulation and nursing education, an overview of the limitations, and recommendations for further research. The intent of this chapter is to expand upon the on the study findings and relate them to theoretical foundations for simulation and debriefing and the use of different roles within the context of prelicensure nursing education.

Summary of the Study

The purpose of this study was to explore the relationship between prelicensure, baccalaureate, nursing students' roles in simulation (active participant or observer) and cognitive knowledge demonstration, knowledge retention, and knowledge application in simulation with Debriefing for Meaningful Learning© (DML) (Dreifuerst, 2010). Simulation involves the assignment of different learner roles including the active participant or passive observer (Bong et al., 2017; INACSL Standards Committee, 2016b; O'Regan et al., 2016). Active participants make decisions and provide patient care during the scenario while observers watch the scenario unfold without direct participation in the decision-making (Jeffries & Rizzolo, 2006; O'Regan et al., 2016). This study was underpinned by a Observational Experiential Learning (OEL), a framework merging the work of Bandura's (1971) Social Learning Theory (SLT) and Kolb's (1984, 2015) Experiential Learning Theory (KELT).

This study used two research questions to examine the current International Nurses Association for Clinical Simulation and Learning (INACSL)

Standards of Best Practice: Simulation^{SM} occurring in one simulation with theory-based debriefing with DML. The first question asked, “Is there a difference in knowledge demonstrated and retained by nursing students in active participant versus observer roles after a simulation about the care of a patient with respiratory distress (opioid-induced respiratory depression) at baseline, before and after debriefing with DML, and four weeks later?” The Concrete Experience (CE) knowledge instrument operationalized KELT’s concept, the concrete experience, to measure knowledge assimilation about the care for the patient that students either actively participated in or observed. Results from the CE instrument demonstrated no significant difference at baseline, after the scenario, after the debriefing, and four weeks later between the active participant and observer scores. Additional analysis supported that both active participant and observer had significant and similar positive gains in knowledge from baseline to debriefing and a significant and similar decline in knowledge four weeks later.

The second question asked, “Is there a difference in knowledge demonstrated and knowledge retained by nursing students in active participant versus observer roles when applied (assimilated/accommodated) to a parallel case about a patient with a different kind of respiratory distress (anaphylaxis) after DML and 4 weeks later?” The Active Experimentation (AE) instrument operationalized the active experimentation phase of KELT to measure accommodated knowledge about a parallel and contextually similar case with subtle differences (Forneris & Fey, 2016) that was presented through debriefing with DML. Results from the AE knowledge instrument demonstrated no significant difference in knowledge demonstrated immediately after debriefing or knowledge retained four weeks later between active participant and observer roles.

Discussion of the Findings in Context of the Current Literature

Nursing students enter into a complex healthcare environment after graduation requiring them to enter the field prepared for their full scope of practice, using higher-order thinking (Institute of Medicine, 2011; Ironside et al., 2014). Simulation is being used more extensively to replace traditional patient care clinical experiences due to decreased clinical site availability as well as theoretical and empirical support that simulation results in increases in those higher-order thinking processes, as well as knowledge, skills, and attitudes (Adamson & Rodgers, 2016; Dreifuerst, 2009, 2010, 2012; Hayden et al., 2014; National League for Nursing, 2014; Tanner, 2006b). These results stand widely accepted despite the recognition that numerous students are in observing roles and not actively participating in care for patients in simulation. While there are some studies that demonstrate there are no differences in knowledge outcomes between actively participating and observing students (Fluharty et al., 2012; Jeffries & Rizzolo, 2006; Kaplan et al., 2012; LeFlore et al., 2007; Rode et al., 2016; Scherer et al., 2016; Smith et al., 2013; Thidemann & Soderhamn, 2013), there are no studies that have operationalized how the current theories in simulation support knowledge assimilation and accommodation for students in different roles. Additionally, there are no studies that have tested that debriefing a parallel case results in similar knowledge demonstration or knowledge retention when comparing students in active participant and observer roles.

Therefore, the goal of this study was to compare the differences in knowledge demonstration, knowledge retention, and knowledge application (assimilation/accommodation) between active participants and observers at each pole of KELT: grasping the concrete simulation experience and transforming via the contextually similar parallel case facilitated by the debriefing. This operationalized the grasping and transforming phase of KELT and also measured knowledge retention, a concept from SLT, as an outcome in the OEL framework. The knowledge differences were compared again four weeks later to assess knowledge retention over time.

After data analysis, the Investigator returned to the literature to further develop concepts identified during this study. This enabled the Investigator to contextualize findings in comparison to previous studies that support current practices, expand on theoretical implications for simulation, or counter current assumptions. Table 19 summarizes the conceptual definitions and attributes, operationalization of concepts for the study, and outcomes supported by this study and the literature.

Table 19

Conceptualization of Concepts Identified in Study

Concepts of OEL	**Conceptual Definition/ Attributes**	**Operationalizing of Theoretical Concepts** (in this study)	**Outcomes** (in this study)	**Outcomes** (according to the literature)
Attention	Attending to or recognizing essential features Desire to solve complex situations Intentional observation with goal setting Visual attention Contrast to passive watching (Bandura, 1971; McGonigal, 2011; Kühn & Gallinat, 2014)	*Prebrief:* psychological safety and fiction contract, telling the patient story (complexity), objectives (goals). Encouraged to pay close attention to timeline of events (goal setting). *DML*: Engage (Dreifuerst, 2010, 2012, 2015; Page-Cutrara, 2015)	N.A.	Intentional goals as opposed to exposure Engaged by complexity Readiness to learn Psychological safety addressed to structure anticipatory reflection and planning to promote engagement and readiness of the learner. (Bandura, 1971; Biocca, 1988; Gantz, 1978; Gunter, 1987; Lang et al., 2000; Petty, et al., 1983; Lang, et al.,1999, 2000; Page-Cutrara, 2015; Thorson et al., 1986; Yoon et al., 1997, 1998)

Concepts of OEL	**Conceptual Definition/ Attributes**	**Operationalizing of Theoretical Concepts** (in this study)	**Outcomes** (in this study)	**Outcomes** (according to the literature)
Motivation	Intrinsic motivation with a commitment to bring about a future action (Bandura, 2001)	*Prebrief*: psychological safety and fiction contract, telling the patient story (commitment to bring about future action), allowing observers to either take notes or simply observe (intrinsic). Encouraged to pay close attention to timeline of events (goal setting). *DML*: Engage (Dreifuerst, 2010, 2012, 2015; Page-Cutrara, 2015)	N.A.	Human agency: Intention Forethought Self-reactiveness Self-reflection (Bandura, 2001)

Concepts of OEL	Conceptual Definition/ Attributes	Operationalizing of Theoretical Concepts (in this study)	Outcomes (in this study)	Outcomes (according to the literature)
The Grasped Experience Definition: The taking in of an experience. (Kolb, 2015)	***Concrete Experience*** Immediately sensed experience requiring minimal analysis or inquiry (Kolb, 2015)	*Simulated Scenario*: Role in Opioid-Induced Respiratory Distress Case *Instruments*: CE Pretest, CE Posttest 1, 2, & 3	Knowledge Retention: Research Question 1 Observers and active participants grasp concrete experiences similarly.	Use of Mirror Neuron System and Action-Observation-Network No differences between active participants and observers Assimilation (Caspers et al., 2010; Fluharty et al., 2012; Jeffries & Rizzolo, 2006; Kaplan et al., 2012; Kolb, 2015; LeFlore et al., 2007; Livsey & Lavender-Stott, 2015; Rizzolatti, 2005; Rode et al., 2016)
	Abstract Conceptualization Allows for communication, prediction, and recreation of experience. (Kolb, 2015)	*Simulated Scenario*: Role in Opioid-Induced Respiratory Distress *DML*: Socratic questioning. Engage in Critical Conversation. Reflection-in-action. Reflection-on-action (Dreifuerst, 2009, 2010, 2012, 2015; Forneris & Fey, 2016; Kolb, 2015; Schön, 1983)	Knowledge Retention: Research Question 1 Observers and active participants grasp concrete experiences similarly The simulation results in significant knowledge gain.	

Concepts of OEL	**Conceptual Definition/ Attributes**	**Operationalizing of Theoretical Concepts** (in this study)	**Outcomes** (in this study)	**Outcomes** (according to the literature)
The Transformed Experience Definition: Analysis of experience after it occurs. Creates tension with grasped experience for remarkable learning environment. (Kolb, 2015)	***Reflective Observation*** Internal reflection Looking back Internal dialogue (Kolb, 2015)	*DML*: Exploring, Explaining, Elaborating, Evaluating, Reflection-on-action, Reflection-in-action (Dreifuerst, 2009, 2010, 2012, 2015; Schön, 1983)	Knowledge Retention: Research Question 1, 2 Debriefing is the most significant component of simulation	Human agency: intention, self-reflection, forethought (anticipation) Assimilation and Accommodation Debriefing is the most significant component of simulation, assists in application of knowledge to different contextual situations, and facilitates Active Experimentation (Adamson & Rodgers, 2016; Bandura, 2001; Dreifuerst, 2009; Forneris & Fey, 2016; INACSL Standards Committee, 2016a; Kolb, 2015)
	Active Experimentation Real-world manipulation Extension Testing/applying the knowledge in a new real-life situation. (Kolb, 2015)	*DML*: A parallel case (Anaphylaxis) *DML*: Extend Reflection-Beyond-Action *Instruments*: AE Posttest 1 & 2 (Dreifuerst, 2009, 2010, 2012, 2015; Forneris & Fey, 2016)	Knowledge Retention and Application: Research Question 2 Debriefing most significant component of simulation, assists in application of knowledge to different contextual situations, and facilitates Active Experimentation	

Concepts of OEL	**Conceptual Definition/ Attributes**	**Operationalizing of Theoretical Concepts** (in this study)	**Outcomes** (in this study)	**Outcomes** (according to the literature)
Knowledge Retention	Memory of events that occurred in the past (Bandura, 1971)	*Instruments*: CE Pretest, CE Posttest 1, CE Posttest 2, CE Posttest 3, AE Posttest 1, AE Posttest 2	Research Question 1 & 2 Assimilation Accommodation Significant knowledge decay at 4 weeks Supports sequential simulations	Mirror Neuron, Action-Observation-Network, cerebellar, and hippocampal activation Assimilation and Accommodation Error control Sequential simulations (Andrieux & Proteau, 2013, 2014; Callan et al., 2013; Caspers et al., 2010; Domuracki et al., 2015; Fabbri-Destro & Rizzolatti, 2008; Hansen & Bratt, 2017; Iacoboni et al., 2005; Monfardini et al., 2013; Rizzolatti & Craighero, 2004; Rizzolatti, 2005; Schiffer et al., 2012)
Motor Reproduction	Overt action, behavior reproduction from previously modeled behavior. (Bandura, 1971)	Observing the simulation scenario of novice prelicensure nursing students.	N.A.	

Knowledge Retention from Grasped and Transformed Experiences

Knowledge retention was the primary empirical outcome of interest in this study. Since retention typically conveys a longer length of time, the term knowledge demonstration was used to communicate a more immediate form of knowledge retention. Knowledge was examined immediately after the grasped experience (CE Posttest 1), the transformed concrete experience (CE Posttest 2) and four weeks later (CE Posttest 3). The transformed experience also involved examining knowledge applied to a parallel case (AE Posttest 1) and that knowledge four weeks later (AE Posttest 2).

Knowledge assimilation. The first question, “Is there a difference in knowledge demonstrated and knowledge retained by nursing students in active participant versus observer roles after a simulation about the care of a patient with respiratory distress (opioid-induced respiratory distress) at baseline, before and after debriefing with DML, and four weeks later?” was an important step to identify how knowledge is demonstrated and how it compares between active participant and observer. Knowledge was measured using the CE instrument designed to measure assimilated knowledge about the scenario that participants actively participated in or observed. The findings from this question demonstrated no significant differences in knowledge demonstration between active participant and observer at baseline, immediately after the scenario, immediately after debriefing with DML, and knowledge retention four weeks later. Further analysis demonstrated that despite role, knowledge increased significantly from baseline to after participation or observation of the scenario, increased significantly again immediately after debriefing with DML, and then decayed significantly after four weeks.

This is important because it indicates that despite role, knowledge scores were not significantly different at any point in time, but made significant increases and decreases in tandem. The literature already supports the assumption that there are no differences between active participant and observer in knowledge demonstration and knowledge retention (Fluharty et al., 2012; Jeffries & Rizzolo, 2006; Kaplan et al., 2012; LeFlore et al., 2007; Livsey & Lavender-Stott, 2015; Rode et al., 2016). While this study supports those findings, this study also sought to operationalize the OEL framework and theoretically support how learners in different roles, active participants and observers, *grasp* and *transform* knowledge in one simulation and debriefing, and how that knowledge is retained over a four week period. The Investigator facilitated the scenario each time according to the INACSL Standards of Best Practice: Simulation^{SM} and then debriefed the scenario with the DML debriefing method using a consistent pattern. This provided optimal control in this experimental study to reduce confounding variables of different simulation facilitators and debriefers to execute every student's Concrete Experience and transformation with debriefing similarly.

The outcome from baseline to immediately after the scenario, measured by CE Posttest 1, supported that knowledge was *grasped* similarly according to the OEL framework and that students gained knowledge similarly, despite role, related to the concrete experience. Kolb never stated that the concrete experience must be a hands-on experience (Hoover & Giambatista, 2009; Kolb, 2015), yet there is still a belief, despite contradictory evidence, that active participants gain the most knowledge due to direct immersion in the simulation experience (Bong et al., 2017). Although uncommon to examine knowledge immediately after the simulated scenario, this data collection point supported the notion that participating or observing the experience results in similar concrete experiences and similar increases in knowledge demonstration with no significant difference in scores between the two groups. This was a key point in this study as it isolated what active participants and observers gained from the simulation alone. This finding indicated that the simulation scenario resulted in a significant knowledge gain for both the active participant and observer supporting that designing and facilitating simulation scenarios according to the INACSL Standards of Best Practice: Simulation^{SM} result in a significant knowledge gain prior to the debriefing for those in the most active and passive roles.

The outcome from immediately after the scenario to immediately after debriefing with DML, measured by CE Posttest 2, further supports that debriefing is where the learning occurs (Adamson & Rodgers, 2016, p. 16) and again demonstrates that knowledge scores were not significantly different between students in active participant and observer roles. Previously described, DML facilitates OEL and KELT by iteratively asking students to abstractly conceptualize (describe or recreate the grasped experience) and reflectively observe (internally reflect and transform) on the previous concrete experience. Knowledge was measured directly after the debriefing as part of the OEL framework and it was determined that knowledge was similarly *transformed* and *assimilated* according to the theoretical concepts and that student role had no significant impact on the scores. Further, this finding adds to the theoretical support and empirical support for the DML debriefing method that the structured, iterative process facilitates knowledge assimilation and that knowledge assimilation is a defining attribute of debriefing (Dreifuerst, 2009, 2010).

While knowledge demonstration was examined throughout the two-hour simulation and debriefing, knowledge retention over longer periods of time currently in need of further support in simulation (O'Donnell et al., 2014; Olson et al., 2018). Knowledge of the concrete experience was examined four weeks later using CE Posttest 3 and showed significant decay, but again no significant difference between active participant and observer. This study demonstrated that despite theory-based and evidence-based debriefing by the same facilitator, knowledge decayed regarding the care for the same patient experiencing opioid-induced respiratory distress as early as four-weeks.

Of all the previous literature demonstrating no differences between active participant and observer in simulation, Rode et al. (2016) examined knowledge retention over time; however, their study examined large groups of classroom simulations where students were observers. Therefore, this study is the first study to compare participant and observer scores at a distant time point using high-fidelity simulation with observation via audio-visual equipment, following the INACSL Standards of Best Practice: Simulation^{SM}, and debriefing with a theory-derived debriefing method, DML.

Knowledge accommodation. The second question, “Is there a difference in knowledge demonstrated and knowledge retained by nursing students in active participant versus observer roles when applied (assimilated/accommodated) to a parallel case about a patient with a different kind of respiratory distress (anaphylaxis) after DML and 4 weeks later?” took the study further in examining the OEL framework. It examined the assumption that debriefing *transforms* through *extension* and facilitates the Active Experimentation and the accommodative knowledge phase by providing learners with a contextually similar case that has a different underlying structure (Dreifuerst, 2009; Forneris & Fey, 2016; INACSL Standards Committee, 2016a). This was operationalized and measured by the AE knowledge instrument (AE Posttest 1) that consisted of nearly identical questions and answers, but due to contextually different care, the answers were similar on some questions and different on others than that of the CE instrument. The results supported that there were no significant differences in knowledge demonstrated by active participants and observers related to a parallel case of respiratory distress (anaphylaxis) presented through the reflection-beyond-action component of DML.

The results indicated accommodated knowledge was an outcome of the DML debriefing method and that debriefing facilitated the ability to apply learning in a different contextual clinical situation (Forneris & Fey, 2016; INACSL Standards Committee, 2016a). In addition, the results to this question support that learners can assimilate and accommodate when guided through debriefing, supporting the assumption provided by Forneris and Fey (2016) that debriefing accomplishes the Active Experimentation phase. This again supports that debriefing is the most significant component of simulation (Adamson & Rodgers, 2016) and that debriefing facilitates assimilation and accommodation, the essentials of practice professions (Dreifuerst, 2009).

The outcome for knowledge retention of the Active Experimentation parallel case at four weeks was measured with AE Posttest 2 and the data demonstrated no significant difference between active participant and observer. In addition, the mean scores were lower than the immediate post-debriefing (AE Posttest 1) score. Considering both cases of respiratory distress showed decline, regardless of role, this finding demonstrates that four weeks is a timeframe that knowledge decay occurs for students related to the parallel case that is presented in the reflection-beyond-action phase of DML. This outcome further supports the previous studies that there are no differences in knowledge demonstration and retention between active participant and observer.

There is contradictory literature surrounding the active experimentation phase of KELT. Kolb (2015) defined this as the external manipulation of the world and it is typically thought of as a hands-on experience. There is literature in simulation that equates the debriefing as the component that operationalizes the active experimentation phase (Forneris & Fey, 2016), while other literature suggests the active experimentation phase should be executed through sequencing simulation and bringing learners back to the simulation experience to allow for this final phase to be executed (Stocker et al., 2014) or through an additional activity other than debriefing (Chmil et al., 2015). Although this study supports that the Active Experimentation phase is facilitated through debriefing, the decline in knowledge four weeks later related to the concrete experience and active experimentation parallel case presented through DML also supports that both active participants and observers need to return to a simulation experience involving the care of a patient in a similar contextual simulation within four weeks.

Attention and Motivation

Kolb defines the concrete experience as a tangible or felt experience lacking minimal analysis or inquiry (Kolb, 2015); however, exposure to a situation does not necessarily indicate that one is intentionally paying attention to the experience (Biocca, 1988; Chaffee & Schleuder, 1986; Lang et al., 2000). It is essential that healthcare professions students are attentive and motivated to learn considering the complex demands of professional practice. Therefore, two antecedents to grasping the concrete experience were added to the OEL framework. Although attention and motivation were not explored empirically in this study, the literature and operationalization of the INACSL Standards of Best Practice: Simulation^{SM} support that the prebrief, or the initial encounter with the learners prior to simulation, may have a role in engaging the attention and motivation of learners. Page-Cutrara (2015) conceptually analyzed the prebrief and reported that it is more than the time when learners receive information about the objectives of the scenario, the patient story, roles, tasks, and an orientation to the general environment. Rather, the prebrief is also associated with building meaningful learning environments, encouraging students to talk out loud and discuss the simulation (Page-Cutrara, 2015).

This idea is further supported by Rudolph, Raemer, & Simon (2014) that the prebriefing serves as a time to establish a safe container of psychological safety to feel uncomfortable and trust that when and if difficult feelings arise, they will be supported. In simulation, learners are placed in vulnerable and anxiety-producing situations when expected to perform in front of instructors or peers; however, Rudolph, Raemer, & Simon (2014) reported that when learners know what to expect and have a sense of control, they are more likely to engage their attention in the simulation and debriefing. Ways to foster psychological safety include: clarifying objectives, confidentiality, and expectations, establishing a fiction contract to draw learners in, consistently conveying commitment to respecting learners, and attending to logistics such timing or breaks.

The likelihood to engage learners correlates with the attention they will devote to the simulation. Additionally, if learners feel psychologically safe, informed of the objectives, drawn into the patient’s story and the simulation that is about to occur, and this prebrief happens consistently, learners may have more of an intrinsic motivation to bring about actions in the simulation environment. Therefore, the prebrief may contribute not only to the attention, but create an environment that fosters intrinsic motivation and human agency development attributes of intention, forethought, self-reactiveness, and self-reflectiveness.

Motor Reproduction

Motor reproduction is the final SLT concept that was added as an outcome of grasping and transforming experiences in the OEL framework. Motor reproduction was not explored empirically in this study; however, the literature was revisited to contextualize this concept in accordance with the literature. Simulation typically involves the assignment of roles indicating that student nurses assume a role such as a registered nurse or even a charge nurse and are charged with objectives to provide care for a patient in the scenario in the way a registered nurse or charge nurse would provide care. This is a widely accepted practice in simulation and results in a novice demonstration of patient care.

Novice demonstrations provide a frame of reference for learners to recognize and control for errors (Callan et al., 2013; Monfardini et al., 2013). Motor reproduction based on the novice, or flawed/erroneous, demonstration is supported to help future behavior (Anderson & Campbell, 2015; Andrieux & Proteau, 2013, 2014; Callan et al., 2013; Domuracki et al., 2015; Hiyamizu et al., 2014). These studies demonstrated that through self-observation of previous actions or observation of a novice, inconsistent results may occur and that feedback is necessary for improvement (Andrieux & Proteau, 2013, 2014, 2016; Domuracki et al., 2015). Therefore, the novice demonstrations are not considered efficient alone for learning environments according to literature outside the discipline, yet, the majority of research in simulation and the associated positive results are based on these novice demonstrations of patient care and the debriefing afterwards.

Implications for Simulation and Nursing Education

The findings from this study are meaningful to nurse educators using simulation in prelicensure nursing education and other health professions using simulation as a teaching and learning strategy. The challenges identified within this study point to ways in which educators can use simulation and measure outcomes with confidence in the data and inferences made. The majority of students in simulation are observing the scenario unfold as opposed to actively participating (Hayden et al., 2014) and up to this point, research and theoretical support for simulation in nursing education has equated having students observing nursing practice with active and experiential learning guided by the same frameworks as actively participating students. This study is the first study to support this finding that observers and active participants are similarly going through the KELT cycle of grasping and transforming experiences.

The Observational Experiential Learning Framework in Simulation

Kolb (1984) suggested the concrete experience requires minimal analysis or inquiry. This is concerning considering simulation is widely supported by KELT and that immediately after prelicensure nursing education students begin caring for complex patients. Therefore, OEL is a framework merging the work of SLT and observational learning with KELT and supports that attention and motivation must inform the concrete experience to facilitate attentional and intentional observation and active participation in the simulation. The prebrief in simulation receives the least support in the literature for its practice in simulation (Page-Cutrara, 2015); however, it is the first interaction with the facilitator and learner and sets the stage for engagement of the learner’s attention (Rudolph et al., 2014). Therefore, while there are assessments to evaluate the facilitator during the simulation and the debrief, the prebrief is just as important to make certain elements such as the patient's story, objectives, expectations, logistics, and psychological safety including the fiction contract are addressed. The prebrief is supported theoretically to enact the SLT concepts of attention and motivation. Further, while the prebrief may be seen as a way of informing active participants of the objectives and ensuring their psychological safety, it is imperative that those in observer roles are part of the prebriefing to fully understand objectives and also have a sense of psychological safety. Although observers are not in the stressful environment of the unfolding simulation scenario, the debriefer will challenge their knowledge and assumptions as well.

This study and literature review addressed the common practices of prebriefing, facilitating a scenario, debriefing, and measuring knowledge with short NCLEX-style pretest and posttest knowledge instruments. Participants were randomly assigned by the facilitator to a small group of five or six students and then randomly assigned to their role in simulation immediately prior to prebrief. All students were then guided through a simulation experience following the INACSL Standards of Best Practice: Simulation^{SM}. Therefore, simulations that include randomization to role in small groups of five to six students, facilitation according to the INACSL Standards of Best Practice: Simulation^{SM} may result in similar outcomes for knowledge demonstration between active participants and observers on the grasped and transformed experience. Debriefing with a theory-derived and evidence-based debriefing method such as DML may result in similar knowledge demonstration between active participants and observers. However, this study was facilitated by the Investigator for optimal control. This finding supports that training for educators is needed to implement the INACSL Standards of Best Practice: Simulation^{SM} and that training is needed for debriefing (Bradley, 2016) so that simulations and debriefings are consistent when numerous facilitators are present.

Moreover, this study supported that KELT was facilitated through simulation and debriefing with DML. The Concrete Experience (CE) was achieved through active participation in or observation of the opioid-induced respiratory distress scenario. Reflective Observation and Abstract Conceptualization were facilitated through the theoretically derived debriefing method, DML. Finally, Active Experimentation (AE) was also facilitated with the reflection-beyond-action parallel case of DML by presenting a contextually similar situation with subtle changes in respiratory distress (anaphylaxis). The Active Experimentation phase, up to this point, has been the most debated area of KELT in simulation regarding how to operationalize this concept. Ultimately, this study supports that the current practices in simulation operationalize these concepts.

Further, the concept of knowledge retention in the OEL framework was assessed as an outcome of the grasped and transformed learning experience in KELT. Considering no differences were found between students in different roles throughout the study, this provided theoretical support and empirical support for knowledge retention for both active participants and observers in simulation learning. Active participants and observers were able to grasp an experience and then transform that experience regardless of hands-on participation without a difference in knowledge demonstration and knowledge retention. This is important because it supports a shift away from the commonplace belief that nursing requires doing the tasks in clinical situations; rather, it is about continuing the investigation into “when, how, and under what conditions students best learn practice” (Ironside et al., 2014, p. 191). Participants in this study gained knowledge about patient care in the most active and most passive roles when the learning environment was carefully constructed according to current standards of best practice. This provides support that while debriefing with theory-derived methods of debriefing is important, a scenario designed and facilitated according to standards of practice is just as important as they both resulted in significant knowledge gain.

The findings of this study support that knowledge decayed four weeks later despite role about the patient cared for during the simulation scenario and the parallel case indicating a need for repetition of contextual and complex patient simulations. Currently, literature supports that knowledge decays regarding basic cardiopulmonary resuscitation skills in nursing students in as little as three months (Aqel & Ahmad, 2014; Oermann et al., 2011). Therefore, as situations become more complex requiring higher order thinking, administrators and educators should not only consider how simulation is sequenced with direct patient care clinical experiences (Hansen & Bratt, 2017; Herrington & Schneidereith, 2017), but also how each simulation is sequenced throughout curriculum and the concepts that thread from one simulation to the next (Schlairet & Fenster, 2012). Rather than moving from one body system to another, this study provides evidence supporting that simulations should build on similar, yet different contextual presentations of concepts. While assimilation and accommodation are demonstrated during one simulation, the knowledge decay signifies that simulations around comparable concepts should be occurring at least every four weeks. This supports the critique of conventional pedagogical approaches to teaching and learning found in nursing education where there is an assumption that once the content is covered, the thinking about that content follows (Ironside, 2004). Ironside (2004) suggested that nursing educators must think more about how content is taught rather than what content should be taught. This study supports this suggestion to consider how content is taught and revisited throughout education as there was a significant knowledge decay in as quickly as four weeks. Additional interventions, such as sequencing subsequent simulations that are carefully constructed by educators to readdress the thinking and actions from previous situations, should be considered to help prevent knowledge decay.

Further, the participants in this study are one semester away from graduation and entry to practice. The results of this study and the previous implications for nurse educators regarding covering content are meaningful to educators in practice settings considering newly licensed nurses, as well as practicing nurses, may still experience similar decays in knowledge during their orientation phase and employment. As hospital educators consider how to orient new nurses and demonstrate competency, internships and annual competency assessments should incorporate teaching and learning practices to maintain competency if knowledge may potentially decline so quickly. Participants in this study scored perfectly on the CE Posttest 2 and AE Posttest 1 instrument administered immediately after debriefing and then scored below the passing standard of 75 four weeks later on both assessments. This finding is important because it demonstrates that interventions such as simulation and debriefing paired with competency assessments may need to be frequently administered to maintain competency. Clearly, if cardiopulmonary resuscitation skills are decaying quarterly, as evidenced by the initiation of Resuscitation Quality Improvement® Program (American Heart Association, 2018), competencies centered around providing safe care in complex clinical situations with acute-on-chronic comorbidities must be maintained over time especially if exposure is infrequent.

Finally, education for healthcare trainees using simulation is costly and requires numerous resources posing challenges for colleges and universities that desire to efficiently and adequately prepare healthcare professionals (Maloney & Haines, 2016). At the same time, the gaming generation of learners with advanced visual learning capabilities is entering into the higher education, health professional training classroom (Kühn & Gallinat, 2014). During this time of challenges paired with a new generation of learners, researchers and educators can continue to shape the observational experience through maximizing the use of technology to assist in grasping and transforming experiences in simulation and in teaching and learning strategies. The previous observational protocols, brain-based learning science, virtual reality opportunities, and ability to use observation in clinical practice are not limited to using an audiovisual room connecting one simulation room to another. Technology can allow learners to observe across simulation labs, campuses, and cities where learners grasp care through a rich observation experience followed by debriefing with theory-based debriefing supported to facilitate experiential and observational learning. Learning through observation needs further support and rigorous research to evaluate outcomes and experiences for healthcare professions training. Cordovani and Cordovani (2016) stated, “In an environment [healthcare] where efficacy and effectiveness are essential, observational learning seems to fit well” (p.1). Therefore, the time is ripe—and right—for advancing the science for nursing and health professions education through the use of observation.

Instrumentation

The knowledge instruments were developed based on three semesters of pilot data to arrive at the questions used in this study. The CE instrument was developed to assess knowledge about the clinical situation participants either actively participated in or passively observed (opioid-induced respiratory distress). The AE instrument was developed to assess knowledge about the parallel case (anaphylaxis) that was facilitated through DML. These two assessments had identical knowledge domains and NCLEX-RN processes. This operationalized two major concepts in the KELT framework allowing the assessment of the two primary forms of knowledge facilitated through creating tension between grasping and transforming experiences throughout simulation and debriefing: assimilation and accommodation.

Educators should consider how questions are delivered in simulation and compare knowledge over time related to previous simulations. Repeating similar questions or slightly adjusting questions to assess if learners assists in the operationalization of assimilation and accommodation. Students were exposed to the same questions multiple times throughout the simulation experience in this study; yet, knowledge declined on those exact same questions four weeks later. This indicates that using the same question provides insight if knowledge was ever gained, if it was maintained, or if it decayed.

Finally, challenges in demonstrating reliability and validity were explored over the course of three pilot studies resulting in the final instrumentation for this study. Although a tradeoff may occur in reliability and validity when short knowledge assessments occur, it does not indicate that developing knowledge assessments and measuring knowledge should be haphazard. Careful consideration of questions that are appropriate for the learner, demonstrate adequate difficulty and discrimination, are sensitive to the content of the simulation, should go into every knowledge assessment used so that reliable inferences can be made.

Limitations

There were three substantial limitations identified within this study. While experimental design controlled major threats to internal validity, there are limitations that threaten the external validity to this study. The first is related to the execution of the simulations and debriefings. This study used one facilitator and one debriefer (the Investigator) that was trained extensively in the use of the

INACSL Standards of Best Practice: Simulation^{SM} and has also been trained extensively in the DML debriefing method and components of the Debriefing Assessment for Simulation in Healthcare (Simon, Raemer, & Rudolph, 2017). This study may not generalize to every simulation facilitator and debriefer who has not received this training and raises the previously mentioned need for faculty training and competency in debriefing (Bradley, 2016; Rudolph et al., 2016). While a necessary control for internal validity in this study to eliminate the confounding variable of different facilitation and debriefing styles, it does limit the external validity until tested in other student groups with other different debriefing methods and multiple trained facilitators and debriefers.

The second limitation is related to the instruments used in this study. The instruments were designed to operationalize constructs of the OEL framework and were nearly identical in nature. It is possible that the similarity of instruments, the four administrations in the span of two hours, and the ungraded nature of these instruments resulted in testing fatigue and learners asking specific questions in the debriefing to answer the questions. However, the Investigator was the debriefer and all questions were countered with Socratic questioning true to the DML method. Also, despite the numerous times students were exposed to the exact same questions, knowledge still decayed four weeks later. The Investigator also piloted the knowledge instruments used in this study and was aware of the knowledge being tested on these instruments. Blinding the facilitators and debriefers to the instruments used would provide further validity to the simulation and instrumentation for the study.

Finally, all participants were familiar with the Investigator in this study due to previous coursework. It could be assumed that because students knew this was a doctoral study, students desired to perform better in both roles. Although the independent variable of interest (student role) was not disclosed a priori, students may have desired to improve and were more attentive during observation than in other simulations.

Recommendations for Further Research

The purpose of this study was to explore the relationship between prelicensure baccalaureate nursing students' roles in simulation (active participant or observer) and cognitive knowledge demonstration, knowledge retention, and knowledge application in simulation with DML. Future research in this area is needed and several recommendations for future studies can be derived from this work. The first recommendation is to provide a more rigorous study design to extend external validity. A multi-site study providing in-depth training to different facilitators and debriefers other than the Investigator would add generalizability, control previously described limitations, and provide support for the effectiveness of current practices in simulation learning for active participant and observer roles. Additionally, different debriefing methods should be explored and blinding to the knowledge instruments should be considered.

While this study supported that all concepts of KELT were facilitated, more theoretical support is needed to establish that learners in observer roles are actively inquiring and analyzing the concrete experience being observed and if this experience can be optimized. Much of the literature in simulation has been centered on the transformation of the simulation experience through debriefing, and this research demonstrated that further exploration of how learners grasp experiences could provide more evidence-based learning environments for simulation in health professions education. The OEL framework supports that there are two antecedents from SLT, attention and motivation, to the grasped Concrete Experience. There are multiple opportunities in the literature to begin exploring these concepts in the OEL framework, specifically in the prebriefing component of simulation and how proper prebriefing fosters these concepts.

The prebrief may be an area of further exploration as to how learners grasp the simulation scenario considering it is the place where learners first begin to anticipate and plan ahead (Page-Cutrara, 2015), which would assist in attention of learners and Social Cognitive Theory (SCT) concepts of anticipation. Further, feed-forward, or subtly cuing observers in the prebrief to what they are about to observe may facilitate intentional observing, or observing to recognize (Andrieux & Proteau, 2016). Dang, Palicte, Valdez, and O'Leary-Kelley (2018) found that virtual reality observation more closely resembles active participation than observing through the traditional audio-visual television equipment. Their measurement of the concept of *presence,* or the feeling of being somewhere, may be related to attention of observers. All of these areas of inquiry provide opportunities to begin to set the stage for increased attention and motivation for active, meaningful, and significant learning experiences before the simulation scenario even begins.

Further, after the initial simulation experience and before debriefing, there are opportunities to optimize the grasping of simulated scenario experience. Brain-based observational protocols are currently being tested in simulation for health professions education literature regarding expert and novice observations and is supported to result in significant learning benefits (Welsher et al., 2018). Outcomes in simulation are overwhelmingly based on the execution of care performed by novices and then debriefed by a clinical teacher/expert. Yet to be explored extensively are results when novice learners are able to observe the *expert* demonstration and compare to their *novice* peers' performance and how knowledge is gained, retained, and applied through debriefing. This study provides evidence based on observation of novice learners, as do most studies in simulation for health professions education literature, but the novice demonstration is typically not recommended as the sole form of learning. The findings thus far are promising considering the recent rise in the use and support for simulation; however, observing an expert may have an impact on knowledge retention and or applying the knowledge behaviorally. While the novice or flawed observation provides for error-control, the expert observation provides an opportunity for behavior mimicry through mirror neuron system activation; thus, mixed observation protocols are the most effective observational learning environments (Anderson & Campbell, 2015; Andrieux & Proteau, 2013, 2014; Callan et al., 2013; Cordovani & Cordovani, 2016; Domuracki et al., 2015; Sakadjian et al., 2014; St-Onge et al., 2013; Welsher et al., 2018).

Motor behavior, the second SLT outcome of the OEL framework, was not examined in this study. This study neither supports nor recommends that all experiences become observational. Rather, ongoing investigation is needed regarding the knowledge gained (cognitive and behavioral) through observational and hands-on learning experiences. Brain-based learning protocols provide evidence for learning motor behavior through observing expert and novice behavior. Considering that thinking becomes observable when learners audibly speak what they are thinking (Meichenbaum, 1984), studies incorporating these protocols where experts make their thinking observable would provide opportunities to examine the knowledge that is behaviorally reproduced when learners observe and then participate in simulation, or vice versa.

This study needs be extended to expand on literature involving sequencing simulation (Hansen & Bratt, 2017; Herrington & Schneidereith, 2017; Schlairet & Fenster, 2012) and incorporate the actual second (anaphylaxis) simulation with debriefing. This study found that knowledge decayed for the actual simulated clinical situation and the parallel case four weeks later. Additional research is needed to determine how often experiences need to be offered for different types of concepts taught using simulation. By continuing the practice of sequencing contextually similar cases and designing instruments to operationalize these concepts, the opportunities to examine assimilation and accommodation abound within nursing and health professions curricula. Respiratory distress is treated similarly despite different underlying contextual differences. This study examined patients experiencing opioid-induced respiratory distress and anaphylaxis; however, could be further examined in scenarios with magnesium-toxic intrapartum patients, asthmatic clients, congestive heart failure clients, and could be adjusted on acuity based on the objectives for the learner.

A possible reason for this knowledge decay may be found in the simulation literature surrounding deliberate practice and that frequent repetition is needed for mastery learning of skills (Clapper & Kardong-Edgren, 2012; Gonzalez & Kardong-Edgren, 2017; Oermann et al., 2011). At a national level, cardiopulmonary resuscitation skills training agencies are recommending increasing the frequency of training due to significant skills decay in much shorter time periods (American Heart Association, 2018; Sutton, Nadkami, & Abella, 2012). This finding is supported by the aviation industry, the first industry that used simulation largely for education, proficiency, and competency. Pilots must receive simulated training every six months for infrequent experiences that are not logged in-flight (U.S. Department of Transportation Federal Aviation Administration, 2015). This practice is due to a concern that knowledge of how to handle certain identified situations will decrease if not frequently exposed. Unfortunately, this practice did not carry forward into simulation in prelicensure nursing education or professional practice. It is not surprising that complex higher-order thinking and knowledge about critical care situations decreases in prelicensure nursing education with infrequent exposure. Thus, as previously mentioned, sequencing simulations with nuances in underlying clinical concepts to contextually link to one another along may be inextricably linked with deliberate practice literature resulting in deliberate *thinking* practice for mastery learning of clinically complex situations. This body of knowledge could be examined in both educational and practice settings where learners receive frequent interventions, or ‘boosters’, to help maintain competency.

Conclusion

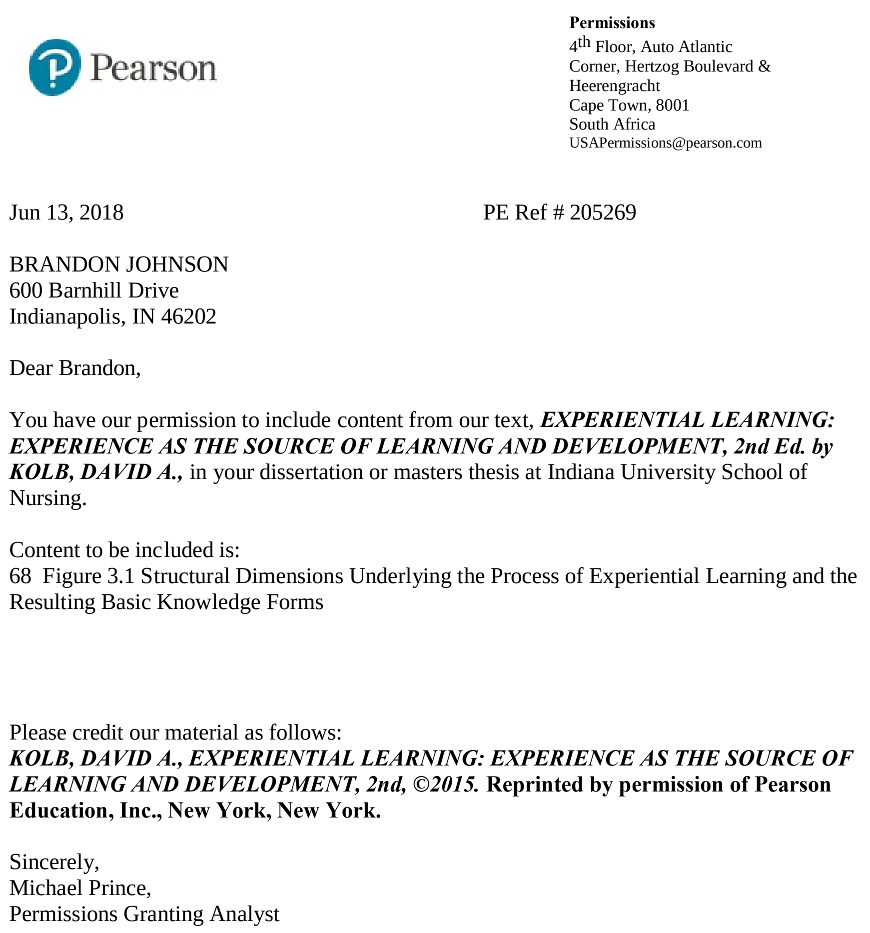
The findings from this research study contribute to the work of previous researchers in the area of simulation, debriefing, and learning for students in the observer role. This study also deepened the theoretical support by proposing OEL, a new framework that is based on current theories supporting simulation, and supported that observers undergo experiential learning concepts that had previously been assumed and not explored. Additionally, the review of literature provided evidence for optimal observational learning through examining literature in disciplines other than nursing that are needed in the body of nursing education research and simulation.

The findings from this study reveal that simulation facilitated according to the INACSL Standards of Best Practice: Simulation^{SM} operationalize concepts within KELT and observational learning that were presented in a new framework, OEL. Specifically, this study supported that the role of the learner during the concrete experience resulted in no significant differences in knowledge demonstration or retention indicating that learners can grasp clinical care through both active participation and observation. A simulation scenario has the capability of significantly increasing knowledge for the most active and passive learners. Further, using theory-derived and evidence-based debriefing methods such as DML resulted in significant knowledge increase for the previous simulation and the ability to apply (assimilate/accommodate) knowledge to a parallel clinical situation. This finding supported that DML facilitated the remaining concepts of KELT (reflective observation, abstract conceptualization, and active experimentation) and resulted in knowledge assimilation and accommodation. Therefore, implementing the INACSL Standards of Best Practice: Simulation^{SM} in this study resulted in no significant differences between active participant and observers' knowledge demonstration, knowledge retention, and knowledge applied (assimilated/accommodated) to the concrete experience and similar parallel clinical situation after debriefing. This study also supports that despite identical execution and debriefing, knowledge decayed on both cases by four weeks.

In conclusion, despite the limitations, this study uncovered useful information about the relationship of learner roles in simulation for prelicensure baccalaureate nursing education and cognitive knowledge demonstration and knowledge retention by providing an experimental, repeated-measures study without altering the common practice of simulation. This study contributes to the growing body of knowledge for the use of different roles in simulation in nursing education and health professions education and supports how the pedagogy of teaching and learning with simulation can be used in both education and practice.

APPENDIX A

Permission to Reprint the Process of Experiential Learning



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Jun 13, 2018 PE Ref # 205269

BRANDON JOHNSON
600 Barnhill Drive
Indianapolis, IN 46202

Dear Brandon,

You have our permission to include content from our text, ***EXPERIENTIAL LEARNING: EXPERIENCE AS THE SOURCE OF LEARNING AND DEVELOPMENT, 2nd Ed. by KOLB, DAVID A.,*** in your dissertation or masters thesis at Indiana University School of Nursing.

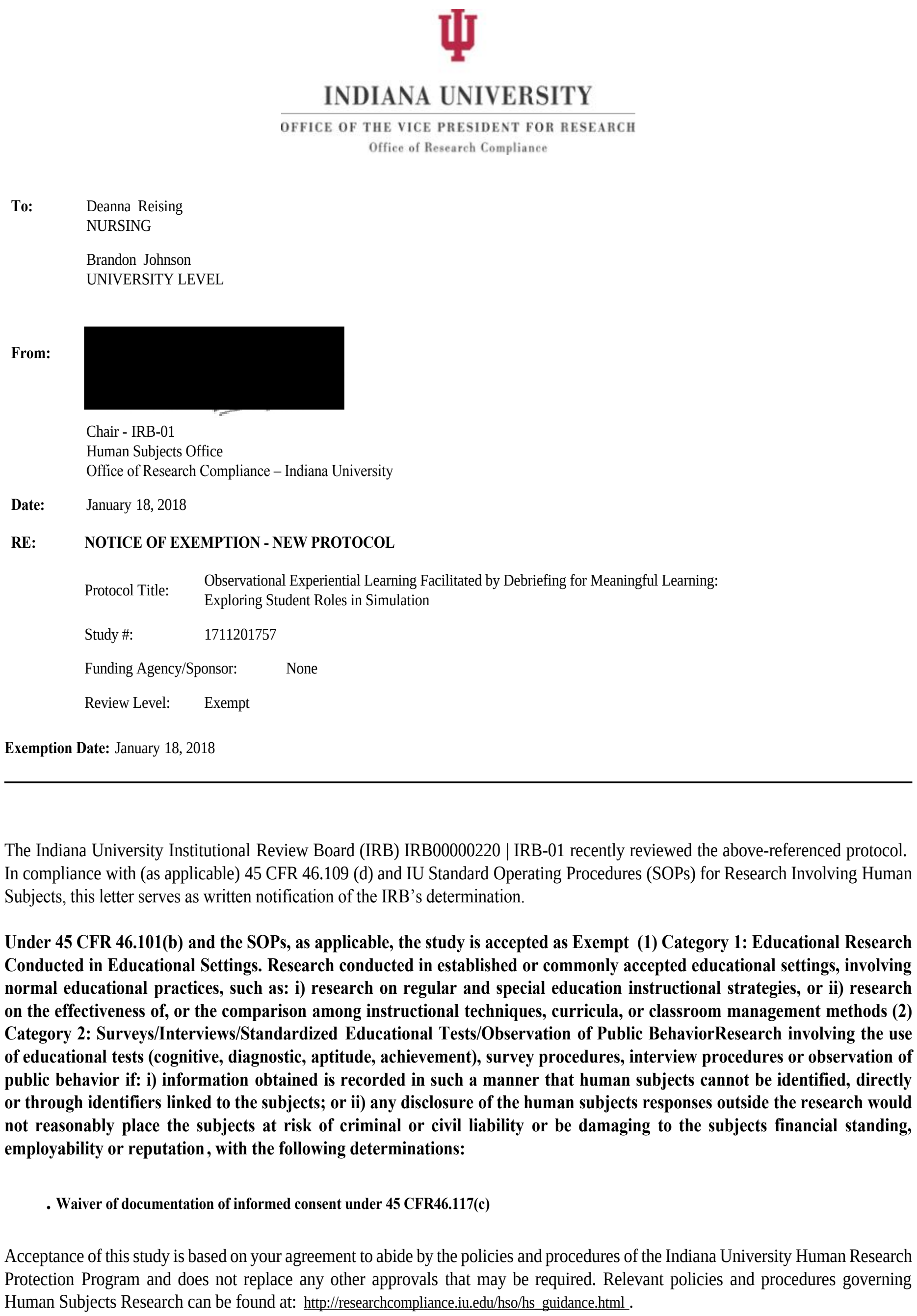
Content to be included is:
68 Figure 3.1 Structural Dimensions Underlying the Process of Experiential Learning and the Resulting Basic Knowledge Forms

Please credit our material as follows:
KOLB, DAVID A., EXPERIENTIAL LEARNING: EXPERIENCE AS THE SOURCE OF LEARNING AND DEVELOPMENT, 2nd, ©2015. **Reprinted by permission of Pearson Education, Inc., New York, New York.**

Sincerely,
Michael Prince,
Permissions Granting Analyst

APPENDIX B

Institutional Review Board Approval



INDIANA UNIVERSITY
OFFICE OF THE VICE PRESIDENT FOR RESEARCH
Office of Research Compliance

To: Deanna Reising
NURSING

Brandon Johnson
UNIVERSITY LEVEL

From: [redacted]

Chair - IRB-01
Human Subjects Office
Office of Research Compliance – Indiana University

Date: January 18, 2018

RE: **NOTICE OF EXEMPTION - NEW PROTOCOL**

Protocol Title: Observational Experiential Learning Facilitated by Debriefing for Meaningful Learning: Exploring Student Roles in Simulation

Study #: 1711201757

Funding Agency/Sponsor: None

Review Level: Exempt

Exemption Date: January 18, 2018

The Indiana University Institutional Review Board (IRB) IRB00000220 | IRB-01 recently reviewed the above-referenced protocol. In compliance with (as applicable) 45 CFR 46.109 (d) and IU Standard Operating Procedures (SOPs) for Research Involving Human Subjects, this letter serves as written notification of the IRB's determination.

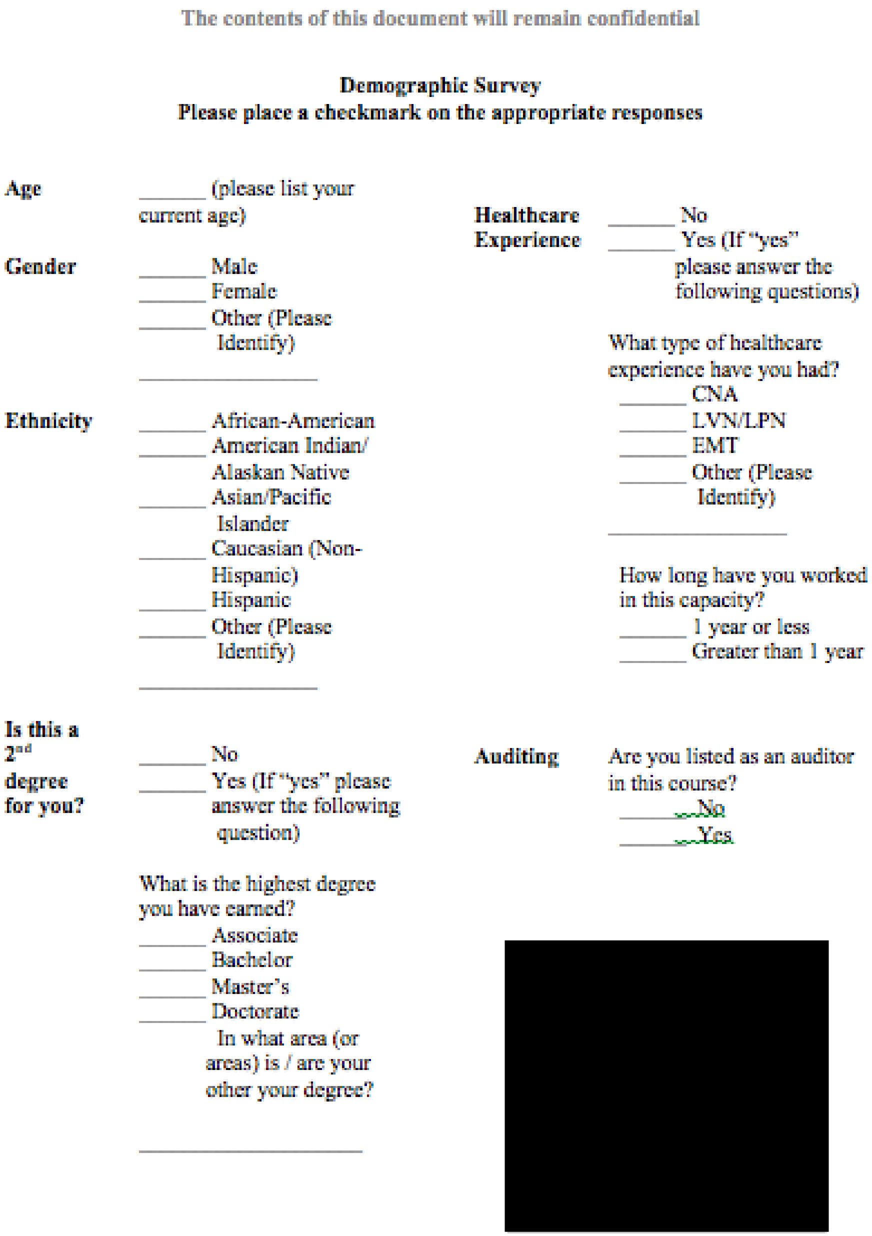
Under 45 CFR 46.101(b) and the SOPs, as applicable, the study is accepted as Exempt (1) Category 1: Educational Research Conducted in Educational Settings. Research conducted in established or commonly accepted educational settings, involving normal educational practices, such as: i) research on regular and special education instructional strategies, or ii) research on the effectiveness of, or the comparison among instructional techniques, curricula, or classroom management methods (2) Category 2: Surveys/Interviews/Standardized Educational Tests/Observation of Public BehaviorResearch involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures or observation of public behavior if: i) information obtained is recorded in such a manner that human subjects cannot be identified, directly or through identifiers linked to the subjects; or ii) any disclosure of the human subjects responses outside the research would not reasonably place the subjects at risk of criminal or civil liability or be damaging to the subjects financial standing, employability or reputation, with the following determinations:

- **Waiver of documentation of informed consent under 45 CFR46.117(c)**

Acceptance of this study is based on your agreement to abide by the policies and procedures of the Indiana University Human Research Protection Program and does not replace any other approvals that may be required. Relevant policies and procedures governing Human Subjects Research can be found at: http://researchcompliance.iu.edu/hso/hs_guidance.html .

APPENDIX C

Demographic Survey



The contents of this document will remain confidential

Demographic Survey
Please place a checkmark on the appropriate responses

Age
______ (please list your current age)

Gender
______ Male
______ Female
______ Other (Please Identify)
____

Ethnicity
______ African-American
______ American Indian/ Alaskan Native
______ Asian/Pacific Islander
______ Caucasian (Non-Hispanic)
______ Hispanic
______ Other (Please Identify)
____

Is this a 2nd degree for you?
______ No
______ Yes (If "yes" please answer the following question)

What is the highest degree you have earned?
______ Associate
______ Bachelor
______ Master's
______ Doctorate
In what area (or areas) is / are your other your degree?
____

Healthcare Experience
______ No
______ Yes (If "yes" please answer the following questions)

What type of healthcare experience have you had?
______ CNA
______ LVN/LPN
______ EMT
______ Other (Please Identify)
____

How long have you worked in this capacity?
______ 1 year or less
______ Greater than 1 year

Auditing
Are you listed as an auditor in this course?
______ No
______ Yes

[redacted]

APPENDIX D

CE Instrument

Concrete Experience—Assimilation
Opioid-Induced Respiratory Depression
Knowledge Instrument

Doris Bowman is a 30-year-old female patient under the care of Dr. Phelps. She is currently post-operative total abdominal hysterectomy with bilateral salpingo—oophorectomy. The patient received fentanyl during the surgery and hydromorphone towards the end of surgery as they discontinued anesthesia. The patient is now post-operative and is complaining of pain and the patient receives an additional intravenous dose of hydromorphone. After receiving the hydromorphone, the family member steps outside and yells "I can't get her to wake up.

Please answer the following questions related to Mrs. Bowman's immediate care.

1. Which of the following assessments indicates an adverse reaction to the hydromorphone?
    a. **Bradypnea**
    b. Inspiratory stridor
    c. **Lethargic**
    d. **Decreased oxygen saturation**
    e. Anxiety
    f. Bradycardia

2. The nurse would expect which of the following priority findings?
    a. Wheeze in bilateral lung fields
    b. **Shallow, diminished lung sounds**
    c. Bradycardia
    d. Glasgow Coma Scale: 14

3. Which of the following medications should the nurse prepare to administer first?
    a. **Naloxone**
    b. Flumazenil
    c. Dantrolene
    d. Epinephrine

4. Ms. Bowman is receiving oxygen at 15L/min via a nonrebreather mask. The nurse recognizes she is receiving which of the following fraction of inspired oxygen (FiO2) percentages?
    a. 40-60%
    b. 28-36%
    c. 60-80%
    d. 80-95%

5. Which of the following assessments should the nurse give highest priority to?
    a. Oxygen saturation
    b. Blood Pressure
    c. Level of Consciousness
    d. Heart rate

6. The respiratory rate declines to 2 breaths per minute, the SpO2 declines to 60%, and the patient is not arousing. Which statement indicates the nurse understands **prioritization**?
    a. “I will notify the respiratory therapist for a breathing treatment immediately.”
    b. “I will initiate rescue breathing with a bag-valve mask at 1 breath every 4-6 seconds.”
    c. “I will begin chest compressions at a rate of 30 compressions:2 respirations.”
    d. “I will initiate the protocol for immediate intubation with respiratory therapy.”

7. An arterial blood sample is obtained from Ms. Bowman. Which of the following would the nurse anticipate?
    a. pH: 7.47
    b. PaCO2: 51 mmHg
    c. PaO2: 86 mmHg
    d. HCO3: 30 mEq/L

8. A nurse is providing basic life support for respiratory arrest and Ms. Bowman’s oxygen saturation is not increasing. Which of the following actions should the nurse implement **first**?
    a. Assess if the mask is tightly sealed around the patient’s nose and mouth
    b. Notify the provider to prepare for a rapid sequence intubation
    c. Provide mouth-to-mouth resuscitation and initiate chest compressions
    d. Apply suction to dislodge a potential mucus plug in the airway

9. Mrs. Bowman begins to recover and over time she is able to tolerate oxygen at 2L/min via a nasal cannula. The nurse recognizes she is receiving which of the following inspired oxygen concentration (FiO2) percentages?
    a. 70%
    b. 50%
    c. 36%
    d. 28%

10. The nurse understands that which of the following assessments indicates the expected therapeutic response to the antidote indicating patient stability? Select all that apply:
    a. Glasgow Coma Scale: 15
    b. Respiratory rate: 8 breaths/minute
    c. Blood pressure: 87/45 mmHg
    d. Lung sounds clear bilaterally
    e. Urticaria
    f. Heart rate: 87 beats/minute

APPENDIX E

AE Instrument

Active Experimentation—Assimilation/Accommodation
Anaphylaxis
Knowledge Instrument

Javier Maya is an 8-year-old male patient who was at school when he was stung by a bee. His teacher rushed him into the school nurse clinic as Javier was inconsolable and beginning to cough.

Please answer the following questions related to Javier's immediate care.

1. Which of the following assessments indicates an immediate adverse reaction to the bee sting?
    a. Bradypnea
    b. Inspiratory stridor
    c. Lethargic
    d. Decreased oxygen saturation
    e. Anxiety
    f. Bradycardia

2. The nurse would expect which of the following priority findings?
    a. Wheeze in bilateral lung fields
    b. Shallow, diminished lung sounds
    c. Bradycardia
    d. Glasgow Coma Scale: 14

3. Which of the following medications should the nurse prepare to administer first?
    a. Naloxone
    b. Flumazenil
    c. Dantrolene
    d. Epinephrine

4. Javier is receiving oxygen at 15L/min via a nonrebreather mask. The nurse recognizes he is receiving which of the following fraction of inspired oxygen (FiO2) percentages?
    a. 40-60%
    b. 28-36%
    c. 60-80%
    d. 80-95%

5. Which of the following assessments should the nurse give highest priority to?
    a. **Oxygen saturation**
    b. Blood Pressure
    c. Level of Consciousness
    d. Heart rate

6. The respiratory rate increases to 40 breaths per minute, the SpO2 declines to 60%, and the patient is not arousing. Which statement indicates the nurse understands **prioritization**?
    a. "I will notify the respiratory therapist for a breathing treatment immediately."
    b. "I will begin rescue breathing with a bag-valve mask at 1 breath every 4-6 seconds."
    c. "I will immediately begin chest compressions at a rate of 30 compressions:2 respirations."
    d. **"I will initiate the protocol for immediate intubation with respiratory therapy."**

7. An arterial blood sample is obtained from Javier. Which of the following would the nurse anticipate?
    a. pH: 7.47
    b. **PaCO2: 51 mmHg**
    c. PaO2: 86 mmHg
    d. HCO3: 30 mEq/L

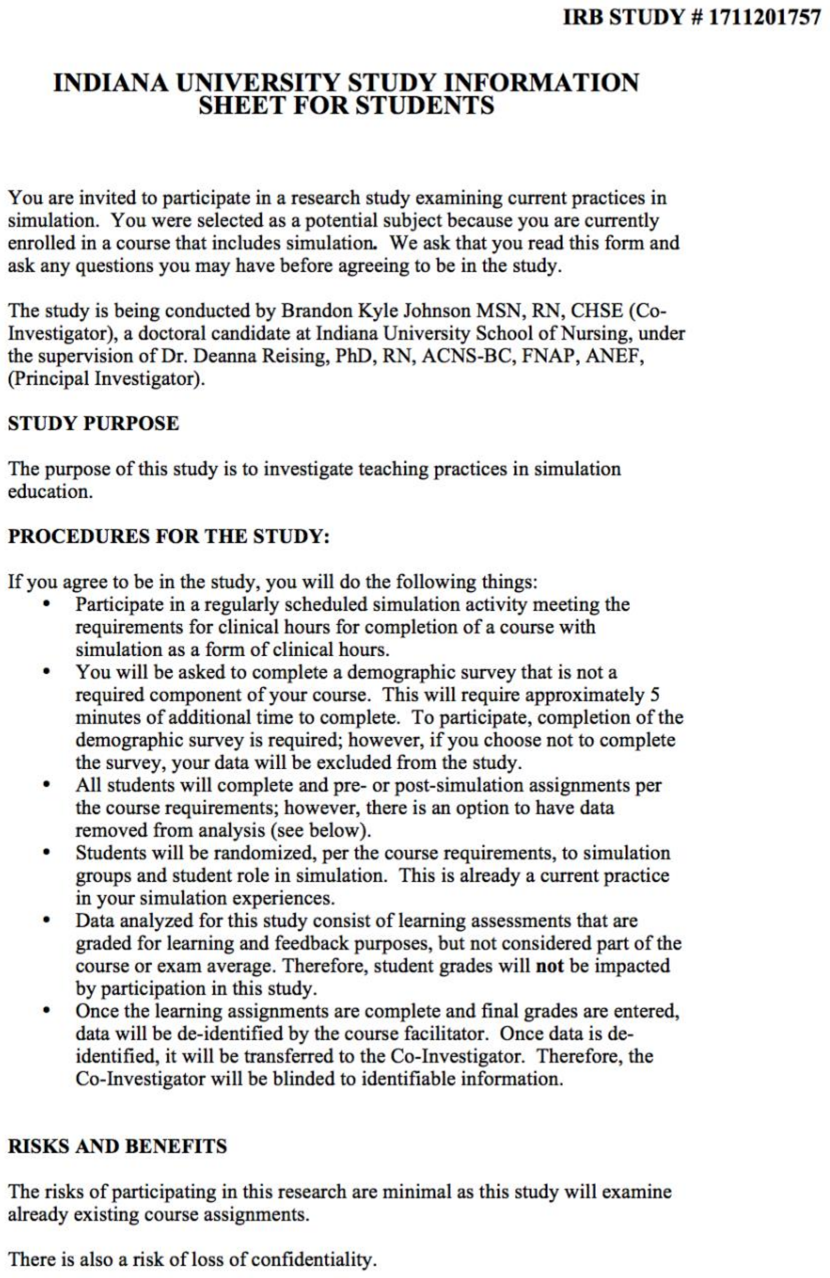
8. A nurse is providing basic life support for respiratory arrest and Javier's oxygen saturation is not increasing. Which of the following actions should the nurse implement **first**?
    a. Assess if the mask is tightly sealed around the patient's nose and mouth
    b. **Notify provider to prepare for a rapid sequence intubation**
    c. Provide mouth-to-mouth resuscitation and initiate chest compressions
    d. Apply suction to dislodge a potential mucus plug in the airway

9. Javier begins to recover and over time she is able to tolerate oxygen at 2L/min via a nasal cannula. The nurse recognizes he is receiving which of the following inspired oxygen concentration (FiO2) percentages?
    a. 70%
    b. 50%
    c. 36%
    d. **28%**

10. The nurse understands that which of the following assessments indicates the expected therapeutic response to the antidote indicating patient stability? Select all that apply:
    a. **Glasgow Coma Scale: 15**
    b. Respiratory rate: 8 breaths/minute
    c. Blood pressure: 87/45 mmHg
    d. **Lung sounds clear bilaterally**
    e. Urticaria
    f. **Heart rate: 87 beats/minute**

APPENDIX F

Study Information Sheet for Students



IRB STUDY # 1711201757

INDIANA UNIVERSITY STUDY INFORMATION SHEET FOR STUDENTS

You are invited to participate in a research study examining current practices in simulation. You were selected as a potential subject because you are currently enrolled in a course that includes simulation. We ask that you read this form and ask any questions you may have before agreeing to be in the study.

The study is being conducted by Brandon Kyle Johnson MSN, RN, CHSE (Co-Investigator), a doctoral candidate at Indiana University School of Nursing, under the supervision of Dr. Deanna Reising, PhD, RN, ACNS-BC, FNAP, ANEF, (Principal Investigator).

STUDY PURPOSE

The purpose of this study is to investigate teaching practices in simulation education.

PROCEDURES FOR THE STUDY:

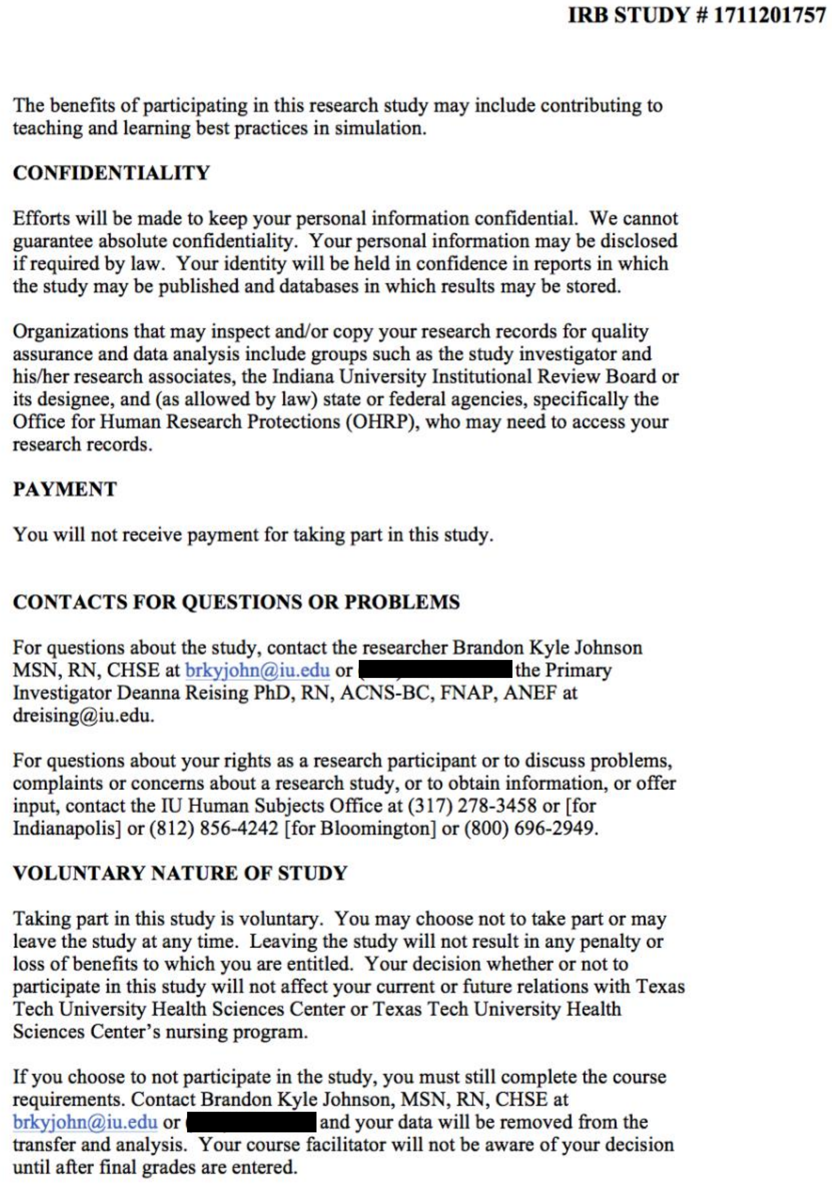
If you agree to be in the study, you will do the following things:

- Participate in a regularly scheduled simulation activity meeting the requirements for clinical hours for completion of a course with simulation as a form of clinical hours.
- You will be asked to complete a demographic survey that is not a required component of your course. This will require approximately 5 minutes of additional time to complete. To participate, completion of the demographic survey is required; however, if you choose not to complete the survey, your data will be excluded from the study.
- All students will complete and pre- or post-simulation assignments per the course requirements; however, there is an option to have data removed from analysis (see below).
- Students will be randomized, per the course requirements, to simulation groups and student role in simulation. This is already a current practice in your simulation experiences.
- Data analyzed for this study consist of learning assessments that are graded for learning and feedback purposes, but not considered part of the course or exam average. Therefore, student grades will **not** be impacted by participation in this study.
- Once the learning assignments are complete and final grades are entered, data will be de-identified by the course facilitator. Once data is de-identified, it will be transferred to the Co-Investigator. Therefore, the Co-Investigator will be blinded to identifiable information.

RISKS AND BENEFITS

The risks of participating in this research are minimal as this study will examine already existing course assignments.

There is also a risk of loss of confidentiality.



The benefits of participating in this research study may include contributing to teaching and learning best practices in simulation.

CONFIDENTIALITY

Efforts will be made to keep your personal information confidential. We cannot guarantee absolute confidentiality. Your personal information may be disclosed if required by law. Your identity will be held in confidence in reports in which the study may be published and databases in which results may be stored.

Organizations that may inspect and/or copy your research records for quality assurance and data analysis include groups such as the study investigator and his/her research associates, the Indiana University Institutional Review Board or its designee, and (as allowed by law) state or federal agencies, specifically the Office for Human Research Protections (OHRP), who may need to access your research records.

PAYMENT

You will not receive payment for taking part in this study.

CONTACTS FOR QUESTIONS OR PROBLEMS

For questions about the study, contact the researcher Brandon Kyle Johnson MSN, RN, CHSE at brkyjohn@iu.edu or [redacted] the Primary Investigator Deanna Reising PhD, RN, ACNS-BC, FNAP, ANEF at dreising@iu.edu.

For questions about your rights as a research participant or to discuss problems, complaints or concerns about a research study, or to obtain information, or offer input, contact the IU Human Subjects Office at (317) 278-3458 or [for Indianapolis] or (812) 856-4242 [for Bloomington] or (800) 696-2949.

VOLUNTARY NATURE OF STUDY

Taking part in this study is voluntary. You may choose not to take part or may leave the study at any time. Leaving the study will not result in any penalty or loss of benefits to which you are entitled. Your decision whether or not to participate in this study will not affect your current or future relations with Texas Tech University Health Sciences Center or Texas Tech University Health Sciences Center's nursing program.

If you choose to not participate in the study, you must still complete the course requirements. Contact Brandon Kyle Johnson, MSN, RN, CHSE at brkyjohn@iu.edu or [redacted] and your data will be removed from the transfer and analysis. Your course facilitator will not be aware of your decision until after final grades are entered.

APPENDIX G

CE Instrument Item Analyses

Table G1

CE Pretest Item Analysis

Question	**% Correct: Whole Group (*n* = 119)**	**% Correct: Upper 27% (*n* = 32)**	**% Correct: Lower 27% (*n* = 32)**	**Discriminant**	**Type**
1	12	34	3	0.31	4
2	71	93	50	0.43	1
3	97	100	93	0.06	3
4	57	84	31	0.53	4
5	68	84	50	0.34	1
6	57	65	40	0.25	4
7	76	87	62	0.25	1
8	78	90	56	0.34	1
9	66	81	43	0.37	1
10	61	78	43	0.34	1

Table G2

CE Posttest 1 Item Analysis

Question	**% Correct: Whole Group (*n* = 119)**	**% Correct: Upper 27% (*n* = 32)**	**% Correct: Lower 27% (*n* = 32)**	**Discriminant**	**Type**
1	43	75	18	0.56	4
2	91	100	81	0.18	3
3	100	100	100	0	3
4	63	87	40	0.46	1
5	73	93	53	0.4	1
6	93	100	90	0.09	3
7	80	87	59	0.28	1
8	89	100	78	0.21	1
9	70	81	56	0.25	1
10	44	81	25	0.56	1

Table G3

CE Posttest 2 Item Analysis

Question	**% Correct: Whole Group (*n* = 119)**	**% Correct: Upper 27% (*n* = 32)**	**% Correct: Lower 27% (*n* = 32)**	**Discriminant**	**Type**
1	73	100	40	0.59	1
2	95	100	90	0.09	3
3	100	100	100	0	3
4	94	100	84	0.15	3
5	83	100	65	0.34	1
6	94	100	84	0.15	3
7	87	96	68	0.28	1
8	89	100	78	0.21	1
9	88	100	71	0.28	1
10	50	90	25	0.65	4

Table G4

CE Posttest 3 Item Analysis

Question	**% Correct: Whole Group (*n* = 119)**	**% Correct: Upper 27% (*n* = 32)**	**% Correct: Lower 27% (*n* = 32)**	**Discriminant**	**Type**
1	17	37	9	0.28	4
2	83	100	71	0.28	1
3	100	100	100	0	3
4	84	96	59	0.37	1
5	73	96	53	0.43	1
6	62	90	31	0.59	1
7	89	100	78	0.21	1
8	84	93	62	0.31	1
9	77	87	59	0.28	1
10	50	68	28	0.4	4

APPENDIX H

AE Instrument Item Analyses

Table H1

AE Posttest 1 Item Analysis

Question	**% Correct: Whole Group (*n* = 119)**	**% Correct: Upper 27% (*n* = 32)**	**% Correct: Lower 27% (*n* = 32)**	**Discriminant**	**Type**
1	81	100	53	0.46	1
2	96	100	93	0.06	3
3	100	100	100	0	3
4	93	100	81	0.18	3
5	91	100	81	0.18	3
6	92	100	84	0.15	3
7	82	100	50	0.5	1
8	81	100	59	0.4	1
9	88	100	68	0.31	1
10	61	100	50	0.5	1

Table H2

AE Posttest 2 Item Analysis

Question	**% Correct: Whole Group (*n* = 119)**	**% Correct: Upper 27% (*n* = 32)**	**% Correct: Lower 27% (*n* = 32)**	**Discriminant**	**Type**
1	65	90	25	0.65	1
2	83	96	65	0.31	1
3	100	100	100	0	3
4	84	96	71	0.25	1
5	84	96	62	0.34	1
6	66	87	43	0.43	1
7	56	75	34	0.4	4
8	42	71	18	0.53	4
9	78	93	71	0.21	1
10	52	78	25	0.53	4

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CURRICULUM VITAE

Brandon Kyle Johnson

EDUCATION

- Doctor of Philosophy in Nursing (Minor-Nursing Education), Indiana University, earned at IUPUI, Indianapolis, IN (2015-2018)
- Master's of Science in Nursing, Lubbock Christian University, earned at Lubbock Christian University, Lubbock, Texas (2012-2013)
- Bachelor's of Science in Nursing, Texas Tech University Health Sciences Center, earned at Texas Tech University Health Sciences Center, Lubbock, TX, (2008-2010)

LICENSURE

Registered Nurse, Texas

CERTIFICATIONS

Certified Simulation Health Educator (CHSE)

PROFESSIONAL EXPERIENCE

Academic Experience

2015-present	Assistant Professor, Clinical and Simulation Director, Texas Tech University Health Sciences Center
2012-2015	Instructor, Texas Tech University Health Sciences Center

Clinical Experience

2010-2012	University Medical Center, Lubbock, TX Cardiovascular/Cardiac Intensive Care Unit

CAREER HIGHLIGHTS

Honors, Scholarships, and Recognitions

- National League for Nursing Mary Anne Rizzolo Doctoral Research Award, 2018
- American Association of Colleges of Nursing Jonas Nurse Leader Scholar, 2016-2018
- 2018 Exceptional Teaching Award, Texas Tech University Health Sciences Center School of Nursing
- Texas Nurses Association, District 18, Scholarship, 2016, 2017, 2018
- Florence Nightingale Scholarship, Indiana University School of Nursing, 2015
- 2014 Exceptional Classroom Teaching Award, Texas Tech University Health Sciences Center

Presentations

- Exploring student perception of design and realism using augmented reality. Poster presentation. International Nursing Association for Clinical Simulation and Learning. Decker, S.I., Caballero, S.A., Johnson B.K., et al., Toronto, Canada, June, 2018.*
- Overcoming challenges in evaluating active versus observer roles in simulation-based education. Podium presentation. National League for Nursing and Sigma Theta Tau International. Johnson, B.K., Reising, D.L. Washington, D.C., April, 2018.*

- Integrating the INACSL Standards. Laerdal Simulation User Network Local Conference. Johnson, B.K., Round Rock, TX., May, 2017.
- The active observer: Strategically integrating a two-minute assessment clinical activity into the observer role in high-fidelity simulation to develop critical thinking. Webinar presentation. International Nursing Association for Clinical Simulation and Learning. Johnson, B.K., Veesart, A.T., September, 2015.*
- Challenging the sacred cow: Using nontraditional clinical methods to facilitate critical thinking during clinical. Professional Nurse Educator Group, Veesart, A.T., Johnson, B.K., Rochester, MN., 2014.*

  *indicates peer reviewed

Service

- International Nursing Association for Clinical Simulation and Learning, Regulatory Initiatives Committee, 2018-present
- Society for Simulation in Healthcare/International Nursing Association for Clinical Simulation and Learning, Regional Conference Committee, 2018-present
- Society for Simulation in Healthcare/International Nursing Association for Clinical Simulation and Learning, Regional Conference Content Subcommittee, 2018-present
- Texas League for Nursing, Director for Communications, 2017-present
- Texas Tech University Health Sciences Center Interprofessional Simulation Advisory Council, 2017-present

- Texas Tech University Health Sciences Center School of Nursing Curriculum Leadership Group, 2015-present
- Texas Tech University Health Sciences Center SON Traditional Undergraduate Program Council, 2012-present
- Sigma Theta Tau International, Iota Mu, Publicity Chair, 2014-2016
- Texas Tech University Health Sciences Center Sex and Gender Specific Medicine Simulation Task Force, 2014-2015

PROFESSIONAL ACTIVITIES

Professional Organizations

- American Nurses Association
- International Nursing Association for Clinical Simulation and Learning
- National League for Nursing
- Sigma Theta Tau International, Iota Mu Chapter
- Society for Simulation in Healthcare
- Texas League for Nursing
- Texas Nurses Association