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The Impact of Debriefing for Meaningful Learning on Knowledge Development, Knowledge Retention, and Knowledge Application Among Baccalaureate Nursing Students

Ann Louise Loomis
University of Northern Colorado

UNIVERSITY OF NORTHERN COLORADO

Greeley, Colorado

The Graduate School

THE IMPACT OF DEBRIEFING FOR MEANINGFUL LEARNING ON KNOWLEDGE DEVELOPMENT, KNOWLEDGE RETENTION, AND KNOWLEDGE APPLICATION AMONG BACCALAUREATE NURSING STUDENTS

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Ann Louise Loomis

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Accepted by the Doctoral Committee

____

Jeanette McNeill, DrPH, RN CNE, ANEF, Research Advisor

____

Carol Roehrs, PhD, RN Committee Member

____

Kristina Thomas Dreifuerst, PhD, RN, CNE, ANEF Committee Member

____

Michael Allen, PhD Faculty Representative

Date of Dissertation Defense March 21, 2018

Accepted by the Graduate School

____

Linda L. Black, Ed.D.
Associate Provost and Dean
Graduate School and International Admissions

ABSTRACT

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Debriefing offers an opportunity to ensure that students can master critical components of nursing that they might not otherwise learn and to remove epistemological roadblocks to knowledge acquisition. Within this study, Debriefing for Meaningful Learning (DML), a theoretically-derived, evidence based and structured debriefing method, was used to explore student's knowledge acquisition, knowledge retention, and application of knowledge from one patient situation to a different, yet parallel, situation.

This quasi-experimental pretest, posttest study explored the impact of the type of debriefing method on the development of knowledge, knowledge retention, and knowledge application. Eighty-two prelicensure baccalaureate nursing students, enrolled in an adult health (medical-surgical nursing) theory course, participated in this study testing the use of Debriefing for Meaningful Learning compared with customary debriefing. The outcomes of this study revealed a significant difference in knowledge acquisition, knowledge retention, and knowledge application with DML compared to customary debriefing. These findings are significant for nurse educators using simulation to potentiate clinical

learning in prelicensure students and add to the growing evidence regarding the impact of debriefing.

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DEDICATION

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CHAPTER I

INTRODUCTION

In this quasi-experimental research study, the impact of a theoretically-derived and evidence based structured debriefing method, Debriefing for Meaningful Learning© (DML; Dreifuerst, 2010), was tested to learn the impact of its use on the development of nursing knowledge, knowledge retention, and application of knowledge in traditional, prelicensure baccalaureate nursing students. Utilizing a pretest, posttest, posttest design, participants were engaged in a simulation with debriefing and the impact of the simulation on knowledge, knowledge retention, and application of knowledge was measured. This chapter includes the background of the study, the theoretical framework, a statement of the problem, the purpose of the study, the significance of the study, the research questions and hypotheses, the limitations, the study assumptions, and finally definitions of key terms.

Background

Patient safety remains one of the most pressing health care challenges in the United States (US). An Institute of Medicine (IOM) report (2011), revealed a large chasm between quality of care and patient safety. In the report, the authors urged healthcare professionals to develop proficiency in delivering patient-centered care. Their definition of patient-centered care included working in interdisciplinary teams, using evidence-based practices, focusing on quality improvement, and integrating information technologies (Benner, Sutphen, Leonard, & Day, 2010; IOM, 2011).

Educating nursing students to be clinicians capable of providing quality, safe patient care is the mission of all nursing programs. However, clinical experiences in which students can actively engage with patients to hone clinical skills, foster therapeutic communication, and enhance interdisciplinary practices are increasingly challenging to secure. Within clinical education, educators cannot be expected to present a comprehensive range of clinical situations to every student to ensure the safe execution of skills and decision-making that a nurse must possess in practice. Novice nurses present inherent risks to patients due to inexperience and developing clinical reasoning skills. Complicating this issue further are shorter lengths of patient stays, unpredictable unit occupancy rates, increased patient acuity, and limited nurse educators to supervise students during clinical rotations (National Council of State Boards of Nursing [NCSBN], 2014).

There are other challenges associated with this problem. The growth in the number of nursing programs offering clinical education creates competition for the limited clinical sites available for training. Patient safety initiatives also restrict student access to patients and limit the number of students per patient unit resulting in a limited ability for students to engage in hands-on patient care (Orledge, Phillips, Murray, & Lerant, 2012; Randolph & Ridenour, 2015). For example, facilities are limiting student access to electronic health records for legal concerns leading nursing programs to seek alternative experiences for documenting care. These issues are exacerbated by the increasing burden of a national nursing educator shortage (Cato, 2012; NCSBN, 2014). Furthermore, nurse educators are constantly challenged to develop new teaching methods and strategies to educate and train students to care for a diverse patient population in a rapidly changing health care environment.

Simulation is an educational pedagogy that provides clinical opportunities for students to experience contextual patient care in a controlled environment using simulated patients. Over the past decade, nurse educators noted the benefits simulation brought to learning resulting in dramatic increases in its use (Hayden, Smiley, & Gross, 2014; Kirkman, 2013; McDavid, 2014). In this increasingly complex health care environment, the demands placed on nurses to engage in interdisciplinary teams and to perform more complex care in a shorter amount of time requires a different approach to training (Randolph & Ridenour, 2015). Simulation with debriefing can provide experiences to improve the provision of quality and safe patient care (Frick, Swoboda, Mansukhani, & Jeffries, 2014; Jeffries & Clochesy, 2012).

With increased use of simulation in nursing education, researchers rigorously studied the use of the effectiveness of simulation as a substitute for traditional clinical experiences (Hayden, Smiley, Alexander, Kardong-Edgren, & Jeffries, 2014). The need for structured debriefings facilitated by knowledgeable educators is a recurring theme in the literature (Fey, Scrandis, Daniels, & Haut, 2014; Flo, Flaathen, & Fagerstrom, 2013; Tosterud, Hall-Lord, Petzall, & Hedelin, 2014; Waznonis, 2015). Moreover, there is evidence that debriefing is where the majority of learning occurs (Shinnick & Woo, 2015) and increasingly, reports are focused on the impact of specific debriefing methods on student outcomes (Chronister & Brown, 2012; Dreifuerst, 2010, 2012, 2015; Eppich & Cheng, 2015; Fanning & Gaba, 2007; Levett-Jones & Lapkin, 2014; Reed, Andrews, & Ravert, 2013; Rudolph, Simon, Rivard, Dufresne, & Raemer, 2007).

In the International Nursing Association for Clinical Simulation and Learning (INACSL) Standards of Best Practice: Simulation^{SM} regarding debriefing, one recommendation is to use a theory-based method (INACSL, 2016). This concurs with the National League for Nursing (NLN; 2015) and the National Council of State Boards of Nursing (NCSBN; Hayden, Smiley, Alexander et al., 2014) statements on using theoretically- derived and evidence based debriefing methods. Debriefing for meaningful learning is one theoretically-derived and evidence-based method that embodies these recommendations; additionally, the research on DML demonstrated statistically significant changes in prelicensure students' clinical reasoning and higher order thinking resulting from the method (Dreifuerst, 2010).

Students encounter a variety of patient situations requiring different thinking, skills, and levels of performance that are a foundation for their future nursing practice. When educators design nursing curricula, they design experiences for the student to master critical components of patient care. However, despite good planning, the nuances of patient care environments are so dynamic that students may not actually have the intended experiences.

Simulation gained popularity in nursing education programs because it provided an opportunity to ensure that every student experienced particularly high-impact and low frequency clinical situations necessary for practice, which are not guaranteed to occur in every traditional clinical environment (Hayden, Smiley, & Gross, 2014).

Debriefing offers an opportunity to ensure that students can master critical components of nursing that they might not otherwise experience and to remove epistemological roadblocks to knowledge acquisition. The use of DML could promote knowledge application beyond the simulation scenario. By offering a debriefing experience, debriefers offer a parallel clinical situation that students can use to apply what they have just learned to another clinical scenario, thus expanding the value of the experience to the student’s nursing practice (Dreifuerst, 2015).

Existing research clearly articulates the importance of debriefing and there is significant literature demonstrating the impact of simulation with debriefing on student knowledge acquisition and retention (Dreifuerst, 2010; Fanning & Gaba, 2007; Shinnick, Woo, Horwich, & Steadman, 2011). However, there is little evidence regarding how DML affects students’ ability to apply knowledge to parallel clinical situations. Further testing of DML is required to address this gap in simulation pedagogy and nursing education.

Theoretical Framework

Philosophical underpinnings of debriefing in healthcare education focus on a constructivist approach to group learning (Dreifuerst, 2010; Fey et al.,, 2014;

Jeffries & Clochesy, 2012; Rudolph, Simon, Dufresne, & Raemer, 2006) with many of the goals, conditions of learning, and instructional methods of debriefing building on the primary concept of reflection. Dewey (1933) was one of the first to identify reflection as a process of moving a student from one experience to another whereby the student makes connections that create a deeper understanding. During reflective inquiry, “the thinker turns a subject over in the mind, giving it serious and consecutive consideration” (Dewey, 1910, p. 23).

Mezirow (1981) expanded Dewey’s description, defining reflection as a process whereby new meanings are formed through critical examination of one’s own beliefs. Critical reflection involves key elements, beginning with the acknowledgement of one’s belief structures, followed by objective reflection on those beliefs, and the perseverance to uncover and examine those beliefs even when it becomes uncomfortable to do so (Mezirow, 1981, p.162). Mezirow’s (1978) transformative learning theory is a theoretical framework that aligns well with the outcome of debriefing by promoting transformational learning through reflective practice. This theory underpins the current research study because the theory describes how reflection could influence learning in a manner that informs and transforms outcomes, and because the theory provided a framework for the development of DML (Dreifuerst, 2010).

Mezirow (1978) developed transformative learning theory to explain how students use the process of reflection during learning to develop a deeper understanding of concepts. The theory’s central themes revolve around the students’ prior experiences, reflection on, and interpretation of new information, which lead to the confirmation of new perspectives (Gum, Greenhill & Dix, 2011; Parker & Myrick, 2009). In this framework, the student reflects on situations and events developing new frames in which to view past beliefs and judgments. The student then learns to let go of ‘taken-for-granted’ frames of reference and in turn transforms their understanding (Mezirow, 1998).

Critical reflection is a key component in transforming perspectives. A new experience, a crisis, or a ‘disorienting dilemma,’ can question and challenge students’ frames of reference. Analysis and interpretation of the experience results in students altering their frames of reference through critical reflection, facilitating transformation of perspectives, and the development of new meaning for existing structures (Mezirow, 1978). Simulation and DML debriefing align well with the critical components of Mezirow’s framework whereby students experience a new patient care dilemma during simulation, causing them to evaluate and reevaluate their thinking and actions. During debriefing, the debriefer guides the discussion through critical reflections towards transformation. Mezirow’s transformative learning theory has been used as a framework in nursing education research to assess the impact of simulation and debriefing on student learning outcomes (Cecil, 2014; Morse, 2015; Parker, McNeill, & Howard, 2015; Paterson & Chapman, 2013). This transformative learning framework further underpins DML debriefing as students examine their thought-patterns as they reflect-in-action, reflect-on-action (Schön, 1983) and reflect-beyond-action (Dreifuerst, 2009) to become reflective practitioners.

Schön (1983) identified reflection that is ‘thinking while doing’ as reflection-in-action, recognized this quality in master educators, and indicated that the opportunity for reflection-in-action occurs within the simultaneous interchange of doing and thinking. Reflection-in-action represents decisions and judgments that occur in the moment as opposed to reflection-on-action, which is retrospective reflection (Dreifuerst, 2015; Schön, 1983). Thus, the essence of connecting knowledge and action is the central component of reflection-in-action, particularly with students or novice nurses (Dreifuerst, 2015; Schön, 1983). Learning to view the situation or experience in a different way, and to learn from experience through deliberate thinking practice, is common at the reflection-in-action level (Zeichner & Liston,1987).

Schön’s (1983) concept of *reflective practice* stemmed from Dewey’s work and the desire to understand the thinking of professional practitioners. Schön identified ways expert practitioners are cognizant of their responses to experiences and examine them as they occur. After the experience, the practitioner spends time reflecting on those actions to gain insight to improve future encounters. A reflective practitioner is described as possessing the professional ability to draw from practical experiences while acting both creatively and intuitively to refine their expertise (Schön, 1983, p.189). Reflection is central to the ability to critically examine information to see reality (Freire, 2000, p.211).

Kolb’s (1984) experiential learning cycle also included the stage of reflective observation, whereby students notice inconsistencies between learning experiences, then reflect upon those differences to give rise to new ideas or meaning. Gibb's (1988) model for reflection, built upon Kolb's (1984) experiential learning cycle, prompted practitioners to reflect upon experiences to gain new understanding to inform their practice. It is in this reflective process that practitioners can view change as a conduit for improved practice of future care (Gibb, 1988).

These theories, descriptions, and definitions help to define what a practitioner does when they reflect in and on their practice; therefore, underpinning the primary purpose of debriefing clinical experiences. However, reflective thinking may not occur innately and may require instruction and modeling over time to help develop this skill (Dreifuerst, 2010; Rudolph et al., 2007). Less experienced practitioners may not have the skills to analyze practice and may find guided and structured reflection beneficial (Kuiper & Pesut, 2004). Though much of Schön's (1983) work described reflection, his seminal work focused on facilitation of reflective practice through awareness, analysis, and summary of past practice. The first phase is an awareness of feelings or thoughts when encountering uncertain situations, which triggers a curiosity to explore those feelings. During the second phase, the unexpected feelings or issues are analyzed until there is new understanding of the situation noted in the final phase, summary of the learning experience (Schön, 1983). The phases are supported and further expounded on by three types of reflection: reflection-in-action, reflection-on-action (Schön, 1983), and reflection-beyond-action (Dreifuerst, 2009). Reflection-in-action is the simultaneous teaching and thinking interchange that facilitates refinement of decisions and judgment during practice, as opposed to reflection-on-action, which is achieved retrospectively (Dreifuerst, 2015). Reflection-on-action is reflecting after an action has occurred (Dreifuerst, 2015; Schön, 1983). This type of reflection introduces the student to the previous event to reexamine feelings, actions, and the processes that influenced the outcome (Schön, 1983). Finally, reflection-beyond-action is the process of reflecting on an event after it has occurred to examine how the students' actions contributed to the outcomes and how those actions may influence future actions; thereby providing a path for transference of knowledge to future events (Dreifuerst, 2010).

Schön's (1983) work regarding reflection and reflective practice provides further foundation for this research study since reflection is a primary component of DML. Reflection guides students in recognizing responses to experiences and examining them as they occur (Schön, 1983). Furthermore, by reflecting on actions to gain insights for future experiences, the relationship between reflection and anticipation is realized (Dreifuerst, 2009). In this way, Mezirow's transformative learning theory, together with Schön's theory of reflective practice, provides the theoretical framework that underpinned this research.

Problem Statement

With the increase in simulation use, and a heightened awareness that debriefing is where much of the learning takes place, it is important to examine how debriefing impacts learning in prelicensure nursing education. A consistent, theoretically derived, and evidenced based method for guiding students through debriefing is recommended to enhance student learning. However, further research is needed to understand the impact of contextual knowledge application, supported by knowledge acquisition and retention, on prelicensure students' learning in order to enhance future clinical instruction within the discipline.

Purpose

Within this study, DML, a theoretically derived, evidence based, and structured debriefing method was used to explore the development of students' knowledge application from one patient situation to a different, yet parallel, situation. To explore this phenomenon, prelicensure nursing students engaged in a simulation about the care of a patient with a neurological diagnosis followed by either DML or a traditional debriefing. This quasi-experimental pretest, posttest study explored the impact of the type of debriefing on the development of knowledge, knowledge retention, and knowledge application by undergraduate baccalaureate nursing students enrolled in an adult health (medical-surgical nursing) theory course.

Significance of the Study

The ability to apply knowledge learned from one clinical situation to another has intrinsic importance, affecting not only nursing education, but also subsequent patient outcomes as student nurses transition into practice. In this study, the impact of the use of a particular debriefing method, DML, on students' application of knowledge from one similar, but not identical, patient care situation to another was examined. Within the literature, researchers widely accepted and tested the DML for its impact on development of clinical reasoning and judgment.

However, knowledge retention or application to a parallel clinical situation has not been tested, despite the fact that DML specifically includes the process of application to a parallel case. Since this is unique to DML, and this debriefing method is widely adopted, this study was important to explore.

Research Questions

Three research questions were asked in this study:

Q1 What is the impact of a simulation with DML debriefing compared to customary debriefing, on knowledge acquisition in the care of a patient with a neurological condition demonstrated by nursing students in a traditional BSN program?

Q2 What is the impact of a simulation with DML debriefing compared to customary debriefing on knowledge retention in the care of a patient with a neurological condition demonstrated by nursing students in a traditional BSN program, 30 days after a simulation and debriefing?

Q3 What is the impact of a simulation with DML debriefing compared to customary debriefing, on knowledge application to a parallel patient scenario, demonstrated by nursing students in a traditional BSN program?

Null Hypotheses

The null hypotheses for this study were as follows:

$H1_0$ There is no difference between the impact of simulation with DML debriefing or customary debriefing on nursing knowledge in the care of a patient with a neurological condition, demonstrated by nursing students in a traditional BSN program.

$H2_0$: There is no difference between the impact of simulation with DML debriefing or customary debriefing on nursing knowledge retention in the care of a patient with a neurological condition, 30 days after a simulation with debriefing.

$H3_0$: There is no difference between the impact of simulation with DML debriefing or customary debriefing on nursing knowledge application in the care of a parallel patient scenario by nursing students in a traditional BSN program.

Definition of Terms

The following terms were used throughout this study.

Customary debriefing. The debriefers determined the content and method of the customary debriefing. They were encouraged to debrief as they typically do. These debriefers were not questioned a priori about their debriefing method to avoid contamination of the control group.

Debriefer. A debriefer is an individual who facilitates a reflective discussion with students after a learning experience. Debriefers in this study are nurse educators who facilitate simulation experiences and debriefing with baccalaureate nursing students.

Debriefing. Debriefing is the event immediately following a simulation experience where the debriefer facilitates a collaborative, reflective discussion with the students. Debriefing is a teaching-learning method that guides students in examining the experience through reflective thinking to deepen their understanding of the event. While simulation and debriefing are considered integral to each other by many educators, there are occasions where a simulation does not include debriefing, such as high-stakes testing environments, and scenarios that emphasize task training and skills development. Therefore, simulation and debriefing will be considered independent concepts in this study.

Student. Learners are baccalaureate-nursing students in the seventh semester of an eight- semester traditional prelicensure program.

Organization of the Study

This research study is presented in five chapters. Chapter I includes the background of the study, theoretical framework, statement of the problem, purpose of the study, significance of the study, research questions, hypotheses, limitations, assumptions, and definition of terms. Chapter II provides a review of the literature, which includes the topical areas of simulation, debriefing, reflection, DML, nursing knowledge acquisition, knowledge retention, and knowledge application. Chapter III describes the methodology used in this research. This includes selection of participants, instrumentation, data collection, and data analysis procedures. Chapter IV presents and summarizes the findings of the research. This section includes the participant demographics, the descriptive statistics used to analyze the data, and the results. Chapter V summarizes the study and contains a discussion of the findings, and implications for further research in this area.

CHAPTER II

REVIEW OF THE LITERATURE

Overview

Within this chapter, the literature pertinent to the study of the impact of the use of simulation with Debriefing for Meaningful Learning (DML; Dreifuerst, 2010) and customary debriefing is presented. Additionally, literature is presented on the development of nursing knowledge, knowledge retention, and knowledge application in a parallel clinical situation. Preparing nurses who can provide safe patient care, of significant quality, is the mission of all nursing programs. The challenge to educators is in providing clinical experiences where students actively engage with patients to hone clinical skills, work on therapeutic communication, develop clinical reasoning, learn time management, organizational skills, and how to be a team player (D’Souza, Venkatesaperumal, Radhakrishnan, & Balachandran, 2013; Potgieter, 2012). Complicating this challenge are issues surrounding shorter patient stays, unpredictable unit occupancy rates, increased patient acuity, and limited nursing educators to supervise students during long clinical rotations (Kim, Park, & Shin, 2016; NCSBN, 2014).

Simulation

Simulation is a powerful educational tool ideally suited to aid students in the transformation and application of knowledge in clinical practice. In simulation, participants learn best practices for patient care without the risk of injury to live patients within the clinical setting (Madani et al., 2016; Rivaz, Momennasab, & Shokvollahi, 2015; Tawalbeh & Tubaishat, 2013). Simulation scenarios may be repeated until the participant has mastered the task or skill. Use of patient simulation allows for standardization of patient cases with emphasis on patient safety (Abusaad & Ebrahem, 2015; Cobbett & Snelgrove-Clarke, 2016; Fawaz & Hamdan-Mansour, 2016), effective communication (Evans & Mixon, 2015; Ojha, Liu, Champion, Hibbert, & Nanan, 2014; Sarabia-Cabo, Alconero-Camarero, Lavin-Alconero, & Ibáñez-Rementeria, 2016), and interdisciplinary interactions (Hunt et al., 2014; Luctkar-Flude et al., 2015; Simko, Henry, McGinnis, & Kolesar, 2014), as well as creating a team approach to quality care (Bender & Walker, 2013; INACSL, 2011; Shinnick, Woo, Horwich et al., 2011). Debriefing offers nurse educators and students a time to share, reflect upon, and discuss their experience. This time spent exploring patient outcomes and reviewing critical decision-making is a key contributor to student learning (Shinnick, Woo, Horwich et al., 2011).

The National Council of State Boards of Nursing (NCSBN) landmark, multi-site, study demonstrated that up to 50% of clinical experiences could be replaced with quality simulation with similar or better student outcomes (Hayden, Smiley, Alexander et al., 2014). Yet, there remains a reluctance to use simulation in place of traditional clinical experiences, which is still seen as the gold standard (Jeffries & Clochesy, 2012). Attempts at replacing traditional clinical experiences with simulation may be perceived as a threat to the quality of clinical education. However, as the number of available clinical sites continues to dwindle, schools of nursing must consider the implementation of simulation in their curriculum (Paterson & Chapman, 2013). The American Association of Colleges of Nursing (AACN) Essentials of Baccalaureate Education for Professional Nursing Practice guidelines addressed the need for students to be educated in care of populations across the lifespan (AACN, 2008) requiring creativity by nurse educators as models of healthcare delivery. Incorporating simulation throughout nursing education curriculums may help to address these concerns.

Simulation in Nursing Education

The body of simulation research in undergraduate nursing students continues to grow (Kirkman, 2013; McDavid, 2014). This increasing research base may help to build support to address these challenges and provide clinical experiences that are critical for safe nursing care. The Joint Commission (2015) noted poor communication as one of the top three contributors to sentinel events (as the need for improved patient-centered nursing care continues to rise (Bauchat, Seropian, & Jeffries, 2016). Higher patient satisfaction, improved health outcomes, and cost-effective care are linked to improved patient-centered nursing care, yet traditional clinical experiences are challenged with teaching these non-technical skills using current clinical instructional models (Niederhaus, Schoessler, Gubrud-Howe, Magnussan, & Codier, 2012).

The answer to this challenge may be the increased use of quality simulation. Simulation improves communication and empathy among nursing students (Bauchat et al., 2016; Gillan, Parmenter, van der Riet, & Jeong, 2013) and can strengthen communication between team members (Botma, 2014; Evans & Mixon, 2015; Ojha et al., 2014). In a qualitative study by Botma (2014), third and fourth year baccalaureate nursing students (*n* = 8) who actively participated in a minimum of three immersive simulations, were asked to share their perceptions of how simulation contributed to their learning. Five themes emerged: “transference of classroom knowledge to the clinical learning environment, increased confidence to practice in the real world, deliberate practice improved performance, motivation for continued learning, and the importance of communication among team members” (Botma, 2014, p. 3). Kirkman (2013) argued that nurse educators can use immersive simulations to enhance student transference of knowledge to the clinical setting and other researchers argued that immersive simulations could better prepare students for clinical placement (Larue, Pepin, & Allard, 2015).

Other challenges for obtaining clinical experiences have emerged as well: growth in number of nursing programs create competition for limited clinical sites, patient safety initiatives restrict student access, limits on the number of students per instructor, and limited clinical nurse educators all inhibit students from engaging in nursing care (D’Souza et al., 2013). Moreover, facilities are limiting the number of students allowed in a specific care area and student access to electronic health records (Cato, 2012; NCSBN, 2014). These challenges require nurse educators to develop new teaching strategies to educate and train students to care for a diverse patient population in an ever-changing health care system (Niederhaus et al., 2012). Compounding the problem are shorter hospital stays, higher patient acuity levels, and patient safety issues that further limit student exposure to crucial patient care experiences (Orledge et al., 2012; Randolph, & Rider, 2015). Simulation can provide an evidence-based experiential learning experience tailored to the student's practice context (Kirkman, 2013; McDavid, 2014; Sabus & Macauley, 2016). Larue et al., (2015) referred to simulation as the "most accurate possible representation of a care situation" (p. 133).

The use of simulation allows educators to replicate a variety of patient situations for students to practice and develop their nursing skills without harm to the patient (Frick et al., 2014; Jeffries & Clochesy, 2012; Wang, 2011). The increased demands placed on health care providers to perform more complex skills in a shorter amount of time while engaging in interdisciplinary teamwork requires a different level of training (Randolph & Ridenour, 2015). Simulation-based education can replicate these experiences to help foster students' clinical reasoning and development of skills in order to provide better, safe patient care (Fanning & Gaba, 2007; Frick et al., 2014; Jeffries & Clochesy, 2012; Wang, 2011). The following studies demonstrate the use of simulation as an effective teaching strategy for students to safely develop their nursing skills.

Kirkman (2013) explored the effectiveness of simulation in nursing students' (*n* = 42) transfer of learning from classroom lecture to the traditional clinical setting. The researcher observed a quarter of the students (n = 11) and rated their ability to perform a respiratory assessment. The observations and ratings took place at the patient bedside, before a respiratory assessment lecture (Time 1), following the respiratory assessment lecture (Time 2), and following a simulation (Time 3). Findings from Kirkman's (2013) study indicated students demonstrated a statistically significant difference (p = 0.000) in transfer of respiratory assessment knowledge and the use of simulation proved an effective learning and teaching method. Limitations of the study include a convenience sample from a single university, implementation of a single simulation, and using a time series design (Kirkman, 2013).

Parker et al. (2015) used a quasi-experimental method to examine baccalaureate students (n = 44) in the second semester of a five-semester program involved in hybrid clinical experiences comparing traditional pediatric clinical experiences with pediatric simulation clinical experiences. The authors used three simulation-specific tools to gather data. They utilized the Simulation Design Scale (SDS), a National League for Nursing (NLN) instrument, which has been used nationally and has established reliability and validity. They used this instrument to evaluate students' perceptions of feedback, clarity of presentation objectives, problem solving, and nurse educator support of the simulation scenario.

Parker et al. (2015) also measured students' perception of the inclusion of active learning, collaboration, diversity of learning, and expectations using the Educational Practices Questionnaire (EPQ). They also used the Student

Satisfaction and Self-Confidence in Learning Scale (SSSCLS) to measure student satisfaction and perceived confidence (NLN, 2015). The authors received permission from the NLN to modify the simulation instruments to measure students' perceptions of a traditional clinical experience. The researchers modified the items by replacing the word "simulation' with the word "traditional" when appropriate; the letter "T" was placed in front of the instrument to denote traditional.

Parker et al. (2015) reported acceptable reliability and internal consistency for the items comprising the T-EPQ ($\alpha = 0.94$), the T-SSSCLS ($\alpha = 0.92$), and the T-SDS ($\alpha = 0.94$). The authors conducted a Wilcoxon signed rank test on the data and findings demonstrated overall similarities in student perceptions of each learning experience, with significance found with opportunities for collaboration in the simulation environment (z = 3.506, $p < .001$). Additionally, the results indicated higher student satisfaction with learning occurring in the clinical setting ($z = -5.59$, $p < .001$).

However, most technical and clinical learning is acquired through experiences obtained in the clinical setting, posing risks to both patient and student (Maloney, 2012). The use of simulation allows nurse educators to mitigate these risks by providing a controlled experience (Hall & Tori, 2017; McDavid, 2014; Rudolph et al., 2006). Instructors can design simulation scenarios for students to incorporate assessment skills with classroom knowledge to formulate and implement a plan of care. The use of simulation allows the student to develop and demonstrate clinical thinking while implementing the entire nursing process (Lavoie, Pepin, & Boyer, 2013; Mariani, Cantrell, Meakim, Prieto, & Dreifuerst, 2013). The use of simulation can also assist students in their understanding of the various roles they may perform in the healthcare environment.

McDavid (2014) explored the effectiveness of simulation on Associate Degree Nursing (ADN) students' ability and confidence to adequately perform didactic content learned in a course. Students (n = 107) participated in three specialty simulations to assist with a better understanding of cardiac content, enhanced neurology, and an end-of-semester inter-professional comprehensive simulation. The course content and simulations also included Necessary Basic Life Support and Advanced Cardiac Life Support nursing skills. Instructors assigned participants the roles of charge nurse, primary nurse, nurse assistant, family member, and the patient. Exposure to the different roles facilitated a better understanding of the dynamics involved when students enter the health care field (McDavid, 2014). McDavid (2014) collected quantitative data at the end of each semester, over four consecutive semesters: spring 2014 (n = 28), fall 2013 (n = 30), spring 2013 (n = 25), and fall 2012 (n = 24). Findings from the data analysis indicated simulation aided participants in meeting learning outcomes (90%), enhancing management skills (87%), incorporating patient safety into practice (91%), and eliciting clinical decision making among nursing students (86%) demonstrating that it was an effective teaching strategy. The tools used to collect the participant data and how the data were analyzed were identified as limitations of the study.

Simulation is a student-centered teaching strategy. The benefits of using clinical simulation include: active involvement of students in their learning, more effective use of nurse educators in the teaching of clinical skills and interventions, and improved student instruction (Loke, Lee, Noor, & Loh, 2014; Park & Ha, 2016; Shinnick & Woo, 2015). In a study by Cummings (2015), nurse educators spent a year evaluating senior students participating in simulation within their clinical curriculum using an evaluation rubric based on the nursing process. Students enrolled in the Professional Nursing Integration course (*n* = 80) were scheduled in one-hour increments for their simulation experience, the actual scenario lasted 30-40 minutes, and the debriefing lasted 20-minutes. After participants randomly drew a premade NLN simulation scenario from a hat containing a list of interventions and lab results, they would then perform the appropriate intervention for that scenario.

Immediately following the simulation, participants were brought into another room and shown the video recording of their performance and then be debriefed by nurse educators. The debriefing consisted of asking participants how they felt about the experience, areas of strengths and weaknesses, and teachable moments. Participants had one week to document their findings on the computer system and then a final grade was posted (Parker et al., 2015). Study outcomes demonstrated that 54% of students had issues with identification and usage of medications; 32% failed to read back physician orders; 28% did not complete assessments; 19% could not correctly identify lab values: and 15% were unable to identify the rhythm strip. In addition, Cummings (2015) noted that placing the student in an individual evaluation experience allowed nurse educators to identify errors in critical thinking and performance that may not have been apparent in the clinical environment. This finding helped to identify the need for changes in curriculum to facilitate student preparedness, which is consistent with findings from other studies (Shinnick, Woo, & Mentes, 2011).

Research has also demonstrated that simulation supports students' different learning styles. Shinnick and Woo (2015) examined the impact of student learning styles on knowledge gains in simulation in a multi-site study. Four cohorts of prelicensure nursing students (*n* = 161) participated in simulation using a high-fidelity manikin. The researchers used the Kolb Learning Style Inventory to assess student-learning styles. Shinnick and Woo (2015) confirmed through statistical analysis that nurse educators can confidently implement simulation as a teaching method with students who prefer different learning styles to achieve knowledge gains. These findings corresponded with a similar study on the learning styles of graduate nursing students (n = 202) by Gonzales et al. (2017), which used the Index of Learning Styles to assess learning style differences. Within that study, simulation was found to appeal to the different learning styles of adult students, with several students displaying a propensity for sensing (19%) and visual (20%) style preferences (Gonzales et al., 2017). Understanding their personal learning style may assist students with knowledge acquisition thereby increasing their confidence.

In 2016, Boling and Hardin-Pierce conducted a review of literature regarding the effect of simulation training among critical care providers on knowledge and confidence. Of the 17 papers that met their inclusion criteria of original research, all studies demonstrated an improvement in knowledge using a variety of instruments and forms of measurement. The effect on provider confidence was also examined in 13 of the 17 studies and all found improvement in confidence. Boling and Hardin-Pierce (2016) concluded that high-fidelity simulation is a useful tool for improving knowledge and confidence among critical care providers and merits inclusion in critical care training programs.

Kim et al. (2016) explored the quantitative evidence of 40 of the 2,279 articles reviewed from 1995-2013, to determine the effect size of interventions in pre-licensure, licensed nurses, or nurse practitioners. They also compared effect sizes according to fidelity level of the simulators through a meta-analysis (Kim et al., 2016). Simulation was effective in various learning domains, with a pooled random-effects standardized mean difference of 0.70. Subgroup analysis revealed that effect sizes were larger for high-fidelity simulation (d = 0.86), medium-fidelity simulation (d = 1.03), and standardized patients (d = 0.86) than they were for low-fidelity and hybrid simulations. In terms of cognitive outcomes, the effect size was the largest for high-fidelity simulation (d = 0.50). Regarding outcomes, high-fidelity simulation (d = 0.80) and standardized patients (d = 0.73) had the largest effect sizes demonstrating simulation was an effective educational strategy, with particularly large effects in the psychomotor domain. Simulation is becoming an important addition to traditional clinical experiences.

Simulation Versus Traditional Clinical Experiences

With radical changes in patterns of health care and decreasing availability of clinical sites, simulation offers enormous potential for students to maximize their clinical learning opportunities. However, the use of simulation does come with its challenges. According to Jeffries and Clochesy (2012), nurse educators must meet the following requirements to use simulation successfully: a firm foundation in experiential learning; clear learning objectives for the simulation; and a detailed design taking into account that a nurse educator facilitates learning. Furthermore, sufficient time for students to experience the simulation, reflect on the experience, make meaning of the experience; and the teaching strategy must be student-centered (Jeffries & Clochesy, 2012).

Findings from the NCSBN National Simulation Study (NSS) indicated that substituting up to 50% simulation of prelicensure clinical experiences results in outcomes similar to or better than traditional clinical experiences (Hayden, Smiley, Alexander et al., 2014). However, stipulations for replicating these outcomes were quite clear: (a) nurse educators must be adequately trained, committed and in sufficient numbers; (b) the presence of a dedicated simulation lab with appropriate resources; vignettes are realistically and appropriately designed; and (c) theoretically derived and evidence-based debriefing must be implemented (Hayden, Smiley, Alexander et al., 2014). Jeffries, Dreifuerst, Kardong-Edgren, and Hayden (2015) further noted the importance of faculty development including re-education, and repeated assessment of debriefers to ensure standardized implementation, intervention, and assessment fidelity when developing and implementing simulation in the curriculum, in order to have similar findings to the NSS (p. 22).

Debriefing

Debriefing typically follows simulation. Debriefing offers nurse educators and students a time to share, reflect upon, and discuss their experience (Cantrell, 2008; Dufrene & Young, 2014; Hall & Tori, 2017; Levett-Jones & Lapkin, 2014; Reed, 2012; Shinnick, Woo, Horwich et al., 2011). This time spent exploring patient outcomes and reviewing critical decision-making is a key contributor to student learning (Shinnick, Woo, Horwich et al., 2011). To enhance the learning experience, debriefing is often conducted immediately after the simulation has ended (Cantrell, 2008; Dufrene & Young, 2014; Hall & Tori, 2017; Levett-Jones & Lapkin, 2014; Reed, 2012). Wickers (2010) described debriefing as a process of active learning in which each participant gains a more in-depth understanding of the experience while reflecting on their own skills and knowledge. Debriefing is enhanced when the facilitator creates an environment in which participants feel safe to share their feelings, identify positive aspects of their performance, and openly discuss ways to improve their skill set (INACSL, 2016). A theory-based framework for debriefing should be provided, linking the simulation with nursing knowledge and the desired student outcomes related to patient care (Dreifuerst, 2010; Alexander et al., 2015; INACSL, 2016). Without a debriefing, the optimal learning opportunity may be lost.

Students bring their own experiences to simulation and, through observation and participation, formulate new concepts and strategies for interacting and engaging with patients and fellow healthcare workers (Gum et al., 2011). Debriefing provides an experiential component to learning which aids in the construction of deep understanding rather than rote memorization (Fanning & Gaba, 2007). Researchers recommend debriefing and more studies now specifically address and explain the relationship between debriefing and student learning outcomes (Dreifuerst, 2010, 2015; Fanning & Gaba, 2007; Minehart, Rudolph, Piar-Smith, & Raemer, 2014; Morse, 2015; Shinnick, Woo, Horwich et al., 2011).

A review of literature was conducted exploring methods of debriefing and tools for evaluating learning outcomes. This included literature from the disciplines of nursing, psychology, medicine, and education (2012-present) using the search terms: debriefing, structured debriefing, DML, reflection, simulation, nursing knowledge, and nursing retention. Terms were entered separately and in combination using CINAHL, Medline, PsychINFO, and SocIndex databases.

Dreifuerst (2009) identified the attributes of debriefing as reflection, emotion, emotional release, reception to feedback, summative evaluation, and integration of the new knowledge through assimilation, accommodation, and anticipation. In addition, Sabei and Lasater (2016) noted defining attributes of debriefing to be meaningful time for reflection, student-centeredness, and a link between theory and practice. Gardner (2013) and Palaganas, Fey, and Simon (2016) each defined debriefing as an analysis of events shared through discussion to gain insight into an experience with the aim of improving future performance. Furthermore, debriefing can also occur in clinical settings and after simulation to provide students with a time to reflect, discuss, and learn from the experience (Fanning & Gaba, 2007).

Bender and Walker (2013) found debriefing to be a strong mechanism of support for assisting students with difficult cross-cultural issues associated with global health education. Accommodation and assimilation of emotions during debriefing promote professional development (Marcum, 2013; Maloney, 2012), the opportunity to examine unintended consequences of cognitive frames, and attitudes experienced in clinical encounters (Gillan et al., 2013). The value of debriefing is to aid transference of knowledge and skills from simulation to other clinical settings and situations (Gardner, 2013).

Simulation is often followed immediately by debriefing (Cantrell, 2008; Dufrene & Young, 2014; Hall & Tori, 2017; Levett-Jones & Lapkin, 2014; Reed, 2012), where students share their feelings or reactions, examine their performance, and expand their thinking with the assistance of the clinical educator acting as a facilitator or 'debriefer' who guides the conversation and provides feedback (Dreifuerst, 2009). Health care simulation literature is abundant with information on debriefing but empiric evidence to support a specific debriefing method is limited (Fey & Jenkins, 2015; Waznonis, 2015). In the International Association for Clinical Simulation and Learning (INACSL) Standards of Best Practice: Simulation^{SM} regarding debriefing, using a theory-based method is recommended (INACSL, 2016). This recommendation concurs with the NLN (2015) and the NCSBN (2015) statement on using theoretically-derived and evidence based methods. Currently, researchers identified two such methods in the health care literature: Debriefing with Good Judgment, which uses Advocacy-Inquiry (Rudolph et al., 2007) and Debriefing for Meaningful Learning (Dreifuerst, 2010).

Two recent studies by Waznonis (2015) and Fey and Jenkins (2015) reviewed debriefing practices in nursing programs, including the debriefing methods used and the training and assessment of nurse educators. Fey and Jenkins (2015) surveyed accredited prelicensure nursing programs in the United States (US). Of the 1,440 schools that met inclusion criteria, 35% percent of schools responded (*n* = 502). Results revealed most respondents, 48%, had not received formal training in debriefing (*n* = 197) and only 19% (*n* = 82) of schools assessed competence of debriefers. Only 31% of schools used a guiding theory or model for debriefing and structured debriefings occurred in only 47% of programs. Factors associated with programs using theoretically derived debriefing included the presence of a designated simulation administrator, training for debriefers, and competence assessments of debriefers. This supports the findings from the NSS (Jeffries et al., 2015).

A cornerstone of simulation is the promotion of reflection through debriefing (Decker et al., 2013; Dreifuerst, 2009; Husebo, O'Regan, & Nestel, 2015). Reflection through debriefing provides meaning and understanding for the simulation participants (Reed, 2012). A Debriefing Experience Scale developed by Reed (2012) measured participant experiences during debriefing and the importance of those experiences to the participant. Nursing students (*n* = 130) in an undergraduate baccalaureate-nursing program were divided into obstetric (*n* =

75) and intensive care (*n* = 55) simulation groups. Twenty-five percent (n = 33) of the students from each of the two groups were the sample used to test the scale. The five subscales of the tool addressed: analyzing thoughts and feelings, learning and making connections, facilitator skill in conducting the debriefing, and appreciation for guidance. Reed (2012) reported Cronbach's alpha for each part of the assessment: experience (.93) and importance (.91). Findings revealed that the tool needed further psychometric testing to determine reliability and validity of the importance portion of the scale.

Reflection

Reflection has been studied often as a concept of nursing and healthcare using Dewey's (1933) description, Meizerow's (1981) process of reflection and Schon's (1983) work related to the reflective practitioner.

In one exploratory and descriptive qualitative study, Husebo, Dieckmann, Rystedt, Soreide, and Friberg (2013) analyzed 24 video-recorded debriefings of nursing students following a simulation involving resuscitation teamwork. The researchers explored the depth of reflection expressed in questions by debriefers (*n*=4) and responses from nursing students (*n*=81) during post-simulation debriefings that lasted between 5.5 to 35-minutes and compared the relationship between the debriefers' questions to the level of reflection by the students. They then graded the debriefers' questions and nursing students' responses based on Gibb's stages of reflection: description, feelings, evaluation, analysis, conclusion, and action plan. These questions and responses were then correlated. The debriefers asked 96 questions, of which 34 were evaluative, followed by descriptive (*n* = 28), then analytic (*n* = 23), conclusive (*n* = 14), and emotional (*n* = 3); whereas students answered the most with descriptive responses (*n* = 68) followed by emotional (*n* = 37) and analytic (*n* = 29) responses, evaluative (*n* = 20) and conclusive responses (*n* = 3). None of the questions and responses was rated as questions about action plans. The greatest difference between the debriefers and the students was in the analytic stage. Only 23 of the 96 questions asked by the debriefers were analytic, reiterating the need for longer, structured debriefings that develop questions to facilitate deeper reflection (Husebo et al., 2013).

In another study, structured debriefings were frequently shown to improve individual performance, team performance, and enhance skill retention (Tannenbaum & Cerasoli, 2013). Structured debriefings allowed the debriefer to guide the conversation while keeping the focus on the learning objectives. Finally, this research determined the following as key elements of debriefing: establishing a safe learning environment, addressing learning objectives, using open-ended questions, and allowing for silence. Furthermore, Sawyer et al., (2016) concluded that the act of debriefing is probably more important than the method of debriefing. However, outcome studies related to debriefing were not included in their review, nor did they address the issue of theoretically derived or evidence-based debriefing.

In a survey of nurse educators' (*n* = 219) debriefing practices in accredited, traditional baccalaureate nursing programs, Waznonis (2015) reported that 94% of respondents received debriefing training. Types of training included mentors (47%), training through workshops and/or conferences (40%), training by manufacturers and/or manikin representatives (36%), and other types of training (26%). Respondents (*n* = 205/206) reported 75% of debriefings occurred immediately after the simulation, in a private setting (97%), in a different location from the simulation setting (70%), and the debriefing lasted 40 minutes or less (81%).

Decker et al. (2013) compared survey findings (*n* = 205) to the INACSL Standards for Best practice: Simulation^{SM} regarding an effective debriefing (VI) and discovered that though most nurse educators received debriefing training (Criterion 1: facilitator competency), the training was not formal and lacked a competency evaluation component. A little more than 50% of nurse educators used written confidentiality policies, and consensus was lacking on destruction of video/audio recordings (Criterion 2: environment). Nurse educators met Criterion 3: facilitator responsibilities by debriefing the simulation scenarios they observed using discussion and guided reflection. However, most debriefers struggled to achieve a high level of facilitation. While only 18% of respondents reported using a specific debriefing method, respondents used a structured debriefing 44% close to half of the time (Criterion 4: structured framework). Measurement of Criterion 5: objectives and outcomes could not be measured due to the variety of approaches to achieving this guideline. Findings from the work of Decker et al., (2013), Fey and Jenkins (2015), and Waznonis (2015) demonstrate the need for nurse educator education and development regarding best debriefing practices.

Debriefing is a complex and dynamic skill that is challenging to achieve proficiency in and typically requires hours of practice and thoughtful reflection (Cheng et al., 2015). How educators facilitate debriefings is highly variable (Sawyer et al., 2016; Waznonis, 2015) and, in practice, may stray from the ideal. Thus, novice educators and those new to simulation can be overwhelmed by the complexity of facilitated debriefings requiring guidance to learn the trade of debriefing necessary to ensure positive learning outcomes (Eppich & Cheng, 2015).

Dufrene and Young (2014) and Levitt-Jones and Lapkin (2014) each reviewed the nursing literature from 2002 through 2012, to explore debriefing outcomes. Although they only found 13 publications, their findings supported the widely held assumption that debriefing is an important component of simulation and should remain an integral component of all simulation learning. Furthermore, most studies combined the simulation experience and debriefing, making it challenging to correlate outcomes specific to one concept or the other (Lavoie et al., 2013). Moreover, these researchers noted that comparing results is difficult when the particular method or type of debriefing is often omitted from the study (Lavoie et al., 2013). Lack of clarity regarding method or type of debriefing corresponds to findings by Alba and Kelmonson (2014), who also note that studies in the debriefing literature often exclude debriefing characteristics and lack standardization. Finally, since 2012, many more studies about debriefing have been published which may expand Dufrene and Young (2014) and Levitt-Jones and Lapkin's (2014) conclusions.

A multi-site study by Shinnick, Woo, Horwich, et al. (2011) examined individual components of simulation regarding prelicensure nursing students (*n* = 162) knowledge of Heart Failure (HF). Students were tested before the intervention, post intervention, and immediately following the debriefing. Scores dramatically improved only after the debriefing (*M* = +6.75, *SD* = 4.32; *p* = < .001) establishing debriefing as the most important component of the simulation (Shinnick, Woo, Horwich et al., 2011).

Gillan et al. (2013) expanded this conclusion while conducting a qualitative study that explored third year undergraduate nursing student's (*n* = 120) experiences with an end of life care simulation. Data from evaluation surveys identified five major themes with debriefing as the prominent theme. Students shared that debriefing takes precedence over the simulation experience and, without debriefing, learning would be jeopardized. Study findings also demonstrated the relevance of a timely debriefing in the successful learning experience of end of life care, facilitated by experienced staff members. That study reiterated the importance of debriefing but excludes key elements of how debriefers debriefed, when they debriefed, and the training received by those debriefing students.

The work of Sabei and Lasater (2016) also contributed to the understanding of the value of debriefing for student learning. They noted three main consequences of a structured debriefing following simulation, previously reported in the literature: (a) Students experience a better understanding of the patient's circumstances through acquisition of knowledge which had been identified earlier by Chronister and Brown in 2012 and earlier by Shinnick, Woo, Horwich et al., in 2011, and (b) increased decision-making identified by Dreifuerst in 2009, Lavoie et al. in 2013, and Mariani et al. in 2013. Lastly, Sabei and Lasater (2016) noted that students demonstrated improved performance in psychomotor skills, which correlated to the findings of Levett-Jones and Lapkin in 2014 and reflected increased confidence in knowledge and performance of those skills also described by Boling and Hardin-Pierce in 2016, Keleeki in 2016, and Kim and Shin in 2016. Finally, other studies have documented some evidence suggesting students have the ability to transfer knowledge from the simulation experience to the clinical environment (Lasater et al., 2014; Tosterud et al., 2014). These outcomes are contingent upon the debriefer's ability to assist students, to reflect on their actions, expand their knowledge, and anticipate or reflect-beyond-action (Dreifuerst, 2009; Sabei & Lasater, 2016).

A mixed-method study by Mariani et al. (2013) used the Lasater Clinical Judgment Rubric (Lasater, 2007) to replicate the work of Dreifuerst (2010) and examine the effects of DML on the clinical judgment of 86 junior level baccalaureate-nursing students. The mean clinical judgment scores of the intervention group were higher and improved over time compared with the mean scores of the control group; however, the differences were not statistically significant which was attributed in part to the small sample size. In focus group interviews however, those participants debriefed with DML perceived the debriefing to have a positive impact on their ability to transfer knowledge to future patient care encounters, which the control group did not (Mariani et al., 2013). In the multi-site, repeated measures NSS study however, debriefers used DML within the experimental arm (*n*=432) and the findings indicated no statistically significant differences in clinical competency between students who had more traditional clinical and those who substituted 10%, 25%, and 50% of this time with simulation, as assessed by clinical preceptors and instructors ($p = 0.688$). There were also no statistically significant differences in comprehensive nursing knowledge assessments ($p = 0.478$) and there were no statistically significant differences in NCLEX® pass rates ($p = 0.737$) among the three study groups. These findings validated the impact of DML debriefing on the learning in simulation-based clinical experiences.

For these reasons, an analytical framework for guiding debriefers and students through the debriefing process is paramount in integrating theory with practice so acquisition of knowledge becomes actionable. A variety of methods are currently being used to guide the debriefing process (Fey & Jenkins, 2015; Waznonis, 2015). However, a well-structured, theoretically-derived, and evidenced based framework that teaches reasoning, not merely task or skill development, is the preferred method of debriefing (INACSL, 2016; NCSBN, 2014; NLN, 2015).

Debriefing for Meaningful Learning©

Debriefing for meaningful learning is a structured, theoretically derived, and evidence based debriefing method that has been used in prelicensure programs with positive learning outcomes (Dreifuerst, 2012; Forneris et al., 2015; Hayden, Smiley, & Gross, 2014; Mariani et al., 2014). Furthermore, DML has also been utilized to debrief graduate nursing students and interdisciplinary health care students to optimize contextual learning in both simulation and traditional clinical environments (K.T. Dreifuerst, personal communication, August 7, 2016). Debriefing for meaningful learning facilitates a deepening of students thinking processes by using Socratic questioning to guide students through a reflective dialogue that explicates thinking, decision-making, and associated actions (Dreifuerst, 2012). In this process, debriefers and students explore thinking associated with their actions, exposed, and analyzed the relationships between those choices and actions (Dreifuerst, 2015). Nursing educators can easily adapt DML to any patient situation or environment that students may encounter (Dreifuerst, 2010). Providing these consistent learning opportunities to practice thinking skills, in combination with purposeful and specific discussions is key in developing the clinical reasoning required for thinking like a nurse (Dreifuerst, 2010). There are several teaching-learning concepts incorporated into DML including Socratic questioning, reflection, and the 6E's (engagement, exploration, explanation, elaboration, evaluation, and extend).

Socratic Questioning

Socratic questioning, an integral component of DML, is a process where the debriefer guides the student through a facilitated conversation using deliberate questioning to gain understanding of what the student is thinking related to actions that occurred during simulation (Dreifuerst, 2010; 2015). The use of Socratic questioning helps to explore the student's thinking, determine the depth of their knowledge in an area or on a specific topic, and facilitate an analysis of their line of reasoning (Holden, 2002). Using a Socratic framework, the debriefer does not present information to the student, but rather poses questions in a manner that the student then re-examines what they believe to be true (Whiteley, 2006) and takes the questioning from the level of what the student knows and is comfortable with, deeper, and deeper until reaching the areas of uncertainty. The debriefer is empathetic to the problems the student faces during the learning experience and thus gently guides them to a richer understanding of the issues (Whiteley, 2006).

The technique of Socratic questioning is exploratory and issue-specific (Van Aswegen, Brink, & Steyn, 2011), where the debriefer listens to the viewpoints of the students then presents alternative points of view using questions, helping to teach students to sift through all the information, form a connection to prior knowledge, and transform the data to new knowledge (Van Aswegen et al., 2011). Socratic questioning is different from other types of questioning because within the method, users employ disciplined and systematic questioning, distinguishable from fragmented thinking or rapid-fire questioning, to assess the plausibility of ideas and cultivate deep learning (Holden, 2002). As the student shares their answers, the debriefer responds with another question enticing the student to think at a deeper level using comparison and contrast. Through this process, the student and debriefer gain a better understanding of the student’s thinking. Through Socratic questioning, taken-for-granted assumptions are challenged.

Challenging Taken-For-Granted Assumptions

Using Socratic questioning, the debriefer also exposes the student's frame of reference and taken-for-granted assumptions by revealing the relationships between the student's thinking and actions (Dreifuerst, 2015). It is in the uncovering of faulty assumptions that students become aware of the limitations of their knowledge and likewise, gains confidence through the acknowledgement of correct assumptions (Dreifuerst, 2015). The debriefer asks who, what, when, where, how, and why questions to guide the student through connecting thoughts with actions in order to examine the connections between assumptions and actions, whether correct or incorrect (Dreifuerst, 2015). Through Socratic dialogue, the student is guided in reframing thinking and connecting thinking and actions (Dreifuerst, 2015). The debriefer uses knowledge of the subject matter to ask meaningful questions that invoke reflective thinking in-action, on-action, and beyond-action, whereby students examine their own thought processes to distinguish what they know or understand from what they do not (Dreifuerst, 2015).

Students often find it challenging to engage in thinking or reflection while in the midst of a learning experience and require guidance to examine their thinking and decision-making processes. A novice nurse or reflective practitioner who is just becoming comfortable with contextualizing knowledge into practice is learning to engage in reflection-in-action (Benner, 1984; Dreifuerst, 2015; Shön, 1983) or put the pieces together in the moment and apply knowledge contextually. It is challenging to teach and learn reflection-in-action as it occurs in the moment (Dreifuerst, 2015). Therefore, during debriefing, the debriefer often guides the student to reflect back to the moments when nursing actions and decision-making transpired. In addition, the debriefer guides the student in reflecting on those critical decision-making points when the student did or did not put the pieces of the unfolding situation together. Dreifuerst (2015) noted that during this type of reflecting in the moment, students develop an awareness of thinking and the assumptions that drive their decisions. This new awareness exposes students to their own taken-for-granted assumptions and reveals the strengths and flaws in their thinking and nursing judgment (Dreifuerst, 2015).

Reflecting after an action has occurred is reflection-on-action (Schön, 1983). This type of reflection takes the student through a review of the events to reexamine feelings, thinking, actions, and the processes that influenced the outcome (Schön, 1983). Reflection-on-action is a time when frames, beliefs, experiences, and biases become even more evident and assumptions are critically examined. Reflection-on-action is also a time when the debriefer may guide students in recognizing and identifying patterns or links in thoughts to uncover the thinking behind the actions, thereby exposing new assumptions, information, and theoretical perspectives upon which the student's clinical practice is based. It is both recognition of the things students will do differently the next time they encounter the situation as well as an acknowledgment of the things that they will want to do the same the next time (Dreifuerst, 2015). Reflection-on-action is a commonly seen among competent nurses (Benner, 1984; Dreifuerst, 2015; Shön, 1983).

Though students may independently reflect-on-action, the debriefer guides the student through the process of ‘unpacking’ the experience. Collaboratively analyzing the student’s thoughts, decisions, and actions, while uncovering correct or incorrect thinking, grounds the experience to the intended objectives while generating and exchanging different views and alternative choices through the active discussion.

Dreifuerst (2009) extended Schön’s (1983) concepts of reflection-in-action and reflection-on-action to include reflection-beyond-action. Reflection-beyond-action describes the relationship between anticipation and reflection (Dreifuerst, 2015). Reflection requires anticipation and anticipation requires reflection (Dreifuerst, 2009). The student directs their attention to the identification and integration of what was learned during this experience to a new or similar encounter, based on reflection and anticipation. Through guided reflection-beyond-action, students explore potential patient scenarios, providing a path for transference of knowledge for future patient care under the guidance of a debriefer, who is also a subject matter expert. Guiding students through reflection-beyond-action facilitates assimilation and accommodation of knowledge and skills for future clinical encounters. The value of reflection-beyond-action is that students can learn to recognize and trust decision-making skills in the face of uncertainty. Expert nurses exemplify reflection-beyond-action when, upon hearing a few details about a yet unseen patient, can begin to envision what they will encounter, and the nursing care needed (Benner, 1984; Dreifuerst, 2015). Through assimilation and accommodation then, the expert nurse adapts or continues through the new experience based on reflection from prior ones (Benner, 1984; Dreifuerst, 2009; 2015).

Six E's of Debriefing for Meaningful Learning

The Biological Sciences Curriculum Study (BSCS) E5 Instructional Model is the foundational, theoretical model for the 6E's of DML (Bybee, 1989; Bybee et al., 2006; Dreifuerst, 2010). The principles of the BSCS E5 instructional model are threefold: to engage students in a meaningful way so they will grasp new concepts and information in place of their preconceived ideals; to conceptually frame deep levels of knowledge that are easily retrieved for application; and to give students responsibility for their own learning to achieve their goals. The five phases of the BSCS E5 Instructional Model are engagement, exploration, explanation, elaboration, and evaluation. Dreifuerst (2010) added a sixth phase; *extend,* to the model*,* to include anticipatory thinking (reflection-beyond-action).

While the entire process is iterative, the DML debriefer begins with the initial phase, *engage*, gathering students together to begin the debriefing. During this first phase of *engage*, students silently record their initial thoughts and feelings pertaining to the learning experience on designated worksheets, while the debriefer encourages them to recall the patient's name, story, and a key problem to frame the patient situation. Once this is completed, the debriefer then engages students in a debriefing conversation by maintaining a listening posture, facilitating intellectual dialogue among all participants through Socratic questioning, and encouraging further exploration of thoughts (Dreifuerst, 2010).

During the next iterative phase, *explore*, students discuss the clinical decisions they made as the debriefer guides them in exploring and identifying factors that contributed to their decision-making process (Dreifuerst, 2010). The debriefer uses Socratic dialogue to guide students in uncovering thinking that contributed to their decision to act, or not to act, as they reflect-in-action and reflect-on-action. The debriefer challenges the students' taken-for-granted assumptions during the *explore* phase to uncover the reasoning behind the nursing actions and to identify what could have been done differently (Dreifuerst, 2015).

In the iterative *explain* phase, the debriefer then guides the students through the process of their learning experience, facilitating the students' explanations of what they did, what they saw, what it meant and the decisions they made, continuing to reflect-in-action and reflect-on-action (Dreifuerst, 2010). The debriefer guides the students in connecting thinking with actions and examining how this thinking corresponds to what is known about the care of these types of patients. If the student's knowledge or assumptions are incorrect, the debriefer probes, clarifies, and engages in other explanations to add clarity to the student's thinking.

In the iterative *elaborate* phase, the debriefer facilitates a conversation that expands student thinking regarding actions through further dialogue about the experience; identifying critical details and points of learning and verbally acknowledging what went right and what went wrong (Dreifuerst, 2010). The debriefer continues to guide students to expand on the thoughts and feelings that shaped their actions and decisions during the learning experience while elaborating on their assumptions through reflection-in-and on-action (Dreifuerst, 2015).

Through guided reflection, the debriefer and students then *evaluate* what did and did not go well in the learning experience (Dreifuerst, 2010). During this phase that students evaluate the impact of their knowledge, decisions, and actions on patient outcomes, then reframe the experience with the appropriate decisions and actions cognitively locked into memory. During this collaborative evaluation, the debriefer guides students through evaluation of all aspects of their thinking and assumptions in order to restructure their frames and knowledge.

The last of the iterative phases, *extend* is achieved through guided anticipation and reflection-beyond-action to consider possible future patient encounters (Dreifuerst, 2010). The debriefer uses *what if* questions to guide students in thinking beyond the isolated clinical encounter and to apply learned concepts to a similar or parallel patient encounter. The student learns to imagine unexpected and unanticipated situations and push their thinking forward with the guidance of a debriefer who possesses clinical knowledge and expertise. The use of a worksheet guides the DML process through the 6E's.

Worksheets

The 6E's of DML use worksheets to help students and debriefers use a consistent debriefing process, while also providing visual learning opportunities and double-loop thinking about the patient encounter (Dreifuerst, 2010). The debriefer also uses a whiteboard or smart board to write out notes and ideas while participants simultaneously use the worksheet to create a written record of the process. In this manner, the group is "thinking, seeing, dialoging, reading, and writing together" (Ironside, 2006, p. 485). Furthermore, the worksheets can help guide the debriefing process with conceptual mapping (Dreifuerst, 2015, p. 270).

Concept mapping is a teaching strategy used in many disciplines with origins in constructivism and roots in education and psychology (Daley, Morgam, & Black, 2016; Decker et al., 2010). The use of concept mapping aids participants in organizing and prioritizing patient data, seeing and analyzing relationships between the data, and working through the nursing process of assessment, nursing diagnosis, outcomes, interventions, and evaluation. This technique allows participants to see the connections between their thoughts and ideas by creating a visual map of those connections that make sense to the participant (Jamison & Lis, 2014). Concept mapping has been shown to enhance skills (Rasoul Zadeh, Sadeghi Gandomani, Delaram, & Parsa Yekta, 2015), increase confidence (Samawi, Miller, & Haras, 2014) and clinical competence (Jamison & Lis, 2014; Xu et al., 2016) among nursing students.

To further enhance double-loop learning, the DML process incorporates the use of different ink colors on the whiteboard and worksheets to record the events that transpire during the debriefing. Black is typically used to note events that took place and student feedback regarding the event; red is for areas of improvement or nursing actions that were wrong; green denotes correct, good, or positive choices or decisions; and blue is used for change or new thinking

(Dreifuerst, 2010). Students take the worksheets with them after DML debriefing for future review or reference (Dreifuerst, 2010). In this way, the worksheets and concept mapping of the clinical experience allows the students to visualize interrelationships among assessment, decisions, and actions to augment cognitive thinking and support clinical competence (Jamison & Lis, 2014).

Debriefing for Meaningful Learning Outcomes

Dreifuerst (2012) first examined the relationship between the use of DML and the development of clinical reasoning skills of prelicensure nursing students (n=238) in simulation. The author tested the research questions using DML as a single intervention variable using the Health Science Reasoning Test (HSRT), Debriefing Assessment for Simulation in Healthcare (DASH) and Debriefing Assessment for Simulation in Healthcare -Student Version (DASH-SV) instruments to assess for a correlation between the effectiveness of structured debriefing and critical thinking acquisition. The findings showed a statistically significant difference (p < .05) between pretest and posttest HSRT scores of the intervention group, indicating DML positively influenced students' ability to transfer clinical reasoning skills into practice (Dreifuerst, 2012). Students in this group also perceived a significant difference in the quality of debriefing, with DML associated with greater positive changes in HSRT posttest scores not seen in the control group.

Forneris et al. (2015) replicated Dreifuerst's (2012) research in a multi-site study testing the impact of DML on clinical reasoning in prelicensure baccalaureate nursing students (n = 153). The HSRT was used during the first week of class, and three weeks after the intervention, to measure changes in clinical reasoning. The intervention included a simulation experience from the NLN's Advancing Care Excellence for seniors' scenarios, followed by a DML debriefing facilitated by debriefers trained in the method (see Appendix A for permission). The change in the mean HSRT score for students in the intervention group was statistically significant (p = .03) and the change in the mean HSRT score between the intervention and control groups was significant (p = .09) at the .10 level (Forneris et al., 2015). Therefore, participants demonstrated an improvement in clinical reasoning when debriefed using DML compared to a customary debriefing, which validated Dreifuerst's (2010) original findings (Forneris et al., 2015).

Nursing Knowledge and Application

Today's acute healthcare environment presents increased challenges for student and novice nurses requiring higher levels of knowledge and critical thinking skills to care for patients (NCSBN, 2013). As patient status changes, nurses are on the front line when it comes to detecting clinical decline and intervening appropriately (NCSBN, 2013). Establishing practice environments that prepare nurses to deliver safe, quality care in a consistent manner is of high priority (Brannon, White, & Long, 2016; Evans & Mixon, 2015; Highfield, Scharf-Swaller, & Chu, 2017). Nurse educators are responsible for preparing nurses for practice by teaching students how to apply knowledge, skills, and attitudes in nursing care (Benner, 2012). The creation of learning environments that facilitate critical thinking and reflection are paramount to the success of nurses entering the care environment (AACN, 2009). Simulation with debriefing can play an integral role in the development of nursing knowledge, skills, and application in all aspects of care (Bayoumy & Jadaani, 2015; Boling & Hardin-Pierce, 2016; Orique & Phillips, 2017).

Bayoumy and Jadaani (2015) investigated the effect of a Percutaneous Endoscopic Gastrostomy (PEG) tube feeding simulation on nursing students' knowledge, competence, self-reported confidence, satisfaction with learning, and compared those involved in this simulations with video-led instruction using a convenience sample of undergraduate baccalaureate nursing students registered in an Adult-II medical-surgical course (*n* = 37). The participants consisted of both undergraduates (stream I) and second-degree students seeking a BSN (stream-II). Participants in the experimental group (*n* = 19) and participants in the control group (*n* = 18) both received a two-hour lecture on effective, competent, and safe administration of PEG-tube feedings. The experimental group received an extensive discussion on PEG-tube competency performance during the simulation, while the control group received a similar discussion after watching a 25-minute competency performance video. Participants from each group were then divided into subgroups of 4-5 students, given a multiple-choice pretest before the educational activity, and a multiple-choice posttest immediately after completion of the activity.

An instructor-built, scenario-based, multiple-choice questionnaire exam was used to measure student knowledge of performing safe and effective PEG tube feedings. Validity and reliability of the multiple-choice questionnaire were not reported but they also used a 21-step checklist adopted from Kozier and Erb's Fundamentals of Nursing (Berman et al. 2008) to test students' competency. Bayoumy and Jadaani (2015) developed this 8-item self-assessment confidence scale to measure students' confidence levels. The reliability of the scale had high internal consistency ($\alpha = 0.94$). They also used a student's satisfaction survey that contained 19 items measured on a 4-point Likert scale (Bayoumy & Jadaani, 2015). A multivariate analysis of variance (MANOVA) was used to examine the data and both groups had significant improvements in posttest task-related knowledge scores ($F = 5.24$, $p = <0.000$) with no significant difference between the simulation and video-control group ($F = 0.65$, $p = 0.53$; Bayoumy & Jadani, 2015).

These findings were similar to Cobbett and Snelgrove-Clarke's (2016) study of third year baccalaureate nursing students participating in maternal newborn clinical scenarios in either face-to-face simulation ($n = 42$) or virtual clinical simulation (n = 42) in the care of a patient with preeclampsia or Group B Streptococcus. There were no significant differences ($p = 0.09$) in scores between face-to-face simulations ($M = 4.80$, $SD = 1.19$) and virtual clinical simulations ($M = 4.12$, $SD = 1.54$). Similar analysis compared post Group B Streptococcus scores for nursing students with no significant difference in scores ($p = 0.31$) for face-to-face ($M = 6.82$, $SD = 1.25$) and virtual clinical simulation demonstrating neither approach had a superior effect on nursing students' knowledge about caring for pregnant women experiencing either preeclampsia or Group B Streptococcus (Cobbett & Snelgrove-Clarke, 2016). Virtual clinical simulation had a statistically significant effect ($p = 0.002$) on students' anxiety levels ($M = 73.26$) as compared to the face-to-face group ($M = 57.75$), with 90% of participants ($n = 22$) reporting a preference for face-to-face simulation over virtual simulation (Cobbett & Snelgrove-Clarke, 2016). Understanding students' different learning styles also helps with knowledge acquisition and application of that knowledge in future care situations.

An experimental study by Brannon et al. (2016) used Felder and Soloman's (2004) Index of Learning Styles instrument to examine nursing students' ($n = 54$) learning styles and their impact on confidence and knowledge in traditional and simulation settings. Findings revealed that, of the 54 students, more were likely to have active ($n = 28$), visual ($n = 40$), sensing ($n = 33$), and sequential ($n = 33$) learning styles in both learning environments. Student confidence or knowledge did not significantly differ ($p > 0.05$) in either simulation ($n = 38$) or traditional classroom ($n = 16$) methods among learning styles (Brannon et al., 2016).

Aina-Popoola and Hendricks (2014) reviewed 18, of 34 articles yielded in a search that pertained to learning styles of first semester baccalaureate nursing students. Students had increased motivation to study and increased learning when different teaching strategies were implemented. In nursing students who were in the first year of the program, demographics and age affected learning styles. However, these differences were no longer observed within the students' in the final year of the program. The authors noted limited research exists on first semester nursing students learning styles limiting the understanding of how learning styles affects this particular group (Aina-Popoola & Hendricks, 2014). Students familiar with different learning styles may be better able to incorporate different teaching methods specific to their patients' learning style preference to maximize patient education.

Evans and Mixon (2015) used a pretest posttest design with undergraduate, second-semester, junior nursing students (n = 117) to study the impact of post-operative pain management simulation. Students assessed pain levels and then provided pain management for a late adolescent male whose mother's fear of addiction was a barrier to typical nursing interventions. Students completed a written survey, the Knowledge and Attitudes Survey Regarding Pain (KASRP) (Ferrell and McCaffery, 2012), to assess pain knowledge with regard to addiction risk and related medication administration. The participants mean KASRP score was 70% and students ranked simulation as slightly more effective than the didactic component for learning about post-operative pain management. Students also stated that the simulation encouraged interprofessional collaboration and enhanced communication skills.

In another study using pretest and posttests, Sawin, Mast, Sessoms, and Fulcher (2016) gathered data on 46 participants, most of who were nursing majors with a few undergraduate health and human service participants. The pretest was given at the beginning of the semester before the course orientation and consisted of the Caregiver Knowledge Scale (CKS; L. A. Markut, personal communication with author, January 7, 2011) and the Understanding of Family Caregiving Scale (UFCS; Sawin et al., 2016). The posttest was given immediately following the *A Life of a Caregiver* simulation and included the same questions, plus the Caregiver Simulation Impact Scale (CSIS) questions (Vandsburger, Duncan-Daston, Akerson, & Dillon, 2010) and four qualitative questions. Findings from the qualitative instruments revealed an increased understanding of caregiving terms, stressors, concerns caregivers experience, and the emotional rewards of caring for a loved one. Quantitative data revealed that students viewed helping older adults in a positive manner and could foresee working with older adults after they graduated (M = 3.49). Findings also revealed student's attitudes were positively influenced (M = 4.56) toward caregivers and care recipients helping students to connect knowledge to real-life events.

Improved patient safety and a reduction in student errors were also found in the literature. Khader (2016) used simulation to examine knowledge, skills, confidence, anxiety, and critical thinking of second year baccalaureate nursing students (n = 58) before attending traditional clinical rotations. A questionnaire was developed to measure the variables of the study and reliability of the tool was acceptable (α = 0.86). A panel of doctorally prepared nurses reviewed content validity, and the reliability was tested using Cronbach's alpha. Khader (2016) then exposed participants in the experimental group (n = 28) to several simulation experiences to master skills of caring for patients with cardiac, respiratory, and neurological issues before attending clinical rotations in the hospital. The control group (n = 28) attended traditional hospital clinical rotations without receiving the simulation experiences. The results of the analysis indicated a statistically significant difference ($p < 0.05$) in knowledge, skills, and critical thinking between the experimental and control group after completion of the educational experience. The educational experience included the simulated sessions. The results also indicated a statistically significant difference ($p < 0.05$) in the level of anxiety, communication, and self-confidence between the experimental and control groups. The experimental group had lower levels of anxiety, improved communication skills, and an increase in self-confidence compared to the control group. In addition, the results of the *t*-test showed the mean score of the experimental group was significantly higher than the means core for the control group (Khader, 2016). Therefore, the results of this study are consistent with results of prior studies (Tawalbeh & Tubaishat, 2014), demonstrating the positive effect simulation had on students' skills, and confidence, and improved knowledge.

Knowledge improvement following simulation has been further documented in the literature. Kim and Shin (2016) evaluated the effect of simulation on nursing student's (n = 47) sexual knowledge regarding sexual problems, sex-related counseling, sexual health, and attitudes in the care of a patient experiencing a sex-related clinical situation. Kim and Shin (2016) used Sex-Role Orientation and the Sex-Role Ideology Scale to measure gender-role perception. The scale was translated and modified by Lee and Chung (1984) with an acceptable internal consistency in this study ($\alpha = 0.83$) and in a previous study ($\alpha = 0.89$). Sexual knowledge was measured using a scale that Choi and Ha (2004) developed, with acceptable levels of internal consistency in several studies ($\alpha = 0.74$ & 0.89; Kim & Shin, 2016). They also measured sexual attitudes using Bae's (2002) scale, which had a previously reported Cronbach's alpha of .70 and was .72 in Kim and Shin's study. All students participated in Session 1, a six-hour lecture, and demonstrated no differences in knowledge ($p > .05$) and attitude ($p > .05$). Additionally, the experimental group ($n = 24$) participated in two simulations the following day on care of women with spontaneous abortion and pelvic inflammatory disease. The results of the analysis revealed statistically significant differences in the improvement of knowledge ($p < .05$) and attitude ($p < .05$) between the two groups. These results demonstrated that simulation was an effective instruction for the care of women with spontaneous abortion and pelvic inflammatory disease (Kim & Shin, 2016).

Lee, Kang, Park, and Kim (2017) used a quasi-experimental pretest posttest design to examine knowledge, confidence in performance, ability in nursing practice, and satisfaction with learning methods in senior nursing students ($n = 127$) caring for children with croup. They compared the senior nursing students to groups of students that received education through simulation combined with pre-education (experimental = 45), simulation only (comparison group 1 = 40), and pre-education only (comparison group 2 = 42). A 10-item multiple-choice questionnaire, that was previously tested, was used for both the pretest and posttest.

Lee et al. (2017) developed a confidence in performance instrument ($\alpha = 0.93$) to measure the degree of confidence among students when performing care. They developed a second instrument to examine ability in nursing practice to care for children with croup; reliability ($\alpha = 0.90$) and the content validity (0.85) were acceptable, tested by a panel of pediatric experts (Lee et al., 2017). The third instrument, used by Lee et al. (2017), measured student satisfaction with the learning method and it was translated, with permission from Otieno et al. (2007), from English to Korean. Cronbach's alpha was 0.93 in this study (Lee et al., 2017). There were significant differences in the mean scores of knowledge ($p < 0.001$), confidence in performance ($p < 0.05$), and satisfaction with the learning method ($p < 0.001$) between the three groups (Lee et al., 2017). The results indicated that pre-education with simulation significantly enhanced students' knowledge, confidence in performance, ability in nursing practice, and satisfaction with learning methods compared with pre-education or simulation alone (Lee et al., 2017).

Loke et al. (2014) used a descriptive, cross-sectional survey design to explore the effect of simulation on decision-making skills of 232 second-year nursing students in the second semester of a pre-registration nursing diploma program. A 24-item Nurse Decision-Making Instrument based on the continuum cognitive theory was used, to capture the effect of simulation on students' complex decision-making skills including intuitive reasoning and rational thinking. Results of the study, using independent sample *t*-tests, revealed three predictive indicators had a positive effect on decision making skills: prior experience with simulation in previous course work (t = 70.6, p < 01), hands-on practice (t = 69.66, $p < .01$), and active participation in the debrief (t = 70.11, $p < .01$). The study results supported the use of simulation with active participation in debriefing to maximize decision-making skills (Loke et al., 2014).

Using a cross-sectional study design, Luctkar-Flude et al. (2015) examined participant knowledge, confidence, and performance of assessments and interventions with an unresponsive patient across three years of an undergraduate-nursing program. Students (n = 239) in all three years of the nursing program participated in post-scenario debriefings in which students reflected on the knowledge and performance gaps and explored the appropriate management of each scenario.

This study constituted Phase 1 of a longitudinal study evaluating outcomes of high-fidelity patient simulations on unresponsive patients. Therefore, several instruments were used including a self-confidence 8-item survey, 5-point Likert scale Critical Behavior Performance Checklist Satisfaction Scale 10-item survey, 5-point Likert scale, and an Experience Survey (Luctkar-Flude et al., 2015). All surveys had acceptable reliabilities (α > .85). There was strong interrater reliability (between 93% and 96%) of the performance checklist (Luctkar-Flude et al., 2015). Overall, knowledge, confidence, and performance scores were similar between second, third, and fourth year students (n = 239). Second year nursing students' knowledge increased significantly following the new simulation ($p < 0.01$) (Luctkar-Flude et al., 2015). This supports the findings by Treister and Darcy (2016) that repetition with feedback and reflection are key attributes of simulation that contributes to learning.

Sarabia-Cobo et al. (2016) developed a palliative care simulation to prepare second year undergraduate nursing students (n = 68) to provide quality palliative/end of life care. Three qualitative and quantitative instruments were used: The Knowledge and Beliefs about PC Questionnaire, the Participant's Questionnaire, and the Observer' Questionnaire. The Observers' Questionnaire had been validated in an earlier study with psychometrically valid results and reliability (Alconero-Camarero, Gualdron-Ramero, Sarabia-Cobo, & Martinez-Arce, 2016). Students participated in either a high-fidelity simulation scenario A (*n* = 53) or a low fidelity simulation scenario B (*n* = 15; Sarabia-Cobo et al., 2016). Students' expressed appreciation for learning increased therapeutic communication skills and the development of therapeutic relationships in handling the care of a dying patient. Students also noted a preference for high-fidelity simulation over low-fidelity simulation (Sarabia-Cobo et al., 2016).

A prospective pretest posttest study by Simko et al. (2014) examined whether baccalaureate and accelerated second-degree nursing students (n = 190) experienced an increase in knowledge of nursing care during a mock code using simulation. The 10-item multiple-choice pretest and posttest questions came from the American Heart Association (AHA) Advanced Cardiac Life Support (ACLS) exam (AHA, n.d.). Both groups demonstrated increased knowledge in the care of a patient experiencing cardiac arrest (Simko et al., 2014). Second-degree student posttest scores (*M* = 8.6 vs. *M* = 5.5; *p* < .001) were statistically significantly greater than the posttest scores of the undergraduate students (*M* = 7.6 vs. *M* = 5.2; *p* < .001). Although not completely explained, it was speculated that the accelerated second-degree students may have had increased motivation and self-drive compared to the traditional baccalaureate undergraduate students, which attributed to the higher test scores (Simko et al., 2014).

Tawalbeh and Tubaishat (2013) also studied the effect of simulation on baccalaureate nursing students' (*n* = 91) knowledge, knowledge retention, and confidence in applying Advanced Cardiac Life Support skills and had similar outcomes to other studies (Simko et al., 2014). An independent *t*-test indicated posttest mean knowledge of Advanced Cardiac Life Support and confidence was higher in both the experimental and control groups (Tawalbeh & Tubaishat, 2013). However, study findings demonstrated simulation to be significantly more effective than traditional training in helping improve nursing students' knowledge acquisition in the experimental group (*M* = 12.92, *SD* = 3.02) and control group (*M* =7.88, *SD* =3.50), knowledge retention in the experimental group (*M* = 12.00, *SD* = 2.90) and control group (*M* = 7.30, *SD* = 3.09), and confidence in the experimental group (*M* = 74.38, *SD* = 11.55) and control group (*M* = 32.85, *SD* = 18.16) about Advanced Cardiac Life Support reported differences in retention overtime (Tawalbeh & Tubaishat, 2013)**.**

Orique and Phillips (2017) reported on a series of meta-analyses of 22 reports and 19 studies on the effectiveness of simulation in both student nurses and registered nurses to recognize and clinically manage patient deterioration in an acute care setting by applying learned knowledge. Synthesis of the findings indicated that simulation had a positive effect on both student nurses and registered nurse's knowledge and performance. The authors recommended testing of standardized simulation education programs for future research. In another study, Tubaishat and Tawalbeh (2015) used a pretest, posttest, posttest design to evaluate the effect of simulation on the acquisition and retention of arrhythmia-related knowledge. Participants were randomly assigned to either the experimental group (*n* = 47), which attended 20-minute simulation scenarios (number of scenarios not specified) on cardiac arrhythmia with 10-minute debriefings, or to the control group (*n* = 44), which received a traditional 2-hour lecture on the same topic. The same 20-item multiple-choice structured questionnaire (content validity index 0.89) was administered for the pre-test and the post-test. Both groups scored significantly higher on the posttest than the pretest ($p < .001$). However, participants in the experimental group demonstrated significantly increased knowledge of cardiac arrhythmia in the first ($p < .05$) posttest and in the second post-test three months later ($p < .001$) compared with those in the control group. These results demonstrated simulation had a stronger impact on students' arrhythmia knowledge (Tubaishat & Tawalbeh, 2015).

Using a quasi-experimental study repeat measure design, Zinmaster and Vliem (2016) examined the effects of simulation on knowledge acquisition and knowledge retention of 41 junior level baccalaureate nursing students. The control group (*n* = 19) participated in lectures only, while the experimental group (*n* = 25) participated in lecture with a seven to ten minute videotaped simulation followed by a debriefing process where they had an opportunity to watch the video of the simulation and be guided through reflection. Both groups completed a knowledge pretest immediately following a pediatric neurology lecture, a posttest immediately following the simulation, and then another posttest four months after completion of the course. The results indicated a statistically significant difference in knowledge gain between lecture-only and lecture with simulation experiences: t (29) = -3.39, $p < .01$. However, there were no statistically significant differences related to knowledge retention, t (42) = -.30, p = .766, between the groups despite the lecture with simulation group having exposure to “repeat testing, components of experiential and cognitive learning, and emotions” (Zinmaster & Vliem, 2016, p. 290).

Qualitative studies have also been used to explore the impact of simulation and debriefing. Study outcomes demonstrated student perceptions of the simulation experiences were supportive of their learning needs (Au, Lo, Cheong, Wang, & Van, 2016; Botma, 2014; Fawaz & Hamdan-Mansour, 2016; Venkatasalu, Kelleher, & Chun Hua, 2015). One qualitative study by Au et al. (2016) explored first year baccalaureate nursing students’ perception (n = 80) of the use of simulation with debriefing in place of traditional clinical rotations, involving the subjects of Health Assessment, Fundamentals of Nursing, and Pharmacology. Students participated in one simulation with a half hour spent in prebrief, half hour for student preparation for the simulated experience, participation in the simulation lasted a half hour, and the debrief was also a half hour.

The facilitators guided the debrief and the simulation was recorded for students to review as part of the debriefing. Role-players used the think-out-loud technique during the debrief and facilitators and student observers shared cues and feedback that contributed to a collaborative learning experience (Au et al., 2016). Students were encouraged to discuss the scenario and share their strengths and weaknesses and the impact their decisions had on future practice. Au et al. (2016) noted that simulation with debriefing positively contributed to student knowledge applicable to practice, a finding similar to those of other qualitative studies of first year baccalaureate nursing students (Fawaz & Hamdan-Mansour, 2016). Unique to their study was the participants' perception of resourceful ability or means of overcoming difficulties during the simulation experience.

Botma (2014) also described a qualitative descriptive study on nursing student's perceptions (*n* = 8) on how immersive simulation promotes theory - practice integration, confidence, deliberate practice, motivation, and teamwork; reflective of findings from other qualitative studies (Fawaz & Hamdan-Mansour, 2016). During the debriefing sessions, student participants discussed ways to improve their skills by identifying their own strengths and weaknesses. Group feedback provided ways to apply classroom knowledge to the clinical setting and observers of the simulation noted they learned as much as the active participants (Botma, 2014). Actively engaging in an immersive simulation with debriefing, motivated students to apply what they learned in the simulation to the practice setting (Botma, 2014).

Venkatasalu et al. (2015), in another qualitative study, assessed the impact of simulation versus classroom education on teaching first-year baccalaureate nursing students (*n* = 187) end-of-life care in preparation for their first traditional clinical experience. Students were randomly allocated to receive either classroom-based education (*n* = 139) or a simulation related to end-of-life care teaching (*n* = 48). Students in the two-hour classroom-based education session watched a brief video on end-of-life care followed by a discussion in which students could reflect on prior personal experiences with loss, how they were affected by those experiences, and ways in which they dealt with those experiences. The simulation session consisted of two simulation scenarios on end-of-life care. The prebrief lasted 15 minutes and introduced students to end-of-life care terminology, provided the background for the two clinical scenarios: a dying patient and a deceased patient, and then introduced the group to SimMan. Students then participated in a 20-minute simulation and the facilitator assisted students in caring for a dying or deceased patient. After the simulation, students debriefed for 40 minutes whereby facilitators encouraged the students to reflect on what transpired during the simulation and to discuss any issues that arose.

When all participants returned from their first clinical placement, Venkatasalu et al. (2015) carried out 12 individual in-depth interviews. Analysis of the data revealed four key themes as clinical outcomes: recognizing death and dying; knowledge into practice; preparedness for clinical eventualities; and emotional preparedness (Venkatasalu et al., 2015). The participants perceived simulation with debriefing as the better teaching method for enhanced practical skills and improved emotional experience, though data analysis revealed both strategies improved student knowledge in the areas of recognizing death and dying, putting knowledge into practice, preparedness for clinical eventualities, and emotional preparedness (Venkatasalu et al., 2015).

Knowledge Retention and Application

It is a common belief within education research, that the better the original learning, the more likely students are to remember materials years later (Canzian et al., 2016). Therefore, information needs to be learned to have a beneficial effect over time. Educators seek methods that increase knowledge retention and application into contexts beyond the rote rehearsal of skills that makes learning durable (Canzian et al., 2016).

Abusaad and Ebrahem (2015) conducted a quasi-experimental, pretest posttest study examining changes in knowledge, confidence, and clinical skills of 100 first semester undergraduate nursing students enrolled in a pediatric nursing course. Students were randomly selected and enrolled into four of either simulation or traditional clinical groups for neonatal resuscitation skill performance. Three of the four tools were developed for the study and a student sociodemographic questionnaire (Tool I) was used to collect data regarding age, sex, residence, and marital status. Tool II was a Neonatal Cardiopulmonary Resuscitation Knowledge 23 item multiple-choice questionnaire used to assess students’ factual knowledge pertaining to neonatal cardiopulmonary resuscitation. Pediatric nursing experts revised that tool. The third tool, Neonatal Cardiopulmonary Resuscitation checklist, was a 23-step checklist derived from a pediatric nursing clinical book updated yearly, to test students’ performance. The fourth tool was a 12-item Likert-type self-confidence scale (Hicks, 2006) measuring students' self-confidence about neonatal resuscitation. High internal consistency reliability was reported for this scale on the current pretest (α = 0.93) and for the posttest (α = 0.96). The results indicated an increase in knowledge, skill performance, and self-confidence of neonatal resuscitation among the simulation group, immediately after the intervention and at three months, compared with the traditional group (Abusaad & Ebrahem, 2015).

Akhu-Zaheya, Gharaibeh, and Alostaz (2012) also examined the effect of simulation on knowledge acquisition, knowledge retention, and self-efficacy of second year baccalaureate nursing students enrolled in an adult health clinical course (n = 110). The experimental group (n = 52) received a 3-hour traditional teaching session of Basic Life Support with demonstration on static manikins in groups of six to seven participants, and participation in a simulation consisting of a 15-minute cardiopulmonary arrest scenario with 10 minutes of debriefing on Basic Life Support. The control group (n = 58) received only traditional teaching of Basic Life Support using a three-hour presentation and demonstration on static manikins in groups of six to seven students. (Akhu-Zaheya et al., 2012).

The results of independent t-tests for Basic Life Support knowledge acquisition mean differences between the experimental group (M = 9.1) and control group (M = 8.6) showed no significant difference; $t(108)= 1.6$, $p = 0.10$. However, the results for knowledge acquisition and retention increased for both the experimental (M = 8.29) and the control (M = 8.28) groups at one month; t (108) = 0.03, $p = .97$. Interestingly, the t-test for self-efficacy was statistically significant, experimental (M = 84.4) and control (M = 75.1); t (108) = 3.91, p =

.001) demonstrating nursing students preferred learning with simulation rather than traditional means (Akhu-Zaheya et al., 2012).

Zinmaster and Vliem (2016) reported similar findings in their study of baccalaureate nursing students with a statistically significant difference in knowledge gain between lecture-only group and lecture with simulation experience group (t (29)= -3.39, p < .01) yet there was no statistically significant difference found between groups for knowledge retention of an infant with a subdural hematoma (Zinmaster & Vliem, 2016). The experimental group's knowledge returned to pre-intervention levels at four months and the control group's knowledge remained constant (Zinmaster & Vliem, 2016).

To promote retention of advanced cardiac life support skills, Tawalbeh and Tubaishat (2013) provided baccalaureate-nursing students (n = 40) with an advanced cardiac life support simulation scenario, a 4-hour PowerPoint presentation, and a demonstration on a static manikin. Compared to the control group (n = 42) who received the PowerPoint presentation and a demonstration only, the experimental group demonstrated significantly higher scores, t(80) = -6.96, p < 0.001, for knowledge acquisition, knowledge retention at 3 months, and confidence about advanced cardiac life support (Tawalbeh & Tubaishat, 2013). Agre and Thomas (2015) divided 300 second year baccalaureate nursing students into three groups (n = 100) and presented three teaching methods: lecture method, computer aided learning, and problem-based learning on the topic of hypertension. When compared with the other two teaching methods, students who received computer-aided learning demonstrated statistically and significantly higher scores on knowledge retention in the care of a patient with hypertension (p < .001; Agre & Thomas, 2015).

Chronister and Brown (2012) evaluated the effect of video-assisted verbal debriefing versus verbal debriefing on quality of skills (assessment and psychomotor), skills response time, and knowledge retention of 37 senior-level baccalaureate nursing students engaged in a cardiopulmonary arrest simulation. The five general areas for reflection during debriefing included: student feelings about the simulation, review of the initial assessment steps, review of psychomotor skills used, communication skills among team members, and open discussion of points of interest. Results demonstrated quality of skill improvement and faster response times among students in the video-assisted verbal debriefing group. On the other hand, verbal debriefing only may play more of a role in improving knowledge retention (Chronister & Brown, 2012).

Training issues are not limited to nursing. Chinn, Yap, Lee, and Soh (2014) found undergraduate pharmacy students (n = 174) in their final year of school who participated in simulation, as compared with case-based learning, performed significantly better in posttest and knowledge retention at 10 weeks regarding patient cases with diabetic ketoacidosis and thyroid storm. The effect sizes (p < 0.05) attributable to high-fidelity human patient simulation were larger than case-based learning in both cases. The results indicated that simulation was superior to case-based learning in teaching diabetic ketoacidosis and thyroid storm (Chinn et al., 2014).

Agha, Alhamrani, and Khan (2015) ran a cross-sectional survey with a response rate of 62% (*n* = 115) for third and fourth year medical students on the effect of simulation on knowledge retention, skills, and communication. The questionnaire validated by expert reviewers, focused on overall satisfaction and challenges with the use of simulation. The alpha coefficient for all questionnaire items was 0.73 (Agha et al., 2015). Results showed 85% of participants were satisfied with simulation, that simulation was a useful addition to learning modalities, and that 71% of participants would like more training sessions using simulation (Agha et al., 2015). Over half the participants (60%) reported that simulation was helpful in retaining knowledge, enhancing decision making skills, and improving communication skills (Agha et al., 2015).

Alluri, Tsing, Lee, and Napolitano (2016) found similar results with preclinical second year medical students (*n* = 20) enrolled in a pathophysiology course covering four different content topics. Study participants participated in one of two pathways. The first pathway was two 20-minute simulations, followed by a 10-minute debriefing led by the nurse educator investigator. Participants had the opportunity to deconstruct their thought processes and ask questions with pre-determined teaching points emphasized. The second pathway was two 30-minute lectures with pertinent outlines and diagrams drawn on the whiteboard emphasizing pre-determined teaching points. Participants in both groups demonstrated improvement between the immediate pretest and posttest five weeks after the intervention ($p < 0.05$; Alluri et al., 2016). Participants in the simulation group also demonstrated improvement between the immediate posttest and delayed posttest ($p < 0.05$), while students in the lecture group did not demonstrate significant improvements (Alluri et al., 2016). The simulation group experienced greater changes in scores between the posttest and delayed posttest ($p < 0.05$), demonstrating equivalent immediate knowledge gain between groups and superior long-term knowledge retention of pathophysiology in the simulation group (Alluri et al., 2016).

Zhao and Potter (2016) studied the effects of discussion-based learning and traditional lecture-based learning among 27 third and fourth year medical students during a surgery clerkship. Discussion-based learning is a similar pedagogy to debriefing. Participants in the experimental group received a PowerPoint presentation, instructor fielded questions throughout the presentation, a clinical scenario along with a low-fidelity model, bowel bag, gastroschisis silo, and they were encouraged to be hands-on with the equipment and simulation model. The control group received the PowerPoint presentation only and the instructor fielded questions throughout the presentation. Participants in the experimental group demonstrated superior knowledge ($M = 7.47 \pm 1.68$ vs. 5.25 ± 2.34, $p = 0.008$) and long-term retention at 3 months ($M = 7.87 \pm 1.77$ vs. 5.83 ± 2.04, $p = 0.005$), compared with the control group, respectively (Zhao & Potter, 2016).

In another study, Couto, Farhat, Geis, Olsen, and Schvartsman (2015) found that when sixth year medical students ($n = 174$) participated in an anaphylaxis simulation and a supraventricular tachycardia pediatric emergency as a single intervention, knowledge acquisition, and retention of pediatric emergencies were not significantly different from case-based discussion. However, the simulation experience received higher student satisfaction (Couto et al., 2015).

Saraswat et al. (2016) observed general surgery residents (*n* = 19) that were block-randomized by postgraduate level to either a didactic or a 15-minute simulation session with debriefing on abdominal compartment syndrome. After 3 months, all residents completed a knowledge assessment before participating in an additional simulation. Two independent reviewers assessed resident performance via audio - video recordings. Results showed no baseline differences in knowledge of abdominal compartment syndrome between groups. However, the observational evaluation demonstrated a significant difference in clinical performance between didactic (M = 9.9) and simulation (M = 12.5) groups: p <.05, with a standardized effect size=1.15. These results suggested simulation might be a more effective educational tool for teaching surgery residents for basic clinical concepts of abdominal compartment syndrome (Saraswat et al., 2016).

Additional health professions research conducted outside of the discipline of nursing also demonstrated knowledge retention for up to one year after learning through simulation. In a study by Boet et al. (2011), attending anesthetists participated individually in a simulation cannot intubate vs. cannot ventilate scenario requiring a cricothyroidotomy for airway management. Immediately after a debriefing and structured teaching session on cricothyroidotomy insertion, the subjects managed a second identical cannot intubate vs. cannot ventilate scenario. At either 6 months or 1 year, all 38 anesthetists successfully completed a third identical cannot intubate vs. cannot ventilate scenario, demonstrating complex procedural skills can be retained for at least one year after a single simulation training session (Boet et al., 2011).

In 2015, Lin et al. examined early cardiology undergraduate learning of the cardiovascular system regarding retention, application of learning, and levels of confidence during clinical clerkships among 10 third-year medical students. During their second year, the students attended two three-hour hands-on simulation-training sessions. Then, as juniors, the students took the objective structured clinical examination and a multiple-choice question test. Participants scored reasonably well on the combined exams (*M* = 52% $\pm$ 8%) and appeared to have retained what they learned from the earlier year (Lin et al., 2015). A significant number of studies have been reported that demonstrate positive student outcomes on knowledge retention, from one week up to one year, with the use of simulation (Boet et al., 2011; Lin et al., 2015; Saraswat et al., 2016; Zhao & Potter, 2016). What remains elusive in the literature is application of retained knowledge to a similar but different patient care scenario.

Summary

Within this chapter, the literature pertinent to the study of simulation with DML debriefing on the development of nursing knowledge, knowledge retention, and knowledge application was presented. Simulation with debriefing is a powerful educational tool ideally suited to aid students in the transformation and application of knowledge in the care of future patients (Madani et al., 2016; Rivaz et al., 2015; Tawalbeh & Tubaishat, 2013). Simulation with debriefing is a student-centered teaching strategy that is supportive of different learning styles (Brannon et al., 2016; Gonzales et al., 2017; Shinnick & Woo, 2015). Use of patient simulation allows for standardization of patient cases with emphasis on patient safety (Abusaad & Ebrahem, 2015; Cobbett & Snelgrove-Clarke, 2016; Fawaz & Hamdan-Mansour, 2016), effective communication (Evans & Mixon, 2015; Ojha et al., 2014; Sarabia-Cabo et al., 2016), and interdisciplinary interactions (Hunt et al., 2014; Luctkar-Flude et al., 2015; Simko et al., 2014); as well as creating a team approach to quality care (Bender & Walker, 2013; INACSL, 2011; Shinnick, Woo, & Mentes, 2011).

A recurring theme in the literature is the need for structured debriefings, facilitated by knowledgeable nurse educators, to guide the debriefing process (Fey et al., 2014; Flo et al., 2013; Tosterud et al., 2014; Waznonis, 2015). Moreover, there is evidence demonstrating that debriefing is where much of the learning occurs (Dufrene & Young, 2014; Levitt-Jones & Lapkin, 2014; Shinnick & Woo, 2015), and there is increasing focus on the use of specific debriefing methods (Chronister & Brown, 2012; Dreifuerst, 2010, 2012, 2015; Eppich & Cheng, 2015; Fanning & Gaba, 2007; Levett-Jones & Lapkin, 2014; Reed et al., 2013; Rudolph et al., 2007). The NLN (Alexander et al., 2015), the NCSBN (Hayden, Smiley, Alexander et al., 2014), and the INACSL Standards of Best Practice: Simulation℠ regarding debriefing (INACSL, 2016a, 2016b) recommends the use of theoretically-derived and evidence-based methods of debriefing. Debriefing for meaningful learning (Dreifuerst, 2010) is a theoretically derived and evidence based debriefing method that embodies these recommendations.

Simulation with debriefing can play an integral role in the development of nursing knowledge, skills, and application in all aspects of care (Bayoumy & Jadaani, 2015; Boling & Hardin-Pierce, 2016; Orique & Phillips, 2017). A cornerstone of simulation is the promotion of reflection through debriefing (Decker et al., 2013; Dreifuerst, 2009; Husebo et al., 2015), which provides meaning and understanding for the simulation participants (Reed, 2012). Immediately after simulation, instructors allow time for students to share, reflect upon, and discuss their experience. Shinnick, Woo, Horwich et al. (2011) noted debriefing by exploring patient outcomes and reviewing critical decision-making choices is a key contributor to student learning. Learning occurs from the student experiencing a salient event and processing the experience through facilitated debriefing (Gardner, 2013). Nurse educators are concerned that students attain the knowledge necessary to provide care to complex patients. Therefore, information needs to be learned to have benefit to practice over time (Brannon et al., 2016; Evans & Mixon, 2015; Highfield et al., 2017; Tawalbeh & Tubaishat, 2014). Educators seek methods that increase knowledge retention and application into context beyond rote rehearsal of skills that makes learning durable (Boet et al., 2011; Dreifuerst, 2010, 2012, 2015; Lin et al., 2015).

Debriefing offers an opportunity to ensure that students master critical components of nursing that they might not have an opportunity to experience in traditional clinical environments and removes epistemological roadblocks to knowledge acquisition (Bayoumy & Jadaani, 2015; Boling & Hardin-Pierce, 2016; Orique & Phillips, 2017). In DML, there is also a methodological aspect that promotes knowledge application beyond the simulation scenario they have experienced to apply knowledge to parallel clinical situations, thus expanding the value of the experience to the student's future practice (Dreifuerst, 2015).

The importance of debriefing is clearly articulated in the literature (Dreifuerst, 2010; Fanning & Gaba, 2007; Shinnick, Woo, Horwich et al., 2011) and there is significant literature demonstrating the impact of simulation with debriefing on student knowledge acquisition and retention (Abusaad & Ebrahem, 2015; Agha et al., 2015; Alluri et al., 2016; Bayoumy & Jadaani, 2015; Boet et al., 2011; Boling & Hardin-Pierce, 2016; Chinn et al., 2014; Chronister & Brown, 2012; Couto et al., 2015; Lin et al., 2015; Orique & Phillips, 2017; Saraswat et al., 2016; Tawalbeh & Tubaishat, 2013; Zhao & Potter, 2016). Yet, there is not enough evidence regarding how DML, specifically, affects knowledge acquisition, retention, and application in parallel clinical situations. Further testing of DML is required to address this gap in simulation pedagogy and nursing education.

CHAPTER III

METHODOLOGY

Introduction

The impact of the use of DML following a simulation on knowledge acquisition, knowledge retention, and knowledge application in a clinical setting among traditional, prelicensure, and baccalaureate nursing students (BSN) was explored in this quasi-experimental study. To address the research questions, the development of nursing knowledge immediately before and after a simulation with debriefing was done by comparing DML to the customary debriefing, and then measured again approximately 30 days later to assess knowledge retention and application in a similar, but different, clinical situation. This chapter includes a summary of the methodology, including the selection of participants, instrumentation, data collection, and data analysis. This chapter also includes a discussion of the limitations of the research design and a summary.

Selection of Participants

After receiving approval from the university in the Midwest of the United States (see Appendix B), prelicensure nursing students in an Adult Health (medical-surgical nursing) course in a baccalaureate-nursing program (BSN) were purposively invited to participate in this research study. Participation in the study was contingent on participants being enrolled in the clinical and theory courses covering adult health issues in acute care, with simulation already an existing component of the clinical course.

A priori, the desired sample size was determined according to a power analysis using G*Power© (Faul, Erdfelder, Buchner, & Lang, 2009) with statistical independent and paired samples *t*-tests. The alpha or significance level was set at p = 0.05, the power was set at 0.95, and G*Power© estimated an effect size of 0.50 with the power analysis based on a large effect. From this, G*Power estimated a sample size of 210 total participants with 105 participants per group (see Table 1). The size of sample needed to achieve power, according the a priori power analysis, was quite large, and was not achieved in data collection. However, a post-hoc power analysis, set to the same power parameters as the a priori analysis, indicated that power was achieved when the means of the groups were added into the power analysis.

Table 1

Power Analysis

Power Analysis of Sample		
Measures Effect Size	A priori .50 (Large)	Post-hoc .50 (Medium)
Alpha (α)	.05	.05
Beta (β)	.05	.01
Power (1 - β)	.95	.99
Sample size total	210	82
Sample size per group	105	41
Critical *t*	1.97	1.99
Degrees of freedom (*df*)	208	80

All students who took the course participated in the simulation even if they chose not to participate in this study. Therefore, study participants were solicited from the available population of 91 seventh-semester nursing students already enrolled in the class. The Nursing Care of Adults III course was previously divided into two 8-week sessions by the program administrators, with some students (*n* = 53) enrolled in the first 8 weeks and other students (*n* = 38) enrolled in the second 8 weeks. All eligible participants (n=91) agreed to be in the study; however, nine were lost to attrition during the semester of data collection. Therefore, 82 participants completed the study with 45 in the experimental group and 37 in the control (see Table 2).

Table 2

Participant Recruitment

Collection Time	Total Invited	Accept	Decline	Attrition	DML Experimental Group	Control Group
#1	53	53	0	5 (48)	30	18
#2	38	38	0	4 (34)	15	19

Quantitative analysis of the data was performed systematically using IBM SPSS Statistics 24™. Descriptive statistics were used to analyze the demographics of the sample. Participants in the study represented the demographics of the nursing program and the majority of subjects were female (95%; *n* = 78). The study participants’ (*n* = 82) ages ranged from 19 to 36 with a mean age of 22.5 years. Most of the participants self-reported as Caucasian (94%, *n* = 77) with 1% identifying as Black (*n* = 1); 1% identifying as of Hispanic descent (*n* = 1); and 3% as identifying as Asian (*n* = 2). One participant declined to report their ethnicity (1%).

Participants assigned to the experimental group (*n* = 45) received DML debriefing after their simulation experience. The experimental group consisted of 96% females (*n* = 43) and 4% males (*n* = 2). The majority of participants in this group (*n* = 42) identified as Caucasian (95%), 2% identified as Asian (*n* = 1), 2% as Hispanic (*n* = 1), and one declined to share this information. Ages ranged from 19 to 28 with a mean age of 22.18 years old (see Table 3).

The two groups were demographically similar. The control group (*n* = 37), which received the customary debriefing used in that program after the simulation, consisted of 95% females (*n* = 35) and 5% males (*n* = 2). The majority of participants in this group (94%) were also Caucasian (*n* = 33), 3% were Black (*n* = 2), and 3% were Asian (*n* = 2). Participants ranged in age from 20 to 36 with a mean age of 22.89 years old (Table 3).

Table 3

Demographics for Total, Experimental, and Control Groups

	Total 89*(*n* = 82)	Experimental 48*(*n* = 45)	Control 41*(*n* = 37)
Ethnicity			
Black	1%	-	3%
Hispanic	1%	2%	-
Asian	3%	2%	3%
Caucasian	94%	95%	94%
Did not share	1%	1%	-
Sex			
Male	5%	4%	5%
Female	95%	96%	95%
First College Degree			
No	4%	2%	5%
Yes	96%	98%	95%
Status			
Educated as CNA	1%	.05%	1%
Certified as CNA	2%	.05%	.2%
Working as CNA	2%	1%	1%
Patient Care Tech	71%	71%	70%

*Participants (*n* = 7) lost to attrition; final numbers in parentheses

Data Analysis

The participants in this study were divided into two groups based on whether they were assigned to the simulation during the first or second eight weeks of the semester. Therefore, homogeneity of variance of the total sample was established using Levene's test of equality of error variances on the pretest data (F (1, 80) = 0.02, p = .90). The findings of Levene's test determined that the samples could be combined into a total sample (see Table 4).

Table 4

Levene's Test of Equality of Error Variances

Measure	*F*	*df*	*p*
Pretest	0.02	1, 80	.90

Next, normality of the total sample was assessed using the Kolmogorov-Smirnov test on the pretest data, D (82) = 0.15, p < .001. Normality testing determined the data were not normally distributed (see Table 5). Therefore, it was determined that parametric statistical tests, such as a *t*-test, could be used to analyze the data for the research questions since there were no errors in the variances between the two groups.

Table 5

Normality Tests

Measure	Sample	Kolmogorov - Smirnov Test			*M*	5% *M*
		Statistic	*df*	*p*		
Pretest	82	0.15	82	.000	9.50	9.54

Protection of Human Subjects

Protection of human subjects followed the University's Institutional Review Board (IRB) policies and procedures for exempt research because the study used normal educational practices and the risks to the participants were minimal (see IRB approval letter in Appendix C). Although all students in the course participated in the simulation and took all three tests as part of their required coursework, allowing inclusion of participant's test scores into the study database was voluntary. All students in the course de-identified themselves. Therefore, no identifying information was collected.

The students were introduced to the study and participation was solicited one week before the scheduled simulation and each student received a copy of the Subject Information Sheet (see Appendix D). The decision to participate, or not participate, did not have an impact on the participant's evaluation in the class or affect their course grade as the course faculty did not have access to the scores. If a student decided to not participate in the study, they still completed the demographic form and the pretest and posttest; however, those documents were removed and destroyed before data were entered into the database. This ensured that no one in the classroom knew who was participating in the study and who was not. By marking the ‘yes’ box at the start of each test, the student indicated they understood this process and agreed to allow their test scores to be included in the dataset of the study. Participants were informed they could end study participation at any time by checking the ‘no’ box at the start of each test. Nine students (9%) were lost to attrition during the study. Finally, the students were asked to refrain from talking about their simulation experiences, as it would contaminate the study and the data collection procedure.

Instrumentation

This study explored the impact of simulation with debriefing on knowledge acquisition, knowledge retention, and knowledge application of nursing students in the care of a patient with meningitis and, subsequently, also in the care of a patient with a subarachnoid hemorrhage. These clinical situations are similar in presentation and patient assessment but require different nursing care and decision-making. There were no known instruments specific to measuring knowledge acquisition, retention, or application in nursing in general or specific to neurological nursing care therefore, two instruments were developed for this study. The first was based on the care of a patient with meningitis, and the second was based on the care of both a patient with meningitis and a subarachnoid hemorrhage.

An extensive review of the literature indicated the usage of pretest posttest research designs utilizing multiple-choice items as test instruments was a common practice (Abusaad & Ebrahem, 2015; Akhu-Zaheya et al., 2012; Bayoumy & Jadaani, 2015; Boling & Hardin-Pierce, 2016; Cobbett & Snelgrove-Clarke, 2016; Lee et al., 2017; Sawin et al., 2016; Simko et al., 2014; Tawalbeh & Tubaishat, 2013; Zinmaster & Vliem, 2016). These formats work well for testing the application of nursing knowledge and knowledge retention in simulation (Oermann & Gaberson, 2014, p.103). However, testing application of knowledge in a parallel case with a second posttest is unique to the research design of this study. The items for the pretest and posttests were based on the learning objectives for care of the patient with neurological impairments and, specifically, meningitis. The course objectives included (a) implements patient safety measures related to patient encounters such as, "5 rights" of medication administration, environmental scan of room, and comprehensive communication to healthcare team; (b) evaluates patient assessment information including vital signs and a focused neuro assessment; (c) establishes seizure precautions; (d) recognizes signs and symptoms of increased intracranial pressure; (e) applies knowledge of infection control in the care of the patient with meningitis; and (f) implements effective communication with patient and family.

Practice examination questions from Saunders Comprehensive Review for the NCLEX-RN® Examination, 6th Edition (2013) relevant to the course learning objectives and the two clinical contexts were used to create items for the study instruments. These questions in the sixth edition of this text were written to address the cognitive ability of entry-level nurses to provide safe and effective care to clients while incorporating the integrated process of caring, communication, documentation, nursing process, and teaching and learning (Silvestri, 2013, p. 4).

Test-items reflective of the knowledge application, analysis, and synthesis of content related to the care of a patient with meningitis and subarachnoid hemorrhages were chosen for the pretest and posttests in this research study, rather than basic recall and comprehension. Senior nursing courses typically have higher learning outcomes to measure learning at these levels. All three instruments contained multiple-choice items. This format included a question or incomplete statement followed by a list of answer options or options to complete the sentence as these item formats are adaptable for an extended range of content and learning outcomes such as evaluating learning and recall, comprehension, application, and analysis.

Pretest

The pretest contained 15 multiple-choice items and study participants took the pretest at the beginning of the simulation prebrief (see Appendix E). The content of these test items assessed the participant's knowledge of the care of a patient with meningitis. Test items addressed the clinical manifestations of meningitis including the clinical manifestations, performing a neurological assessment, interpretation of pertinent lab values, pain management, patient safety, communication with a patient and family, and preventative measures to protect against contracting meningitis. Tyler (2013) indicated the importance of evaluating student behaviors early to establish a baseline from which to measure a change in thinking or behaviors. Students were also asked to complete a demographic questionnaire before taking the pretest (see Appendix F).

Seven experts reviewed the instruments for this study, including three practicing neurological intensive care nurses, a practicing doctorally-prepared nurse practitioner, and three senior level nursing faculty members from a local college of nursing which was not a study site. Zamanzadeh et al. (2015) recommended that at least five people review the instruments to have sufficient control over chance agreement. These reviewers were chosen based on their experiences and well-informed knowledge of nursing care of neurology patients to establish content validity of the tests. The content validation strategy addressed the fit between test questions and the content or subject area as intended (Zamanzadeh et al., 2015). This expert panel determined whether the test-item questions and response options were representative of comprehensive knowledge of meningitis and subarachnoid hemorrhage. Content validity of the instruments established representativeness and clarity of items through recommendations made by the expert panel (Zamanzadeh et al., 2015).

Consensus on content validity was reached by establishing agreement among the experts regarding each test item. The seven experts could score thirty test items as a one, indicating the skill or knowledge measured by this item ‘essential’ for the care of a patient with meningitis. They could also score the item a two as ‘useful, but not essential’ to the care of a patient with meningitis or subarachnoid hemorrhage. Finally, the third option was ‘not necessary’; therefore, the item should not be included in the instrument. Answers to the questions were reviewed for accuracy, requiring 100% agreement among the expert panel. The panel also reviewed the distractors for each question for plausibility, how reflective of content being tested they were, and appropriateness for completing the stem question. The percentage of agreement between the experts regarding the question distractors was calculated and test-items earning 90% agreement or higher were retained. Questions earning less than 90% agreement were revised and resubmitted to the experts for further review. Content validity was established when all question components received at least 90% (n=6) interrater agreement which occurred on the third review.

Next a pilot study was implemented which explored how DML influenced the development of students' knowledge application from one patient situation to a different, yet parallel, situation. To ensure that the research methodology was ready for the full study, this small group of prelicensure nursing students (n = 7) from a different nursing program engaged in the simulation about the care of a patient with a neurological diagnosis, followed by DML debriefing and the pretest and posttest, to ensure that each component of the research was effective.

Posttest 1

Posttest 1 presented the same patient scenario (meningitis) and test items as the pretest, although the numerical order of the test items was different and the corresponding response options to the test items were mixed into a different sequence (see Appendix G). By presenting the pretest and posttest items in a different order, the testing effect or recall bias, which occurs when there is an error due to differences in accuracy or completeness recalling the previous test, was minimized (Marsden & Torgerson, 2012).

Posttest 1 contained 15 multiple-choice items administered to students immediately after completion of the simulation and debriefing on the care of a patient with meningitis (see Appendix H). Test items on Posttest 1 addressed the clinical manifestations of meningitis, performing a neurological assessment, interpretation of pertinent lab values, pain management, patient safety, communication with patient and family, and preventative measures to protect against contracting meningitis. This posttest was required, according to Tyler (2013), to measure change from the start of the instructional process to the end. The Posttest 1 items were closely related to the pre-test items; therefore, the reliability and validity testing was not replicated.

Posttest 2

Posttest 2 included the same test items as the Pretest and Posttest 1, addressing the clinical manifestations of meningitis, performing a neurological assessment, interpretation of pertinent lab values related to an infectious process, pain management, patient safety, communication with patient and family, and preventative measures to protect against contracting meningitis. The numerical order of the test items differed from the Pretest and Posttest 1, and the response options for each were organized into a different sequence (see Appendix I). Also, there were ten additional questions added which were related to a parallel case about subarachnoid hemorrhage, which is similar, but not identical to the care of a patient with meningitis. The nursing assessments, decision-making, and care of this type of patient in this parallel case are closely related to meningitis. However, since subarachnoid hemorrhage involves an injury and meningitis is an infectious process, there are also some important differences. These questions were designed to be structurally parallel to the questions about meningitis to measure how participants transferred and applied knowledge across patient contexts. Test-items addressing the clinical manifestations of subarachnoid hemorrhage included performing a neurological assessment, interpretation of pertinent lab values related to an injury, pain management, patient safety, communication with patient and family, and preventative measures to protect against head injury. Content validity was established in the same manner as the other instruments using the same experts.

Participants in the intervention group reasoned through similarities and differences of another parallel patient case during debriefing involving the care of a patient with a concussion and discussed how those differences might change the nursing decisions and patient outcomes in this similar yet new situation. The skills required to answer the parallel reasoning questions were like those used for logical reasoning questions (deBono, 1994). The parallel reasoning questions tests whether students can transfer and apply knowledge to a similar, but not identical, context. This is a key element of DML, identified as reflection-beyond-action (Dreifuerst, 2009).

In the parallel patient case, the student reasons through similarities and differences between the cases they experienced and a similar, but not identical one. Students determine how to use what was learned in the first case and apply it to the new patient situation through assimilation and accommodation, and also assess how differences in the patient cases might change the nursing thinking and actions in the new situation (Dreifuerst, 2009; Ferreira, Maguta, Chissaca, Jussa, & Abudo, 2016). Assessing a student's ability to transfer or apply knowledge from one clinical situation to another, tests thinking-beyond-action (Dreifuerst, 2009) and requires reflection, inferential thinking, and analytical thinking; hallmarks of clinical reasoning (Facione & Facione, 2006).

The skills required by a student to approach a parallel case are similar to lateral reasoning, requiring the student to restructure thought patterns to generate new alternative answers (deBono, 1995). Testing this type of parallel reasoning examines whether knowledge is transferrable, an indication of meaningful learning (Fink, 2003). As students transition into practice, they need to engage in this type of reasoning as they encounter new patient scenarios and situations. According to Ferreira et al. (2016), two conditions are required to promote the retention of knowledge: first, the student must be willing to deeply learn, or content will only be stored in short-term memory with no incorporation of retained knowledge (Ferreira et al., 2016). Second, the content must be presented in a consistently logical and meaningful way for the student to make sense of the content (Ferreira et al., 2016). Therefore, the learning must be presented in a way that the student can link new knowledge and experience with prior knowledge and experiences.

Study Procedure

Study participants experienced the simulation during either the third or eighth week of the 16-week semester (see Appendix H) depending on whether they were enrolled in the course during the first or second eight weeks of the term. Students in this program customarily participated in simulation in groups of five and were scheduled to be in the Simulation Center on campus for two hours.

One week before the simulation, the course coordinator randomly assigned participants to the experimental or control group using number randomization. These students participated in one simulation scenario about the care of a patient with meningitis for a total of 120 minutes using a modified Evolve simulation scenario (Evolve, n.d.) and the National League for Nursing Simulation Design Template© (2015). There was 25 minutes allotted for the Pretest and prebrief, 20 minutes for the simulation, 55 minutes for debriefing (DML or customary), and 20 minutes for the Posttest 1. The participants in the experimental arm of the study were instructed in the DML method before debriefing.

Upon arrival to the separate prebriefing areas (experimental and control), a designated faculty member who was not involved in the study asked the participants to complete a demographic form with five questions (see Appendix F) followed by the Pretest. By marking the yes box at the start of each test, the participants indicated they agreed to allow their test scores to be included in the dataset of the study. Participants had 20 minutes to complete the Pretest, after which time the designated faculty member collected any remaining scantrons and test booklets.

The Pretest and scantron sheets collected were counted and confirmed they were equal in number to the study participants and placed in designated envelopes, sealed and kept in a locked office until retrieved by the researcher. Within seven days, the data were processed and entered into the database for statistical analysis. Scantrons were destroyed after all data were collated and analysis completed.

Once the participants completed the Pretest, they assumed their assigned roles for the simulation. Role descriptions were RN 1 acting as the primary nurse, RN 2 acting as an experienced nurse orienting to the unit, a family member who is a parent of the patient, and the role of an observer. RN-to-RN shift report was given, and the simulation began with a reminder that what would take place during the simulation and debriefing was to be kept confidential and not discussed or shared outside of their designated group. Following the 20-minute simulation, participants and the debriefer for each group (control and experimental) went separately to designated conference rooms to debrief. The researcher received training in DML and debriefed the experimental group while school of nursing faculty, in their customary way, debriefed the control group.

Immediately following the debriefing, the debriefers for the control and experimental groups each left their rooms and the designated faculty member who was not involved in the study distributed Posttest 1. By marking the yes box at the start of each test, the participants indicated they agreed to allow their test scores to be included in the dataset of the study. Participants had 20 minutes to complete the posttest, after which time the remaining scantrons and test booklets were collected, counted, and confirmed they equaled the number of students that participated in the simulation, and agreed to have their data included in the dataset. Completed Posttest 1 booklets and scantron sheets were placed in designated sealed envelopes by the faculty member and kept in a locked office until retrieved by the researcher. Within seven days, the data were processed and entered into the database for statistical analysis. The scantron sheets and the test booklets were destroyed after all data analysis was completed.

Approximately 30 days later, participants from both the experimental and control groups were given Posttest 2. A designated faculty member, not teaching the course and not involved in the study, administered this 25-item test. By marking the yes box at the start of each test, the participants indicated they agreed to allow their test scores to be included in the dataset of the study. Participants had 25 minutes to complete the test and all students finished the test before the time limit. The test booklets and scantron sheets were collected and counted to confirm they were equal in number to the students who participated in the simulation and who agreed to have their data included in the dataset. The completed measures were placed in sealed, designated envelopes by the faculty member and kept in a locked office until retrieved by the researcher. Within seven days, the data were processed and entered into the database for statistical analysis. All test booklets and scantron sheets were destroyed after all data analysis was completed.

Research Questions and Hypotheses

Data from the pretest and posttests were used to answer the research questions guiding this study:

Q1 What is the impact of a simulation with DML debriefing compared to customary debriefing, on knowledge acquisition in the care of a patient with a neurological condition demonstrated by nursing students in a traditional BSN program?

$H1_o$ There is no difference in the impact of simulation with DML debriefing or customary debriefing on knowledge acquisition in the care of a patient with a neurological condition by nursing students in a traditional BSN program.

Q2 What is the impact of a simulation with DML debriefing compared to customary debriefing on knowledge retention in the care of a patient with a neurological condition demonstrated by nursing students, in a traditional BSN program, 30 days after a simulation and debriefing?

$H2_o$ There is no difference in the impact of simulation with DML debriefing or customary debriefing on nursing knowledge retention on the care of a patient with a neurological condition by nursing students in a traditional BSN program, 30 days after a simulation and debriefing.

Q3 What is the impact of a simulation with DML debriefing compared to customary debriefing, on knowledge application to a parallel patient scenario, demonstrated by nursing students in a traditional BSN program?

$H3_o$ There is no difference in the impact of simulation with DML debriefing or customary debriefing on nursing knowledge application on the care of a parallel patient scenario 30 days later, by nursing students in a traditional BSN program.

Data Analyses for Research Questions

Using IBM SPSS Statistics 24™, data from the Pretest, Posttest 1, and Posttest 2 were downloaded directly from Excel spreadsheets and imported into SPSS 24 version for analysis. The spreadsheets were inspected and all data were present and confirmed. Participant identification numbers were removed from the database used for analysis.

The first research question was tested using a paired samples *t*-test to test for differences in means from the Pretest and the Posttest 1 for the experimental and control groups. Differences between the experimental and control groups were also analyzed using independent samples *t*-test. The data and analysis are found in Chapter IV.

The second research question was also tested using a paired samples *t*-test to test for differences in the means between Posttest 1 and Posttest 2 for the experimental and control groups, respectively. Data were also analyzed using independent samples *t*-test meant to assess for differences between the experimental and control groups at Posttest 2. The data and analysis are found in Chapter IV.

The third research question was tested using an independent samples *t*-test to test for differences in mean scores on the knowledge application questions associated with the parallel case from Posttest 2 between the experimental and control groups. These data and analyses are found in Chapter IV. A summary of the data analyses plans for the three research questions is provided (see Table 6).

Table 6

Summary of Data Analyses for Each Research Question

Research Question	Instrument	Variable	Method
1. What is the impact of a simulation with DML debriefing compared to customary debriefing, on knowledge acquisition in the care of a patient with a neurological condition, demonstrated by nursing students in a traditional BSN program	Pretest Posttest 1	Experimental and Control Group Pre-test and post-test scores	Independent samples *t*-test – Posttest 1 – Experimental & Control Group Paired samples *t*-test – Pretest to Posttest 1 – Experimental & Control group, respectively
2. What is the impact of a simulation with DML debriefing compared to customary debriefing on knowledge retention in the care of a patient with a neurological condition, demonstrated by nursing students, in a traditional BSN program 30 days after a simulation and debriefing	Posttest 1 Posttest 2	Experimental and Control Group Posttest Scores	Independent samples *t*-test – Posttest 2 – Experimental & Control Group Paired samples *t*-test – Posttest 1 to Posttest 2 – Experimental & Control group, respectively
3. What is the impact of a simulation with DML debriefing compared to customary debriefing, on knowledge application to a parallel patient scenario, demonstrated by nursing students in a traditional BSN program	Knowledge Application embedded within Posttest 2	Experimental and Control Group Knowledge Application Scores	Independent samples t-test - Posttest 2 - Experimental & Control groups

Summary

This chapter included a discussion of the methodology used in this research. In addition, a detailed account of the participant recruitment procedure and the statistical methodology used for determining homogeneity of the sample was included. This chapter also provided a description of each of the instruments used in this study: The Pretest, Posttest 1, and Posttest 2. Finally, the chapter concluded with a discussion and justification of the data analysis for testing each of the research questions guiding the study.

CHAPTER IV

ANALYSIS

During this research study, the impact of DML, a theoretically-derived and evidence based debriefing method, was explored related to knowledge acquisition, knowledge retention, and application of knowledge by baccalaureate nursing students. Three instruments were used: (a) a 15-item Pretest, (b) a 15-item Posttest1, and (c) a 25-item Posttest 2. Two of the instruments for this study addressed the care of a patient with meningitis (Pretest and Posttest 1), and the third instrument addressed the care of both a patient with meningitis and a subarachnoid hemorrhage (Posttest 2). Reliability was established for the measures used within the study using the Intraclass Correlation Coefficient (ICC). The ICC was chosen as this measure of reliability accounts for both the degree of correlation and agreement between the measures (Koo & Yi, 2016). The ICC measure of reliability is also especially fitting any time there are more than two measures used in research. The results of the two-way mixed effects ICC reliability analysis indicated a moderate level of reliability across all three measures (see Table 7). Within this chapter, the findings of this study are presented according to each of the three research questions.

Table 7

Intraclass Correlation Coefficient: Test-Retest Reliability

ICC - Test - Retest Reliability - Pretest, Posttest 1, Posttest 2

ICC	95% CI		*F* Test with True Value 0			
	Upper	Lower	Value	*df1*	*df2*	*p*
.650	.763	.494	2.865	1.65	162	.000

Descriptive Statistics

The Pretest was used to measure baseline knowledge of the care of a patient with meningitis among student nurses in the study and was administered to participants (*n* = 82) before the simulation experience. The pretest data for the total sample (*n* = 82, *M* = 9.50, *SD* = 1.67) depict the baseline knowledge and application of care of the patient with a neurological condition for all participants (Table 8) and is comprised of both the experimental group (*n* = 45, *M* = 9.84, *SD* = 1.57) and the control group (*n* = 37, *M* = 9.08, *SD* = 1.72).

The Posttest 1 data for the total sample (*n* = 82, *M* = 10.93, *SD* =1.86) depict the knowledge acquisition of the care of the patient with a neurological condition immediately after the simulation and debriefing for all participants (see Table 8). The total scores for the sample, comprised of both the experimental group (*n* = 45, *M* = 12.02, *SD* =1.31) and the control group (*n* = 37, *M* = 9.59, *SD* = 1.54) were used.

Posttest 2 measured two different concepts: knowledge retention and knowledge application. The first 15 questions of the test measured knowledge retention of the care of a patient with meningitis by participants. The Posttest 2 data regarding knowledge retention for the total sample *(n* = 82, *M* =11.15, *SD* =1.91) included the scores of the experimental group (*n* = 45, *M* =12.04, *SD* =1.61) and the control group (*n* = 37, *M* =10.05, *SD* =1.67) on these 15 items (see Table 8). The last 10 questions of Posttest 2 measured participants' application of nursing knowledge from the simulation with debriefing to the care of a patient with a similar yet different condition: subarachnoid hemorrhage. The knowledge application Posttest 2 data for the total sample (*n* = 82, *M* = 8.12, *SD* = 1.51) included the scores from the experimental *(n* = 45, *M* = 8.51, *SD* = 1.27) and control groups (*n* = 37, *M* = 7.65, *SD* = 1.65) on the knowledge application measures (see Table 8).

Table 8

Means by Test and Study Groups

	Total (*n* = 82)		Experimental (*n* = 45)		Control (*n* = 37)	
	M	*SD*	*M*	*SD*	*M*	*SD*
Pretest	9.50	1.67	9.84	1.57	9.08	1.72
Posttest 1	10.93	1.86	12.02	1.31	9.59	1.54
Posttest 2 (Q3-17)	11.15	1.91	12.04	1.61	10.05	1.67
Posttest 2 (Q18-27)	8.12	1.51	8.51	1.27	7.65	1.65

Research Question 1

Research Question 1 asked: What is the impact of a simulation with DML debriefing compared to customary debriefing, on knowledge acquisition in the care of a patient with a neurological condition demonstrated by nursing students in a traditional BSN program? To answer Research Question 1, the mean scores from Posttest 1 for both the experimental and control groups were compared using an independent samples *t*-test. An independent-samples t-test indicated that scores were significantly higher for the experimental group that received DML debriefing (*M* = 12.02, *SD* = 1.31) than for the control group that received customary debriefing (*M* = 9.59, *SD* = 1.54) for Posttest 1: *t* (80) = -7.738, *p* < .001, d = 1.70 (see Table 9) with a large effect size $\eta^2 = 0.43$.

Table 9

Independent Samples t-Test: Posttest 1

Knowledge Between the Experimental and Control Groups

Measure	Experimental		Control		*t*	*p*
	M	*SD*	*M*	*SD*		
Posttest 1	9.84	1.57	9.08	1.72	-7.738	.000

t-test results - d = 1.70, $\eta^2 = 0.43$.

Additionally, the change in knowledge between the Pretest and Posttest 1 mean scores were compared for the experimental and control groups, respectively. A paired-samples *t*-test demonstrated that scores were significantly higher for the experimental group at Posttest 1 (*M* = 12.02, *SD* = 1.31) than at the Pretest (*M* = 9.84, *SD* = 1.57): *t* (44) = - 8.416, $p < .001$, d = 1.26 (see Table 10). The size of the effect was large, $\eta^2 = 0.45$. However, the paired-samples *t*-test demonstrated that the control group scores were not significantly higher at Posttest 1 (*M* = 9.59, SD = 1.54) than at the Pretest (*M* = 9.08, SD = 1.72): *t* (36) = -.514, $p = .040$ (see Table 10).

Table 10

Paired Samples t-Test: Posttest 1

Knowledge Within the Experimental and Control Groups

	Pretest		Posttest 1		*t*	*P*
	M	*SD*	*M*	*SD*		
Experimental	9.84	1.57	12.02	1.31	-8.416	.000*
Control	9.08	1.72	9.59	1.54	-.514	.040

* Sig. Differences - d = 1.26, $\eta^2 = 0.45$.

The results of these statistical analyses suggest that DML debriefing influenced changes in knowledge scores for the experimental group, when compared to the control, on Posttest 1. Given that *t*-tests were used to answer Research Question 1, a *post-hoc* Bonferroni adjustment was used to determine the appropriate level of significance used to interpret each *t*-test. The Bonferroni adjustment was determined by dividing a standard level of significance ($p = .05$) by the number of *t*-tests conducted ($n = 4$). The adjusted level of significance used to interpret these tests was $p < .0125$ (see Table 11). This same Bonferroni adjustment is used to interpret results for the first and second research questions. The results of these tests remained significant after interpreting the tests using the *post-hoc* Bonferroni adjustment. Given that the results of the test remained significant, these results suggested DML debriefing influenced changes in knowledge scores for the experimental group when compared to the control.

Table 11

Bonferroni Adjustment: Research Questions 1 and 2

Standard p	Number of *t*-tests	*Adjusted p*
$p < .05$	4	$p < .0125$

In conclusion, the analysis of the data pertaining to Research Question 1 demonstrated a statistically significant difference between the experimental and control group mean scores on Posttest 1. Therefore, the null hypothesis that there is no difference in the impact of DML debriefing compared with customary debriefing on Knowledge Acquisition was rejected.

Research Question 2

Research Question 2 asked: What is the impact of DML debriefing compared to customary debriefing on knowledge retention in the care of a patient with a neurological condition demonstrated by nursing students in a traditional BSN program, 30 days after a simulation and debriefing? To answer Research

Question 2, first an independent-samples *t*-test was run on the mean scores from Posttest 2, which indicated that student scores on Posttest 2 remained higher for the experimental group that received DML debriefing (*M* = 12.04, *SD* = 1.61) than for the control group that received customary debriefing (*M* = 10.05, *SD* = 1.67) at Posttest 2 (see Table 12): *t* (80) = -5.486, *p* < .001, d = 1.21. The size of the effect was large, $\eta^2 = 0.27$.

Table 12

Independent Samples t-Tests: Posttest 2

Knowledge Between the Experimental and Control Groups

Measure	Experimental		Control		*t*	*p*
	M	*SD*	*M*	*SD*		
Posttest 2	12.04	1.61	10.05	1.67	-5.486	.000

t-test results - d = 1.21, $\eta^2 = 0.27$.

Next, paired samples *t*-tests were conducted assessing mean differences of knowledge retention from the Posttest 1 to the Posttest 2 for the experimental and control groups, respectively. The results of the paired-samples *t*-tests found that experimental group scores did not significantly increase from Posttest 1 (*M* = 12.02, *SD* = 1.31) to Posttest 2 (*M* = 12.04, *SD* = 1.61): *t* (44) = - .085, *p* = .933 (Table 13). The paired-samples *t*-test also revealed that the control group scores did not significantly increase from Posttest 1 (*M* = 9.59, *SD* = 1.54) to Posttest 2 (*M* = 10.05, *SD* = 1.67): *t* (36) = -1.392, *p* = .173 (see Table 13). Therefore, neither group improved their knowledge however they retained what they had learned from Posttest 1 to Posttest 2.

Table 13

Paired Samples t-Test: Posttest 2

Knowledge Within the Experimental and Control Groups

	Posttest 1		Posttest 2		*t*	*p*
	M	*SD*	*M*	*SD*		
Experimental	12.02	1.31	12.04	1.61	-.085	.933
Control	9.59	1.54	10.05	1.67m	-1.392	.173

* Sig. Differences – No significant difference within groups

The results of these statistical analyses demonstrated both groups' scores essentially remained unchanged, indicating the knowledge that had been learned was retained without significant gain or loss. Given that a series of *t*-tests were used to answer Research Question 2, a *post-hoc* Bonferroni adjustment was used to determine the appropriate level of significance used to interpret each *t*-test. The Bonferroni adjustment was determined by dividing a standard level of significance (p = .05) by the number of *t*-tests conducted (n = 4). The adjusted level of significance used to interpret these tests was p < .0125 (see Table 11). The results of the tests remained unchanged after applying the Bonferroni adjustment. There was, however, a significant difference between the experimental and control groups' total mean scores. Therefore, although both groups did not significantly change from Posttest 1 to Posttest 2, the experimental group scores started and remained higher.

In conclusion, the analysis of the data pertaining to Research Question 2 demonstrated no statistically significant changes on knowledge retention from Posttest 1 to Posttest 2 for either the experimental or control group. While the groups remained statistically and significantly different from each other, the lack of change over time did not provide sufficient evidence to reject the null hypothesis.

Research Question 3

Research Question 3 asked: What is the impact of a simulation with DML debriefing compared to customary debriefing, on knowledge application to a parallel patient scenario, demonstrated by nursing students in a traditional BSN program? To answer Research Question 3, the mean knowledge application scores from Posttest 2 for both the experimental and control groups were compared using an independent samples *t*-test. An independent-samples *t*-test indicated that scores were significantly higher for the experimental group that received DML debriefing (M = 8.51, SD = 1.27) than for the control group that received customary debriefing (M = 7.65, SD = 1.65; see Table 12) for knowledge application: t (80) = -2.669, p < .01, d = 0.58. The size of the effect was moderate, η^2 = 0.08 (see Table 14).

Table 14

Independent Samples t-Tests: Knowledge Application Between the Experimental and Control Groups

Measure	Experimental		Control		*t*	*p*
	M	*SD*	*M*	*SD*		
KA	8.51	1.27	7.65	1.65	-2.669	.009

t-test results - d = 0.58, $\eta^2 = 0.08$.

The results of this statistical analysis demonstrated that DML debriefing influenced changes in knowledge application scores for the experimental group when compared to the control. In conclusion, the analysis of the data pertaining to Research Question 3 demonstrated a statistically significant difference between the experimental and control group mean knowledge application scores on Posttest 2. Therefore, the null hypothesis that there is no difference in the impact of DML debriefing compared with customary debriefing on knowledge acquisition was rejected.

Summary

Within chapter four, the data analyses carried out to address and answer each of the three research questions were presented and discussed. The results indicated there were differences between groups in student knowledge after the simulation and debriefing as asked in the first research question. This result was important as the significance suggests that the differences were likely driven by the differences in debriefing.

Results from the analysis of the data pertaining to the second research question indicated that while the experimental group was significantly different than the control group at Posttest 2; neither of the groups significantly changed from Posttest 1 to Posttest 2. These results indicated that the experimental group did not improve in knowledge retention.

The analysis of the data used to answer the third research question revealed significant differences between the groups on knowledge application which supported the finding that the experimental debriefing resulted in better retention and application of knowledge to a related clinical situation over time. Findings presented in this chapter are summarized and discussed further in Chapter V. Implications of the findings, limitations of the study, and recommendations for future research are addressed.

CHAPTER V

CONCLUSION AND RECOMMENDATIONS

Chapter V includes a summary of this study, a discussion of the findings, an overview of the limitations, implications for nursing education, and recommendations for future research. In this chapter, further discussion of the study findings is presented related to prior research in debriefing and DML, in addition to recommendations for further research in debriefing within the context of nursing education.

Summary of the Study

The purpose of this study was to test the impact of simulation with DML, a theoretically derived and evidence based debriefing method on knowledge acquisition, knowledge retention, and knowledge application of baccalaureate nursing students. The opportunity for students to master critical components of nursing and to remove epistemological roadblocks to knowledge acquisition is offered through debriefing (Cantrell, 2008; Dufrene & Young, 2014; Hall & Tori, 2017; Levett-Jones & Lapkin, 2014; Reed, 2012; Shinnick, Woo, Horwich et al., 2011). The use of DML promotes knowledge application beyond the simulation scenario by offering a parallel clinical situation that students can use to apply what they have just learned to another clinical scenario, thus expanding the value of the experience to the future nursing practice (Dreifuerst, 2015).

The importance of debriefing has been clearly articulated within the literature; in addition, the significant impact of simulation with debriefing on student knowledge acquisition and retention (Abusaad & Ebrahem, 2015; Agha et al., 2015; Alluri et al., 2016; Bayoumy & Jadaani, 2015; Boet et al., 2011; Boling & Hardin-Pierce, 2016; Chinn et al., 2014; Chronister & Brown, 2012; Couto et al., 2015; Dreifuerst, 2010; Fanning & Gaba, 2007; Lin et al., 2015; Orique & Phillips, 2017; Saraswat et al., 2016; Tawalbeh & Tubaishat, 2013; Zhao & Potter, 2016). However, little evidence exists regarding how DML affects students' ability to apply knowledge to parallel clinical situations (Lasater et al., 2014; Tosterud et al., 2014). Further testing of DML was required to address this gap in simulation pedagogy and nursing education.

This study explored three research questions to address this gap. The data from the first research question, "What is the impact of a simulation with DML debriefing compared to customary debriefing, on knowledge acquisition in the care of a patient with a neurological condition demonstrated by nursing students in a traditional BSN program?" demonstrated a statistically significant difference between the experimental and control groups' mean scores on knowledge on Posttest 1.

The second research question asked, "What is the impact of a simulation with DML debriefing compared to customary debriefing on knowledge retention in the care of a patient with a neurological condition, demonstrated by nursing students in a traditional BSN program, 30 days after a simulation and debriefing?" The data obtained in response to this question demonstrated that both groups did not significantly improve in knowledge retention from Posttest 1 to Posttest 2. The significant difference between the experimental and control groups scores from Posttest 1 remained at Posttest 2.

The third and final research question asked, “What is the impact of a simulation with DML debriefing compared to customary debriefing, on knowledge application to a parallel patient scenario, demonstrated by nursing students in a traditional BSN program?” The data demonstrated statistically significant differences between the experimental and control groups mean scores on knowledge application to a parallel patient scenario on Posttest 2.

Discussion of the Findings

The goal of this research study was to compare the impact of DML debriefing with customary debriefing on knowledge acquisition, knowledge retention, and knowledge application among baccalaureate nursing students. In the review of literature, debriefing has been found to be a significant component of the simulation experience where learning occurs (Cantrell, 2008; Dufrene & Young, 2014; Hall & Tori, 2017; Levett-Jones & Lapkin, 2014; Reed, 2012). Furthermore, the use of theoretically-derived and evidence based debriefing methods like DML have been associated with positive student outcomes (Alexander et al., 2015; Dreifuerst, 2010; Forneris et al., 2015). Therefore, understanding the impact of the use of DML on aspects of student learning pertaining to knowledge acquired, retained, and applied, was important.

Research Question 1

Research question 1 compared DML to customary debriefing on knowledge acquisition in the care of a patient with a neurological condition. The purpose of testing this research question was to determine if there was a difference in the impact of simulation with DML debriefing and customary debriefing on the development of nursing knowledge in the care of a patient with neurological condition in the study participants. To study the impact of DML on knowledge acquisition, data from the Pretest, given prior to the start of the simulation and data from Posttest 1 and immediately following the simulation and debriefing were compared. There was a significant difference between the mean scores on Posttest 1 from the experimental group debriefed with DML and the control group debriefed with the customary debriefing. There was also a notable difference in the within group mean scores of the experimental and control groups.

These findings are significant and demonstrate that DML debriefing had a positive impact on the knowledge acquisition of student nurses when compared to usual debriefing. This finding is important because it demonstrates the impact of a single DML intervention on how students process clinical information and clinical decision-making in a simulated patient care context. Using reflection-in-action, reflection-on-action, and reflection-beyond-action, students debrief and unpeel the clinical experience and its significance (Dreifuerst, 2012; Forneris et al., 2015; Mariani et al., 2013). They also practice anticipating how to use this knowledge in the care of other contextually similar patients (Bradley & Dreifuerst, 2016; Dreifuerst, 2012; 2015).

The outcomes from this research question demonstrate difference in the change in knowledge acquisition between the experimental and control groups explained by the intervention. However, it is difficult to understand the slight negative change in test scores observed between the pretest and posttest in the control group. A possible explanation may be that the students in the control group became confused when discussing the simulation scenario during debriefing or they may not have understood the material well enough to remember it consistently. The difference in scores between the experimental and control groups may be attributed to the confounding variable of the debriefer. The debriefer for the experimental group received training in debriefing and DML while the debriefers for the control groups were faculty in the nursing program that did not have debriefing training. Variation in the role of debriefer may have affected participants' engagement. These findings support prior research that aligns with other studies using DML that demonstrate increased clinical reasoning and judgment (Dreifuerst, 2010; Forneris et al., 2015).

Research Question 2

Research question 2 compared DML debriefing to customary debriefing on knowledge retention after 30 days in the care of a patient with a neurological condition. The findings for this research question demonstrated that there were no improvements in knowledge retention for the experimental group or the control group from Posttest 1 to Posttest 2. These findings remained significant however as both groups retained the knowledge acquired at Posttest 1 for thirty days.

Students debriefed with DML maintained knowledge retention compared to the students debriefed with the customary debriefing, demonstrating better learning. Debriefing for meaningful learning positively affects student learning which is supported by prior findings (Dreifuerst, 2010; Forneris et al., 2015; Hayden, Smiley, & Gross, 2014; Jeffries et al., 2015; Mariani et al., 2013). The findings from the control group also demonstrated that debriefing is where the learning occurs as supported in prior literature (Cantrell, 2008; Dufrene & Young, 2014; Hall & Tori, 2017; Levett-Jones & Lapkin, 2014; Reed, 2012). Further studies by Tawalbeh and Tubaishat (2013; 2015) also supported better knowledge retention after simulation with debriefing. However, findings by Zinmaster and Vliem (2016) found no statistically significant differences between groups on knowledge retention. Thus, further research is needed to explore the impact of debriefing methods on knowledge retention across different periods.

These findings are important to nurse educators since they seek methods that increase knowledge retention beyond rote memorization thereby making learning durable (Boet et al., 2011; Dreifuerst, 2010, 2012, 2015; Lin et al., 2015). Increased knowledge retention impacts clinical reasoning and skill development thereby enhancing safe patient care (Frick et al., 2014; Jeffries & Clochesy, 2012; Wang, 2011). The better students learn the information the first time they receive it, the more likely students will retain the information for future use (Canzian et al., 2016).

Research Question 3

Research question 3 addressed DML and customary debriefing methods on knowledge application to a parallel patient scenario. The results demonstrated statistically significant differences between the experimental and control groups on knowledge application. There was a difference in the ability to apply knowledge to a parallel case between the experimental and control groups. Participants in the experimental group were able to take what they learned from the simulated patient care experience, assimilate that knowledge, then through accommodation in their thinking and reasoning skills, apply the prior knowledge and experience to the new knowledge and experience better than the students in the control group. Using reflection-in-action, reflection-on-action, and reflection-beyond-action, students were able to anticipate the use of knowledge about the care of one type of patient with a neurological condition to the care of another type of patient with a different neurological condition.

The ability to apply knowledge learned from one clinical situation to another has intrinsic importance, affecting not only nursing students, but also patient outcomes as student nurses transition into practice. Nursing is a practice profession whereby reasoning and judgment are refined through experience. With a finite number of clinical experiences able to be provided during nursing courses, students have to apply these experiences to an infinite number of patients in the future. Practicing this application during debriefing provides a framework that can be carried into practice.

Debriefing for meaningful learning offers an opportunity to ensure that students can master critical components of nursing that they might not otherwise experience and to remove epistemological roadblocks to knowledge acquisition and subsequent application. The use of DML promotes knowledge application beyond the simulation scenario through reflection-beyond-action thus, expanding the value of the experience to the student's nursing practice (Dreifuerst, 2015). By practicing aspects of guided reflection, students learn to become reflective practitioners (Schön, 1983) and actualize Mezirow's (1978) transformative learning theory. Moreover, this demonstrates the consequences of the perfect debriefing outcome and exemplifies contextual learning (Dreifuerst, 2009). How educators facilitate reflective thinking is crucial to the development of reflective practitioners (Schön, 1983). Debriefing for meaningful learning provides a teaching and learning method nurse educators can use to prepare students for future practice.

Implications for Educational Practice

The International Association for Clinical Simulation and Learning (INACSL) Standards of Best Practice: Simulation[SM] regarding debriefing, recommend using a theory-based method (INACSL, 2016) which concurs with the National League for Nursing (2015) and the National Council of State Boards of Nursing (2015) statement on using theoretically derived and evidence based debriefing methods. The findings from this study support and add to the evidence for these recommendations.

Finding methods that increase knowledge retention and application beyond rote memorization of skills is important in education (Canzian et al., 2016). Debriefing for meaningful learning makes learning durable by facilitating a reflective dialogue that enables students to uncover and analyze the thinking associated with their actions and the consequences of those choices and actions (Dreifuerst, 2015). Debriefing for meaningful learning can easily be adapted to any environment or patient situation students may encounter (Dreifuerst, 2010), thus allowing nurse educators to provide consistent learning opportunities for students to practice thinking skills through this method while participating in purposeful discussions. Assisting students to understand a clinical experience at an in-depth level is key to the development of clinical reasoning skills required for thinking like a nurse (Dreifuerst, 2010). Examination of nurse educators' debriefing practices by Sawyer et al. (2016) and Waznonis (2015) revealed a lack of consistency among facilitated debriefings. Further compounding this issue was the lack of trained debriefers to guide novice educators and those new to simulation to learn best practices in debriefing necessary to ensure positive learning outcomes (Eppich & Cheng, 2015). It is critical that nurse educators be trained in the use of a theoretically derived; evidence based debriefing method supportive of reflective practice within the nursing education environment (Fey 2015; NLN, 2015; Waznonis, 2015).

The outcomes of this study add to the growing body of literature supporting DML as an effective, theoretically-derived and evidence based debriefing method for prelicensure programs that further supports the impact debriefing has on student learning (Dreifuerst, 2012; Forneris et al., 2015; Hayden, Smiley, Alexander et al., 2014; Mariani et al., 2014). Debriefing for meaningful learning is a debriefing method that aligns with the recommendations made by INACSL (2016a, 2016b), NLN (2015), and the NCSBN (2015). There are currently a variety of debriefing methods used to guide the debriefing process (Fey & Jenkins, 2015; Waznonis, 2015). However, a structured debriefing framework is necessary to assist students with integrating theory and practice and using repetitive reflection skills. This concept is important across nursing curricula and should not stand alone in simulation and debriefing. The use of a theoretically derived and evidence based debriefing method such as DML can assist educators in facilitating closure of the theory-practice gap in multiple settings (Hayden, Smiley, Alexander et al., 2014).

Students continue to struggle with understanding how to apply content versus rote memorization. Until now, the impact of how students apply the knowledge they learn during debriefing had not been specifically tested in nursing education. Thinking-beyond-action was tested by assessing students' ability to transfer or apply knowledge from one clinical situation to another (Dreifuerst, 2010). The outcomes of this study have made relevant the need to teach nursing students how to apply the knowledge presented in didactic, clinical, classroom, and simulation beyond one isolated patient care experience through reflection-beyond-action. Debriefers trained in DML guide students in reflecting upon what was learned during the experience and how to anticipate the integration of this knowledge with similar or new patient encounters. Students explore potential patient scenarios through guided reflection-beyond-action to facilitate assimilation and accommodation of their skills and knowledge for future patient encounters across the continuum of care. The results of this study demonstrate the value of reflection-beyond-action and the importance of knowledge application for future patient encounters among baccalaureate nursing students.

Limitations

There were several limitations to this study. First, it was a single site research design. Bellomo, Warrillow, and Reade (2009) acknowledged that single site studies are easier to organize, data collection is simpler, and these studies are cheaper to implement, particularly for novice researchers. However, single site studies frequently lack the external validity required before being able to implement widespread changes in practice (Bellomo et al., 2009). In spite of this limitation, the sample size obtained during this research study offsets the issues of low power frequently seen in single site research. Moreover, for exploratory work, it is common to begin with a single site to develop the methodology.

The second limitation of this research study was time constraints. The time lapse between Posttest 1 and Posttest 2 was approximately 30 days. This may not have been long enough to adequately test knowledge retention; however, this amount of time is a common testing interval in higher education (Canzian et el., 2016; Ferreira et al., 2016). Further studies using a variety of short and longer time intervals would add to the rigor of design and the understanding of the variable of time related to knowledge retention.

The third limitation of this research study was related to the instruments used to test the constructs of knowledge. A previously tested assessment tool to measure this phenomenon in the study could not be located. Therefore, all three instruments were developed by the researcher for this study and tested in a small pilot study prior to use. Repeated use of the instruments is recommended to validate psychometric properties. Moreover, it was challenging to develop a test of application of knowledge to a parallel situation. While this practice is common within nursing education, there are no instances within the literature testing this construct in this way. The 10-item instrument used to assess this construct was developed by the researcher and may not have adequately tested knowledge. Further work developing instruments is warranted.

The fourth limitation of this research study was variation among the debriefers and the debriefing method used for the control group. Different debriefers debriefed participants in the control group and these debriefers may have used a variation of the customary debriefing method; a discussion of what went right, what went wrong, and what could have been done differently. These variations may have influenced the results however; this is the common teaching practice in this school and reflects the customary teaching and learning environment for simulation.

Finally, slight variations each time the simulation was run may have posed another limitation. Every effort to standardize fidelity was taken however, because this study occurred within an active educational environment, it was not possible to completely control the simulations without any variations in administration. The same simulation coordinator ran the simulations for both the experimental and control groups however; each simulation was a unique, live-in-the-moment experience, based on the student responses to the ongoing patient situation. This may have influenced the debriefing despite the use of consistent objectives for the research study.

Recommendations for Further Research

The goal of this study was to test the impact of a simulation with DML debriefing on knowledge application. Future research is needed in this area and additional recommendations can be made. The first is about the study design. This study was a single-site study and included one simulation experience for the intervention. A multi-site, repeated measures design with multiple simulation experiences embedded into it would add rigor to the findings. Students experiencing several simulations, using multiple debriefers trained in DML, may help to advance the critical concept of reflection-beyond-action and the facilitation of knowledge application, contributing to a future of reflective practitioners.

Another recommendation for future research is the development of rigorously tested, valid, and reliable instruments that are not disease specific to measure knowledge and application of knowledge. An important aspect of evidence-based practice is contingent upon the quality and rigor of research studies the practice is based on. It is also important for nurses to be skilled in critiquing quantitative research through the measurement of validity and reliability. Further development and testing of nursing knowledge tools is important for advancement of quality, well-grounded, and replicable studies.

Conclusions

The findings from this research study expand upon the best practices for debriefing. The outcomes of this study revealed the use of DML positively affected knowledge acquisition, knowledge retention, and knowledge application among baccalaureate nursing students. The use of DML will facilitate the development of reflective practitioners. This study contributed to the growing body of knowledge about best debriefing practices and provides new avenues for future research.

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APPENDIX A

DEBRIEFING FOR MEANINGFUL LEARNING
COPYRIGHT PERMISSION LETTER

Dear Ann,

Thank you for your interest in using the Debriefing for Meaningful Learning method of debriefing for your dissertation research. DML is a copyright product. You have my permission to use the method and the worksheets for debriefing in your study and you may copy them as needed for your study participants. You may not change the worksheets without my written permission.

Sincerely,

~Kris Dreifuerst

Kristina Thomas Dreifuerst PhD, RN, CNE, ANEF
Associate Professor
Marquette University College of Nursing
PO Box 1881
Clark Hall, Room 368
Milwaukee, WI 53201-1881
414-288-3817 office
608-444-9688 mobile
kristina.dreifuerst@mu.edu

APPENDIX B

SITE APPROVAL LETTER

April 10, 2017

Ann Loomis
1024 Dress Lane
Evansville, IN 47725

Dear Ms. Loomis;

This letter is to verify that the College of Nursing and Health Professions at the University of Southern Indiana will be a data collection site for your dissertation. In discussions with you and information that you have provided me, I understand the study will explore simulation and debriefing in nursing education. Senior nursing students enrolled in a fourth year nursing course will serve as your sample during the fall 2017 semester. I also understand that you will be working with two USI nursing faculty, Dr. Tracy Kinner and Dr. Marilyn Ostendorf, during this data collection time period.

Upon approval from the University of Northern Colorado IRB, I approve the use of the USI site for the purpose of collecting data for your dissertation. If you need any additional information or support from me, please let me know.

I wish you the best upon the completion of your dissertation and doctoral degree.

Sincerely,

Ann White

Ann White RN, PhD, MBA, NE-BC
Dean, College of Nursing and Health Professions.

College of Nursing and Health Professions
8600 University Boulevard ▾ Evansville, Indiana 47712 ▾ 812-464-1708 ▾ Fax 812-465-7092 ▾ USI.edu

APPENDIX C

INSTITUTIONAL REVIEW BOARD APPROVAL LETTER

UNIVERSITY OF
NORTHERN COLORADO

Institutional Review Board

DATE:	August 18, 2017
TO:	Ann Loomis, PhD
FROM:	University of Northern Colorado (UNCO) IRB
PROJECT TITLE:	[1104734-2] Exploring the Impact of DML Debriefing on Application of Nursing Knowledge
SUBMISSION TYPE:	Amendment/Modification
ACTION:	APPROVAL/VERIFICATION OF EXEMPT STATUS
DECISION DATE:	August 18, 2017
EXPIRATION DATE:	August 17, 2021

Thank you for your submission of Amendment/Modification materials for this project. The University of Northern Colorado (UNCO) IRB approves this project and verifies its status as EXEMPT according to federal IRB regulations.

We will retain a copy of this correspondence within our records for a duration of 4 years.

If you have any questions, please contact Sherry May at 970-351-1910 or Sherry.May@unco.edu. Please include your project title and reference number in all correspondence with this committee.

This letter has been electronically signed in accordance with all applicable regulations, and a copy is retained within University of Northern Colorado (UNCO) IRB's records.

APPENDIX D

SUBJECT INFORMATION SHEET

Institutional Review Board

CONSENT FORM FOR HUMAN PARTICIPANTS IN RESEARCH

UNIVERSITY OF NORTHERN COLORADO

Project Title: Exploring Simulation with Debriefing on Application of Nursing Knowledge
Researcher: Ann Loomis, PhD(c), School of Nursing and Health Sciences
Phone Number: (812) 305-1466 e-mail: loom9586@bears.unco.edu
Research Advisor: Dr. Jeanette McNeill, School of Nursing and Health Sciences
Phone Number: (970) 351-2293 e-mail: Jeanette.mcneill@unco.edu

I am interested in exploring simulation with debriefing in nursing education. As a potential participant in this research, you will be asked to take part in a simulation either as a nurse, family member, or as an observer as a part of your course Nursing Care of Adults III. In addition, you will need to complete three tests, one prior to the start of the simulation, one after completing the required course simulation, and one approximately thirty days after the simulation. These tests are part of the requirements for the course however they will not be graded and will not count toward your course grade in this class. These tests will be given to you during your regularly scheduled class time. The tests will take about 15 minutes each to complete.

You will not put your name on any of the three tests. You will record today's date with the month and the day, the day of your birthday, and last four digits of your phone number to identify yourself. For example, if your birthdate is March 31, 1997 and your phone number is 414-261-2111 then your identifier number would be 0910312111. You will need to use this number on all three tests.

The test questions will all be multiple choice. Your course professor will not see the tests, your answers, or your scores. Test results will be collated and only presented in group form and all original paperwork will be kept in a locked cabinet in the researcher's home office and destroyed after completion of the study analysis. The researcher will strive to protect the anonymity and confidentiality of your responses. No personal identifiers will be used in this study.

Risks to you are minimal. Your decision to participate, or not participate, by including your test result in the database for this study will have no impact on your evaluation in this class or affect your course grade. You may feel anxious or frustrated filling out the tests but we are trying to minimize these feelings because the results will have no bearing on your final grade. The benefit to you is your contribution to the advancement of nursing research, and knowing more about the use of simulation in nursing education, by participating in this study.

Although you must participate in the simulation, and take all three tests, allowing inclusion of your test scores into the study database is voluntary. Should you decide you do not want to participate in the study; your tests will be destroyed before the others are scored. You must however complete all tests as a course requirement. By marking the yes box at the start of each test, you will give us permission for including your test scores in the study.

You may keep this form for future reference.

If you have any concerns about your selection or treatment as a research participant, please contact Sherry May, IRB Administrator, Office of Sponsored Programs, 25 Kepner Hall, University of Northern Colorado Greeley, CO 80639; 970-351-1910.

APPENDIX E

PRETEST

1. My data may be included in the study data base.

    A. Yes

    B. No

2. I am a December graduate.

    A. Yes

    B. No

Meningitis Simulation Pretest

Scenario: You are the nurse preparing to care for Angelia. During report, you learn that Angelia is a 20-year-old female who arrived to the Emergency Department (ED) three hours ago with a fever of 104.1º F, a severe headache, and nausea. She is currently being admitted for further workup, antibiotics, and fluid resuscitation.

3. Angelia arrived in the emergency department reporting a headache, fever, nausea, and photosensitivity. She has been living in close proximity with two people recently diagnosed with meningitis. Which diagnostic test do you anticipate will be ordered?

    A. Lumbar puncture

    B. MRI with contrast

    C. Cerebral angiography

    D. None of the above

4. You are assessing Angelia after she underwent a lumbar puncture. Post-procedure, what assessment finding would be of *most* concern?
    A. Angelia complains of a headache
    B. Angelia has difficulty voiding in the prone position
    C. You note Angelia has less strength in her legs
    D. You observe clear fluid oozing from the lumbar puncture site
5. Angelia was admitted to the medical-surgical unit with presumed bacterial meningitis. What is the *priority* nursing action for Angelia at this time?
    A. Administering an antifungal agent such as amphotericin B as ordered
    B. Observing the client for petechial rash
    C. Placing the client in isolation
    D. Performing neuro checks every 2 hours
6. Angelia is admitted to the hospital for presumed bacterial meningitis and her mother comes to visit. What is the most appropriate intervention?
    A. Explain to the mother she will not be allowed to visit in the hospital without wearing the appropriate garments
    B. Provide education related to the purpose of isolation
    C. Provide the mother with a copy of the CDC guidelines and hospital policy for isolation precautions
    D. Educate the mother to maintain a calm and quiet environment
7. Angelia is admitted to the hospital with presumed bacterial meningitis. Which nursing intervention is the *highest* priority?

A. Decreasing environmental stimuli

B. Strictly monitoring hourly intake and output

C. Performing a neurological assessment every 2 hours

D. Managing pain through pharmacologic and non-pharmacologic methods

8. Angelia is presumed to have bacterial meningitis. Which of these questions is *most* important for you to ask her?

A. Where do you live?

B. When was your last tetanus shot?

C. Have you had any viral infections recently?

D. Have you hit your head recently?

9. Angelia is presumed to have bacterial meningitis. Upon exam, she cannot extend her legs completely without experiencing extreme pain. You correctly document this finding as which sign?

A. Positive Brudzinski's sign

B. Positive Battle's sign

C. Positive Kernig's sign

D. Positive Cosgrow's sign

10. You prepare to provide perineal care for Angelia who has bacterial meningitis. Which personal protective equipment (PPE) should you wear?

A. Particulate respirator

B. Gown and gloves only

C. Mask, gown, and gloves

D. PPE only if exposure to body fluids is anticipated

11. While reviewing the electrolyte values for Angelia who has bacterial meningitis, you note her serum sodium level is 126mEq/L. How do you interpret this finding?

A. Her sodium level is within normal limits considering the diagnosis of bacterial meningitis.

B. Her sodium level is evidence of probable syndrome of inappropriate antidiuretic hormone (SIADH), a common complication of bacterial meningitis.

C. Her sodium level demonstrates the body's natural compensatory mechanism to increase urination and promote a reduced intracranial pressure (ICP).

D. Her sodium level indicates an early warning sign that electrolyte imbalances will potentiate systemic shock.

12. Meningitis can cause Angelia to have a severe headache. You understand that a severe headache can lead to death as a result of what pathophysiological change?

A. Seizures

B. Raised intracranial pressure (ICP)

C. Bacterial sepsis

D. Leukocytosis

13. Patients with the diagnosis of Meningitis are monitored for symptoms of increasing intracranial pressure (ICP). Which of the following assessment findings is the earliest sign of increasing ICP?
    A. Decline in alertness
    B. Alteration in pulse pressure
    C. Sluggish pupils
    D. Speech changes
14. You complete a neurological assessment on Angelia. She opens her eyes to speech, localizes pain, and uses inappropriate words. You calculate Angelia's Glasgow Coma Scale score as:
    A. 14
    B. 3
    C. 8
    D. 11

15. What is generally considered a significant change in the Glasgow Coma Scale?
    A. Any change
    B. -2 points
    C. +1 point
    D. -3 points
16. Angelia has just taken a dose of Ondansetron. What indicates Angelia has had a therapeutic response to the medication?

A. Relief of constipation

B. Decrease in heartburn

C. Absence of abdominal pain

D. Relief of nausea and vomiting

17. Angelia has an oral temperature 102.º F. The best antipyretic to administer to someone with presumed bacterial meningitis would be:

A. Acetaminophen

B. Ibuprofen

C. Omeprazole

D. Aspirin

APPENDIX F

DEMOGRAPHIC QUESTIONNAIRE

Race

- Black
- African American
- Hispanic
- Asian
- White
- Other
- Do not want to share this information

Sex

- Male
- Female
- Other
- Do not want to share this information

Age

- Write in your age __________
- Do not want to share this information

Is this your first college degree?

- Yes
- No

Are you:

- educated as a CNA
- certified as a CNA
- work as a CNA
- work as patient care tech
- cared for someone with meningitis

APPENDIX G

POSTTEST 1

1. My data may be included in the study data base.

    A. Yes

    B. No

2. I am a December graduate.

    A. Yes

    B. No

Meningitis Simulation Posttest

Scenario: You are the nurse preparing to care for Angelia. During report, you learn that Angelia is a 20-year-old female who arrived to the Emergency Department (ED) three hours ago with a fever of 104.1º F, a severe headache, and nausea. She is currently being admitted for further workup, antibiotics, and fluid resuscitation.

3. Angelia is admitted to the hospital for presumed bacterial meningitis and her mother comes to visit. What is the most appropriate intervention?

    A. Provide the mother with a copy of the CDC guidelines and hospital policy for isolation precautions

    B. Educate the mother to maintain a calm and quiet environment

    C. Provide education related to the purpose of isolation

    D. Explain to the mother she will not be allowed to visit in the hospital without wearing the appropriate garments

4. Angelia is presumed to have bacterial meningitis. Which of these questions is *most* important for you to ask?

A. Have you had any viral infections recently?

B. When was your last tetanus shot?

C. Where do you live?

D. Have you hit your head recently?

5. You prepare to provide perineal care for Angelia who has bacterial meningitis. Which personal protective equipment (PPE) should you wear?

   A. Mask, gown, and gloves

   B. Gown and gloves only

   C. Particulate respirator

   D. PPE only if exposure to body fluids is anticipated

6. Meningitis can cause Angelia to have a severe headache. You understand that a severe headache can lead to death as a result of what pathophysiological change?

   A. Leukocytosis

   B. Raised intracranial pressure (ICP)

   C. Bacterial sepsis

   D. Seizures

7. Patients with the diagnosis of Meningitis are monitored for symptoms of increasing intracranial pressure (ICP). Which of the following assessment findings is the earliest sign of increasing ICP?

   A. Speech changes

B. Sluggish pupils

C. Alteration in pulse pressure

D. Decline in alertness

8. What is generally considered a significant change in the Glasgow Coma Scale?

A. -3 points

B. -2 points

C. +1 point

D. Any change

9. Angelia has an oral temperature 102.º F. The best antipyretic to administer to someone with presumed bacterial meningitis would be:

A. Aspirin

B. Acetaminophen

C. Omeprazole

D. Ibuprofen

10. You are assessing Angelia after she underwent a lumbar puncture. Post-procedure, what assessment finding would be of *most* concern?

A. Angelia has difficulty voiding in the prone position

B. Angelia complains of a headache

C. You observe clear fluid oozing from the lumbar puncture site

D. You note Angelia has less strength in her legs

11. Angelia arrived in the emergency department reporting a headache, fever, nausea, and photosensitivity. She has been living in close proximity with two people recently diagnosed with meningitis. Which diagnostic test do you anticipate will be ordered?

    A. Cerebral angiography

    B. MRI with contrast

    C. Lumbar puncture

    D. None of the above

12. Angelia was admitted to the medical- surgical unit with presumed bacterial meningitis. What is the *priority* nursing action for Angelia at this time?

    A. Performing neuro checks every 2 hours

    B. Administering an antifungal agent such as amphotericin B as ordered

    C. Observing the client for petechial rash

    D. Placing the client in isolation

13. Angelia is presumed to have bacterial meningitis. Upon exam, she cannot extend her legs completely without experiencing extreme pain. You correctly document this finding as which sign?

    A. Positive Brudzinski’s sign

    B. Positive Cosgrow’s sign

C. Positive Kernig's sign

D. Positive Battle's sign

14. While reviewing the electrolyte values for Angelia who has bacterial meningitis, you note her serum sodium level is 126mEq/L. How do you interpret this finding?

    A. Her sodium level is evidence of probable syndrome of inappropriate antidiuretic hormone (SIADH), a common complication of bacterial meningitis.

    B. Her sodium level is within normal limits considering the diagnosis of bacterial meningitis.

    C. Her sodium level indicates an early warning sign that electrolyte imbalances will potentiate systemic shock.

    D. Her sodium level demonstrates the body's natural compensatory mechanism to increase urination and promote a reduced intracranial pressure (ICP).

15. You complete a neurological assessment on Angelia. She opens her eyes to speech, localizes pain, and uses inappropriate words. You calculate Angelia's Glasgow Coma Scale score as:

    A. 3

    B. 14

    C. 11

    D. 8

16. Angelia has just taken a dose of oral Ondansetron. What indicates Angelia has had a therapeutic response to the medication?
    A. Absence of abdominal pain
    B. Relief of constipation
    C. Decrease in heartburn
    D. Relief of nausea and vomiting
17. Angelia is admitted to the hospital with presumed bacterial meningitis. Which nursing intervention is the *highest* priority?
    A. Performing a neurological assessment every 2 hours
    B. Decreasing environmental stimuli
    C. Managing pain through pharmacologic and non-pharmacologic methods
    D. Strictly monitoring hourly intake and output

APPENDIX H

MENINGITIS SIMULATION SCENARIO

Meningitis Simulation Scenario

Students will participate in one simulation scenario using a high-fidelity patient simulator. The simulation scenario will represent clinical situations formed based on didactic content of meningitis students will have covered in the Nursing Care of Adults III (medical-surgical) theory course.

Background: Patient is a 20 year old Caucasian female, college student who presented to the Emergency Department (ED) three hours ago with a fever of 104.1, a severe headache, and nausea. Patient has had symptoms of general malaise, headache, nuchal rigidity, and fever for the past 24 hours. Patient was seen at an outpatient center 12 hours earlier and diagnosed with the flu. She is currently being admitted for further workup, antibiotics, and fluid resuscitation.

Social History: Lives in a sorority house, social drinker, non-smoker, and participates in varsity swimming. Mother reports she is up to date on all immunizations at the start of school; however, she did not receive a meningitis vaccination.

Primary Medical Diagnosis: R/O Bacterial Meningitis.

Surgeries/Procedures & Dates: CT of head, lumbar puncture, and lab work done in ED this morning.

Emergency Department report: Angelia Coulter is a 20 year old Caucasian Female University student. She is being admitted to your medical-surgical unit with a diagnosis of bacterial meningitis. The patient reported to the ED three hours ago. She resides in a sorority house on campus. Her roommate brought Angelia to the ED when she had trouble waking her, appeared confused and “out of it," and was crying because her head hurt. The patient was lethargic upon arrival. At this time, she is alert and oriented with no memory of the events. She has a Glasgow coma scale of 14. She states she has not been feeling well x 24 hrs. She was seen at an outpatient clinic yesterday for general malaise, chills, and a headache and was diagnosed with flu. She reports developing a fever, sensitivity to light, and a stiff neck since that time. She reported her headache was a 10/10, reduced to a tolerable level with Morphine Sulfate 2mg IV given at 0600. The patient complains of pain with ocular movement. Last ED Vital signs: BP 118/70, HR 80, R18, T 100.2 orally, O2 sat 99% on room air. Acetaminophen 650 mg rectally administered upon admission at 0600 for elevated temperature. Pupils are 5mm and reactive. Cranial Nerve assessment is WNL. S1S2 heart sounds present, Lung sounds are clear, abdomen is soft, non-distended, bowel sounds are active x four. There is no evidence of petechial rash noted throughout body. +2 peripheral pulses upper and lower extremities, capillary refill <3 seconds upper and lower extremities. Patient vomited; given Ondansetron 4mg po at 0630. She has an 18 gauge angiocath left forearm with NS@ 125ml/hr. Her mother is at the bedside.

Meningitis Simulation

The simulation scenario represents a clinical situation developed according to content provided in the Nursing Care of the Adult III theory course focused on meningitis. The simulation was developed using the National League of Nursing simulation design template.

Learning objectives:

By the end of this scenario, participants will be able to:

1. Demonstrate a focused neurologic assessment on a patient with suspected meningitis.
2. Demonstrate appropriate isolation precautions for the patient with meningitis.
3. Apply best available standards of care for the patient with meningitis.
4. Prioritize care for the patient with meningitis.
5. Provide education for the patient and family regarding meningitis treatment plan.
6. Engage patient and family in therapeutic communication.

Simulation Set-up:

Setting:	**Supplies needed:**
Medical-Surgical Unit	Droplet isolation supplies: sign for door, isolation cart with PPE, trash cans, linen bins IV/Infusion pump Medication cart Pulse oximetry
Manikin:	
20 year old Caucasian female	Hospital gown
Identification:	Appropriate ID band Allergy band Fall risk band
Angelia Coulter	
DOB: 05/04/1997	
Additional roles: Parent	Parent with isolation garments on
IVF: NS at 125/hr Left forearm site	18 gauge angiocath
	Liter Normal Saline
	Infusion pump
Droplet precautions	Isolation cart with PPE

Setting (Cont.):	**Supplies needed (Cont.):**
Provider Orders: 1. Admit to Medical-Surgical unit 2. Diagnosis: Meningitis 3. Admit to the service of Dr. M. Menard 4. Consult Infectious Disease specialist on call 5. IVF: NS@125ml/hr	Copy of orders available during simulation
6. Clear liquid diet; advance as tolerated 7. O2 @ 2L/NC prn if O2 Sat < 94% on room air 8. Vancomycin 20mg/kg IV q 8 hrs 9. Cefoxitin 1 gm IV BID 10. Acetaminophen 650mg rectally q 4hr Temp >101. *Total daily dose of acetaminophen 3900mg/24 hr. including all sources of acetaminophen. 11. Morphine IV 2mg q 3hr prn pain 12. Zofran 4mg po q 8 hrs prn nausea and vomiting	Meal tray with clear liquids at patient bedside O2 hook up, nasal cannula on wall IV piggybacks, IV all labeled Correct syringe sizes and needles for meds., alcohol swabs, flushes

Setting (Cont.):	Supplies needed (Cont.):
Medical Record **Allergies**	NKA
Lab data WBC: 12,000/l CSF: Cloudy, Protein 210mg/dl, Glucose 32mg/dl, WBC 130cells/mm ^{3}, RBC rare Procalcitonin: 2.3 microgram/l CT Head: No signs of increased intracranial pressure or intracranial lesions	Lab data available during simulation
Shift assessment	Documentation forms: Shift Assessment
Medication administration record	ED medications documented: Vancomycin 1.5 gms IV 0700 Cefoxitin 1 gm IV 0700 Morphine 2 mg IV 0600 Acetaminophen 650 mg rectal 0600 Zofran 4 mg po 0630

Simulation-Scenario: Bacterial Meningitis	Student level: Senior Students
Expected Simulation Run time: 20 minutes	Guided Reflection time: 55 minutes
Location: Simulation center	Location for debriefing: Room 1006

Patient situation	Expected Psychomotor skills:
Admission Date: today 0900	
Patient description: Angelia Coulter 20/F Caucasian University student athlete Parent is at bedside	Isolation Precautions Focused Neurologic assessment Vital signs assessment Pain assessment Patient safety precautions IV/rectal/po medication administration
	Completed pre-scenario assignment
Simulation roles:	
Primary Nurse	
Secondary Nurse	
Parent	
Observer 1	
Observer 2	
Physician (phone interaction only)	

Timing (approximate)	Manikin actions	Expected Intervention	May use the following clues:
Entry to patient room and introduction- 5 min	Identifies self as Angelia Coulter DOB: 04/05/1997	Initiates appropriate isolation precautions prior to entering room. Performs hand hygiene prior to donning of isolation garments. Performs assessment of 2 patient Identifiers.	Patient asks staff why everyone is dressed like that around her. Mother: Are you able to take care of her as sick as she is?

Timing (approximate)	**Manikin actions**	**Expected Intervention**	**May use the following clues:**
Conducts initial and focused neurological assessments including VS - 10 min	c/o lights hurting her eyes and has cold cloth over eyes and c/o frontal headache (8 out of 10) Flushed face (moulage) and diaphoretic (gown slightly damp)	Explains purpose of isolation gear to patient and mother. Check correct IV's hanging (including antibiotics), perform IV assessment, check IV pump rate Recognizes abnormal findings: fever, headache, drowsiness. Administer Morphine 2mg IV Check temperature (103.0). Call doctor for Ibuprofen order (SBAR)	Pump set at 125ml/hr Mother requests something for daughter's headache Mother: She feels really warm, like her fever is back. Is it time for more medicine?
5 minutes		Uses therapeutic communication to elicit concerns and clarify information for patient and mother.	Mother: How do we keep this from happening again?

APPENDIX I

POSTTEST 2

1. My data may be included in the study data base.

    A. Yes

    B. No

2. I am a December graduate.

    A. Yes

    B. No

Meningitis Simulation Posttest 2

Scenario: You are the nurse preparing to care for Angelia. During report, you learn that Angelia is a 20-year-old female who arrived to the Emergency Department (ED) three hours ago with a fever of 104.1º F, a severe headache, and nausea. She is currently being admitted for further workup, antibiotics, and fluid resuscitation.

3. Angelia has an oral temperature 102º F. The best antipyretic to administer to someone with presumed bacterial meningitis would be:

    A. Aspirin

    B. Acetaminophen

    C. Ibuprofen

    D. Omeprazole

4. What is generally considered a significant change in the Glasgow Coma Scale?

    A. -3 points

    B. Any change

    C. -2 points

    D. +1 point

5. Angelia has just taken a dose of Ondansetron. What indicates Angelia has had a therapeutic response to the medication?
    A. Decrease in heartburn
    B. Relief of constipation
    C. Absence of abdominal pain
    D. Relief of nausea and vomiting
6. Patients with the diagnosis of Meningitis are monitored for symptoms of increasing intracranial pressure (ICP). Which of the following assessment findings is the earliest sign of increasing ICP?
    A. Alteration in pulse pressure
    B. Decline in alertness
    C. Sluggish pupils
    D. Speech changes
7. You complete a neurological assessment on Angelia. She opens her eyes to speech, localizes pain, and uses inappropriate words. You calculate Angelia's Glasgow Coma Scale score as:
    A. 3
    B. 8
    C. 11
    D. 14

8. Meningitis can cause Angelia to have a severe headache. You understand that a severe headache can lead to death as a result of what pathophysiological change?
   A. Leukocytosis
   B. Seizures
   C. Raised intracranial pressure (ICP)
   D. Bacterial sepsis
9. While reviewing the electrolyte values for Angelia who has bacterial meningitis, you note her serum sodium level is 126mEq/L. How do you interpret this finding?
   A. Her sodium level is evidence of probable syndrome of inappropriate antidiuretic hormone (SIADH), a common complication of bacterial meningitis.
   B. Her sodium level demonstrates the body's natural compensatory mechanism to increase urination and promote a reduced intracranial pressure (ICP).
   C. Her sodium level indicates an early warning sign that electrolyte imbalances will potentiate systemic shock.
   D. Her sodium level is within normal limits considering the diagnosis of bacterial meningitis.

10. You prepare to provide perineal care for Angelia who has bacterial meningitis. Which personal protective equipment (PPE) should you wear?
    A. Gown and gloves only
    B. Mask, gown, and gloves
    C. Particulate respirator
    D. PPE only if exposure to body fluids is anticipated
11. Angelia is presumed to have bacterial meningitis. Upon exam, she cannot extend her legs completely without experiencing extreme pain. You correctly document this finding as which sign?
    A. Positive Kernig's sign
    B. Positive Brudzinski's sign
    C. Positive Battle's sign
    D. Positive Cosgrow's sign
12. Angelia is presumed to have bacterial meningitis. Which of these questions is *most* important for you to ask her?
    A. Have you had any viral infections recently?
    B. Where do you live?
    C. When was your last tetanus shot?
    D. Have you hit your head recently?

13. Angelia is admitted to the hospital with presumed bacterial meningitis. Which nursing intervention is the *highest* priority?

    A. Strictly monitoring hourly intake and output

    B. Decreasing environmental stimuli

    C. Performing a neurological assessment every 2 hours

    Managing pain through pharmacologic and non-pharmacologic methods

14. Angelia is admitted to the hospital for presumed bacterial meningitis and her mother comes to visit. What is the most appropriate intervention?

    A. Provide education related to the purpose of isolation

    B. Explain to the mother she will not be allowed to visit in the hospital without wearing the appropriate garments

    C. Provide the mother with a copy of the CDC guidelines and hospital policy for isolation precautions

    D. Educate the mother to maintain a calm and quiet environment

15. Angelia was admitted to the medical-surgical unit with presumed bacterial meningitis. What is the *priority* nursing action for Angelia at this time?

    A. Observing the client for petechial rash

    B. Placing the client in isolation

    C. Performing neuro checks every 2 hours

    D. Administering an antifungal agent such as amphotericin B as ordered

16. You are assessing Angelia after she underwent a lumbar puncture. Post-procedure, what assessment finding would be of *most* concern?
    A. Angelia complains of a headache
    B. You note Angelia has less strength in her legs
    C. Angelia has difficulty voiding in the prone position
    D. You observe clear fluid oozing from the lumbar puncture site
17. Angelia arrived in the emergency department reporting a headache, fever, nausea, and photophobia. She has been living in close proximity with two people recently diagnosed with meningitis. Which diagnostic test do you anticipate will be ordered?
    A. Lumbar puncture
    B. MRI with contrast
    C. Cerebral angiography
    D. None of the above

Scenario: You are the nurse preparing to care for Michael. During report, you learn that Michael is a 20-year-old male who arrived to the Emergency Department (ED) three hours ago with sudden onset of a severe headache, nausea, and photophobia. He is currently being admitted for further workup and fluid resuscitation.

18. Patients with the diagnosis of subarachnoid hemorrhage are monitored for symptoms of increasing intracranial pressure (ICP). Which of the following assessment findings is the earliest sign of increasing ICP?
    A. Alteration in pulse pressure
    B. Decline in alertness
    C. Sluggish pupils
    D. Speech changes
19. You complete a neurological assessment on Michael. He opens his eyes spontaneously, obeys commands, but is confused. You calculate Michael's Glasgow Coma Scale score as:
    A. 3
    B. 8
    C. 11
    D. 14
20. A subarachnoid hemorrhage can cause Michael to have a severe headache. You understand that a severe headache can lead to death as a result of what pathophysiological change?
    A. Leukocytosis
    B. Seizures
    C. Raised intracranial pressure (ICP)
    D. Bacterial sepsis

21. While reviewing the electrolyte values for Michael who has a subarachnoid hemorrhage, you note his serum sodium level is 136mEq/L. How do you interpret this finding?
    A. His sodium level is evidence of probable syndrome of inappropriate antidiuretic hormone (SIADH), a common complication of subarachnoid hemorrhage.
    B. His sodium level demonstrates the body's natural compensatory mechanism to increase urination and promote a reduced intracranial pressure (ICP).
    C. His sodium level indicates an early warning sign that electrolyte imbalances will potentiate systemic shock.
    D. His sodium level is within normal limits considering the diagnosis of subarachnoid hemorrhage.
22. Michael is presumed to have a subarachnoid hemorrhage. Which of these questions is *most* important for you to ask him?
    A. Have you had any viral infections recently?
    B. Where do you live?
    C. When was your last tetanus shot?
    D. Have you hit your head recently?

23. Michael is admitted to the hospital with a presumed subarachnoid hemorrhage. Which nursing intervention is the *highest* priority?

    A. Strictly monitoring hourly intake and output

    B. Decreasing environmental stimuli

    C. Performing a neurological assessment

    D. Managing pain through pharmacologic and non-pharmacologic methods

24. Michael is admitted to the hospital for presumed subarachnoid hemorrhage and his girlfriend comes to visit. What is the most appropriate intervention?

    A. Provide education related to the purpose of isolation

    B. Explain to the girlfriend she will not be allowed to visit in the hospital without wearing the appropriate garments

    C. Provide the girlfriend with a copy of the CDC guidelines and hospital policy for isolation precautions

    D. Educate the girlfriend to maintain a calm and quiet environment

25. Michael was admitted to the medical-surgical unit with a presumed subarachnoid hemorrhage. What is the *priority* nursing action for Michael at this time?

    A. Observing the client for petechial rash

    B. Placing the client in isolation

    C. Performing neuro checks every 2 hours

    D. Administering an antifungal agent such as amphotericin B as ordered

26. You are assessing Michael after he underwent a CT of the head. Post-procedure, what assessment finding would be of *most* concern?

    A. Michael complains of a headache

    B. You note Michael has less strength in his legs

    C. Michael has difficulty voiding in the prone position

    D. You observe clear fluid oozing from the lumbar puncture site

27. Michael arrived in the emergency department reporting a severe headache, nausea and vomiting, and photosensitivity. He awoke this morning with sudden onset of the "worst headache ever." Which diagnostic test do you anticipate will be ordered?

    A. Lumbar puncture

    B. MRI with contrast

    C. CT of the head

    D. None of the above