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Anxiety, Cognitive Load, and Simulation Effectiveness in Pre-licensure BSN Students

Brittany Behrens
Walden University

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Brittany Lane Behrens

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Walden University
2026

Abstract

Anxiety, Cognitive Load, and Simulation Effectiveness in Pre-licensure BSN Students

by

Brittany Lane Behrens

MSN, Florida Southern College, 2017

BSN, Florida Southern College, 2014

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Philosophy

Nursing Education

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Abstract

High-fidelity simulation experiences are an integral component of pre-licensure nursing curricula, providing students with realistic, controlled environments to develop clinical judgement skills. While these simulations enhance learning, they can increase anxiety and cognitive load, potentially impairing students' ability to process information and derive meaningful outcomes. The purpose of this quantitative, correlational study was to examine the relationships among pre-simulation anxiety, cognitive load, and perceived simulation effectiveness in pre-licensure BSN students. Data were collected from 90 participants using the shortened Spielberger State-Trait Anxiety Inventory (STAI), the Cognitive Load Measurement–Naïve Rating Questionnaire, and the Simulation Effectiveness Tool–Modified (SET-M). Pearson correlation analyses indicated no statistically significant relationship between pre-simulation anxiety and perceived simulation effectiveness ($r(88) = -.206, p = .051$) and no significant relationship was found between anxiety and perceived cognitive load ($r(88) = .019, p = .856$). Multiple linear regression analysis also indicated that cognitive load did not mediate the relationship between anxiety and simulation effectiveness ($B = -.041, \beta = -.036, p = .735$), and pre-simulation anxiety did not significantly predict simulation effectiveness ($B = -.236, \beta = -.206, p = .051$). Findings suggest that pre-simulation anxiety and cognitive load did not influence students' perceptions of simulation effectiveness within this sample. These results contribute to the understanding of factors influencing simulation-based learning and may inform the development of simulation experiences that support effective learning for nursing students thus supporting positive social change.

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Dedication

I would like to dedicate this dissertation to my loving family, who have supported me in many ways throughout this process. Without them, I would not have been able to accomplish many of the things that I am most proud of. My parents, Jesse and Elizabeth, encouraged me to pursue my goals and to push through any challenges I face for as long as I can remember. My husband, Brent, who wholeheartedly supported me in furthering my education and consistently cheers me on to be the best version of myself. I am also dedicating this to my two daughters, Adalynn and Teagan; I hope they recognize that through hard work, anything is possible.

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Chapter 1: Introduction to the Study

Introduction

Nursing programs are thoughtfully designed to develop clinical judgement and prepare students to function as leaders within the healthcare team. To become proficient in these skills, nursing students participate in engaged learning activities to apply their knowledge at various points in the nursing curriculum. A very common engaged learning modality used in nursing education is high-fidelity simulation (Smiley, 2019). High-fidelity simulations are experiences designed to be highly realistic, using advanced equipment, realistic environments, and scenarios that mimic real life (Carey & Rossler, 2023).

While high-fidelity simulation is considered a highly effective learning strategy, these experiences can be stressful for learners, leading to negative emotions such as anxiety or fear (Kapucu, 2017). High-fidelity simulation experiences have also been found to elicit higher cognitive load than traditional classroom-based learning (Josephsen, 2015). Cognitive load is the amount of information the mind can process at any given time (Sweller, 1988). High levels of cognitive load can negatively affect the ability to solve problems or think critically (Jung & Roh, 2022; Josephsen, 2015; Lewis, 2019) and may also affect learners' perceptions of the effectiveness of the learning experience (Josephsen, 2015).

To assess the effectiveness of a simulation experience, educators gather learners' impressions after the simulation concludes to ensure the experience was meaningful and an effective way to learn (Leighton et al., 2015). While anxiety, cognitive load, and

simulation effectiveness have been explored individually, an investigation was needed to determine whether there was a relationship among learners' anxiety, cognitive load, and their perception of the effectiveness of simulation-based learning experiences among pre-licensure nursing students. Despite existing research on these individual concepts, there was a noticeable gap in studies that meaningfully connect these factors to understand their combined impact on student learning outcomes. In Chapter 1, I present background information, research questions, the theoretical framework, key terms, and the significance of this study.

Background

The goal of a high-fidelity simulation experience is to facilitate effective learning in a safe and controlled environment (Carey & Rossler, 2023; Smiley, 2019). High-fidelity simulation is frequently used in pre-licensure nursing programs because it is an effective modality for teaching and assessing knowledge and skills (Carey & Rossler, 2023) and for improving critical thinking and clinical decision-making (Kapucu, 2017; Mills et al., 2016). The use of simulation in nursing education will likely continue to grow as technology becomes more accessible and the number of students in nursing programs increases beyond clinical site capacities (Aebersold, 2018; Jung & Roh, 2022). Findings from a landmark simulation study demonstrated that substituting up to 50% of traditional clinical hours could yield similar end-of-program student outcomes in clinical competency, knowledge assessments, and National Council Licensure Examination (NCLEX) pass rates (Hayden et al., 2014). Therefore, high-fidelity simulation is a viable option for clinical teaching. Based on research findings supporting simulation-based

education as an appropriate and effective teaching modality, many boards of nursing are now allowing programs to substitute up to 50% of traditional clinical hours with simulation experiences (NCSBN, 2016; Smiley, 2019).

High-fidelity simulation experiences are designed to mimic real-life scenarios, which require significant planning, time, and faculty training to ensure they are as realistic as possible (NCSBN, 2016; Carey & Rossler, 2023). While this level of complexity is thought to be a significant factor in the effectiveness of high-fidelity simulation, these experiences can be stressful for learners, leading to negative emotions such as anxiety or fear (Kapucu, 2017). Anxiety has been shown to affect nursing students' skill performance, confidence, and critical thinking ability during simulation experiences (Hutchinson et al., 2018; Kapucu, 2017; Mills et al., 2016). Factors such as the number of simulation participants in the simulation experience, learners' coping style, and emotional intelligence also play a role in learner anxiety, and each of these can lead to some variation in learners' responses to high-fidelity simulations (Alconero-Camarero et al., 2018; Nichols, 2018; Mills et al., 2016). Given the emotional impact that simulation experiences can have, some reported anxiety is expected in evaluations; however, excessive anxiety can hinder critical thinking and undermine the positive impacts of the learning experience (Alconero-Camarero et al., 2018; Mills et al., 2016).

Due to the likelihood of stress and anxiety during high-fidelity simulation experiences, it is important to understand the impact that these emotions have on cognitive load and the perceived effectiveness of the simulation. High-fidelity simulation experiences can increase cognitive load (Josephsen, 2015), and when cognitive load is

high, the overall learning experience may be affected (Lewis, 2019; Jung & Roh, 2022). According to the cognitive load theory, learners have a fixed amount of cognitive capacity, and when faced with stressors such as a complex problem or a large number of tasks, cognitive load increases (Josephsen, 2015; Sweller, 1988). Simulation can be highly complex; therefore, learners can experience high cognitive load, which can overwhelm working memory and negatively affect problem-solving and critical thinking (Jung & Roh, 2022; Josephsen, 2015; Lewis, 2019). Increased cognitive load may also impact learners' perceptions of the effectiveness of the learning experience (Josephsen, 2015). Emphasis is placed on learners' experience to ensure the simulation is perceived as meaningful and effective (Leighton et al., 2015).

Currently, the literature does not include research on how anxiety, coupled with cognitive load, affects nursing students' perceived effectiveness of high-fidelity simulation as a meaningful learning experience. Research was needed to determine whether there is a relationship among learners' anxiety, cognitive load, and their perception of the effectiveness of simulation-based learning experiences among pre-licensure nursing students. This study was necessary because the findings provide insight into factors that may affect the effectiveness of simulation experiences encountered during a pre-licensure BSN student's education. Nursing faculty and simulation facilitators can use the results of my study to inform the development of future simulation-based learning experiences, avoid wasting educational resources, and provide students with meaningful learning experiences.

Problem Statement

High-fidelity simulation experiences are frequently used in pre-licensure nursing curricula because research has shown that simulation-based learning is an effective modality for teaching and assessing knowledge and skills (Carey & Rossler, 2023) and is known to improve critical thinking and clinical decision-making (Kapucu, 2017; Mills et al., 2016). Many pre-licensure BSN students encounter anxiety and stress through high-fidelity simulation experiences (Kapucu, 2017). High-fidelity simulations are experiences designed to achieve a high level of realism through advanced equipment, environments, and scenarios that mimic real-world conditions (Carey & Rossler, 2023). For this reason, the use of simulation has increased rapidly over time, and pre-licensure programs can substitute up to 50% of traditional clinical hours with simulation experiences (NCSBN, 2016; Smiley, 2019).

The ultimate goal of high-fidelity simulation is to facilitate effective learning in a safe and controlled environment (Carey & Rossler, 2023; Smiley, 2019). To assess a simulation experience, educators typically observe learners' behavior and gather information about learners' perceptions of the experience after the simulation concludes (Johnston et al., 2018). Emphasis is placed on learners' experience to ensure the simulation is perceived as meaningful and effective (Leighton et al., 2015). Research has determined that simulation experiences may cause learners anxiety, and that significant levels of anxiety can reduce critical thinking ability and negatively impact learning (Alconero-Camarero et al., 2018; Mills et al., 2016). Additionally, simulation experiences often involve complex tasks and require problem-solving, which can increase

an individual's cognitive load (Sweller, 1988; Josephsen, 2015; Lewis, 2019). Currently, the literature does not include research on how anxiety, coupled with cognitive load, affects nursing students' perceived effectiveness of high-fidelity simulation as a meaningful learning experience. My goal in this study was to determine whether there was a relationship among learners' anxiety, cognitive load, and their perception of the effectiveness of simulation-based learning experiences, to understand factors that may affect simulation's ability to facilitate effective learning and to develop clinical judgement skills.

Purpose of the Study

The purposes of this quantitative study are to determine if there was a (a) relationship between pre-simulation encounter anxiety and the post-simulation perceived effectiveness of high-fidelity simulation as a meaningful learning experience in pre-licensure BSN students; (b) a relationship between pre-simulation encounter anxiety and post-simulation encounter perceptions of cognitive load in pre-licensure BSN students; and (c) a relationship between pre-simulation encounter anxiety and post-simulation encounter perceptions of simulation effectiveness mediated by perceived cognitive load.

Research Questions and Hypotheses

RQ1: What is the relationship between pre-simulation encounter anxiety and the post-simulation perceived effectiveness of high-fidelity simulation as a meaningful learning experience in pre-licensure BSN students?

H₀1: There is no relationship between pre-simulation encounter anxiety and post-simulation perceived simulation effectiveness as a meaningful learning experience in pre-licensure BSN students.

H_A1: There is a relationship between pre-simulation encounter anxiety and post-simulation perceived simulation effectiveness as a meaningful learning experience in pre-licensure BSN students.

RQ2: What is the relationship between pre-simulation encounter anxiety and post-simulation encounter perceptions of cognitive load in pre-licensure BSN students?

H₀2: There is no relationship between pre-simulation encounter anxiety and post-simulation encounter perceptions of cognitive load in pre-licensure BSN students.

H_A2: There is a relationship between pre-simulation encounter anxiety and post-simulation encounter perceptions of cognitive load in pre-licensure BSN students.

RQ3: What is the relationship between pre-simulation encounter anxiety and post-simulation encounter perceptions of simulation effectiveness mediated by perceived cognitive load?

H₀3: There is no relationship between pre-simulation encounter anxiety and post-simulation encounter perceptions of simulation effectiveness mediated by perceived cognitive load.

H_A3: There is a relationship between pre-simulation encounter anxiety and post-simulation encounter perceptions of simulation effectiveness mediated by perceived cognitive load.

I measured learner anxiety using the Spielberger State Trait Anxiety Inventory (STAIS-5 and STAIT-5). I measured cognitive load using the Cognitive Load Measurement – Naïve Rating Questionnaire. I measured learners' perceptions of simulation effectiveness using the Simulation Effectiveness Tool (SET - M). Information on demographic covariates, such as age, gender, and the number of semesters completed in the nursing program, were also collected prior to administering the survey instruments.

Theoretical Framework for the Study

I used Sweller's cognitive load theory to underpin my study. The cognitive load theory posits that learners have a fixed amount of cognitive load, which can be categorized into different types: intrinsic, extraneous, and germane resources (Sweller, 1988; Klepsch et al., 2017; Sweller et al., 2011). Intrinsic load is comprised of the information a learner must process that is necessary for the required learning task, while extraneous load is the term used to describe elements that add to an individual's cognitive load but are not directly connected to the learning task (Klepsch et al., 2017; Sweller et al., 2011). Germane cognitive load is the effort that a learner must put forth to process new information and establish connections with previous knowledge (Klepsch et al., 2017; Sweller et al., 2011).

When individuals learn new information or solve problems, cognitive capacity is used. Learners who face stressors such as complex problems or large numbers of tasks often experience higher cognitive load (Sweller, 1988). As cognitive load increases, effective problem solving and critical thinking become more difficult (Jung & Roh, 2022; Lewis, 2019; Sweller, 1988). Previous research has identified a relationship between

cognitive load, anxiety, and skill performance (Abbott et al., 2021; Lewis, 2019), and that critical thinking and problem-solving can be negatively affected when cognitive load is overwhelmed (Josephsen, 2015). For this reason, I used Sweller's cognitive load theory to explore the relationships among anxiety, cognitive load, and the perceived effectiveness of simulation experiences. Further discussion of this theoretical framework can be found in Chapter 2.

Nature of the Study

To address the research questions in this study, I conducted a correlational study to determine if a relationship exists between anxiety, cognitive load, and pre-licensure BSN students' perceived effectiveness of high-fidelity simulation. The high-fidelity simulation experiences used in my study are part of an existing BSN curriculum at a school of nursing in the southeastern United States. Key variables in this study are learner pre-simulation anxiety, learner cognitive load, and perceived simulation effectiveness. Pre-simulation anxiety is defined as the level of both the participant's state anxiety and trait anxiety before beginning a simulation experience. The term pre-simulation anxiety has not been previously defined due to a lack of literature on this concept. Learner cognitive load is the participant's perception of the amount of mental resources required during the experience (Klepsch et al., 2017; Sweller, 1988). Finally, perceived simulation effectiveness is the learners' evaluation of the overall effectiveness of the simulation experience (De Rosa et al., 2023; Taçgın, 2020).

I recruited individuals enrolled in a pre-licensure BSN program to complete the STAIS-5 and STAIT-5 prior to a simulation experience to evaluate pre-simulation

anxiety. At the conclusion of the simulation experience, students were asked to complete the Cognitive Load Measurement – Naïve Rating Questionnaire to measure cognitive load, and the SET-M to evaluate perceived simulation effectiveness. Because simulation is frequently used in nursing curricula and can replace up to 50% of traditional clinical experiences (NCSBN, 2016; Smiley, 2019), it is imperative that nurse educators have a thorough understanding of factors that can impact simulation-based learning. This study provides data that can assist nurse educators in developing meaningful, learner-centered, and effective simulation learning experiences.

Participants were recruited from one pre-licensure BSN program using convenience sampling. Analysis was conducted using responses to the surveys listed above, using Pearson correlation and multiple linear regression to determine whether there was a relationship among learner anxiety, cognitive load, and perceived simulation effectiveness (Gray & Grove, 2020).

Definitions

Cognitive Load: Describes the amount of information that can be processed by the mind at one time (Sweller, 1988).

Extraneous Cognitive Load: Elements that add to cognitive load but are not necessary to complete the learning task (Sweller et al., 2011).

Germane Cognitive Load: Germane cognitive load is the effort a learner must exert to process new information and connect it with prior knowledge (Klepsch et al., 2017).

High Fidelity Simulation: High-fidelity simulation is a term used to describe a simulation experience designed to be extremely realistic and to provide learners with a high level of interactivity throughout (Healthcare Simulation Dictionary, 2020).

Intrinsic Cognitive Load: Intrinsic cognitive load is the amount of information a learner must process to complete a required learning task (Sweller et al., 2011).

Learner cognitive load: The participant's perception of the amount of mental resources required during the experience (Klepsch et al., 2017; Sweller, 1988).

Pre-simulation anxiety: The level of both the participant's state anxiety and trait anxiety before beginning a simulation experience.

Perceived simulation effectiveness: Learner evaluation of the overall simulation experience (De Rosa et al., 2023; Taçgın, 2020).

Simulation Effectiveness: The concept of simulation effectiveness is the overall evaluation of a simulation experience. An effective simulation experience increases learners' understanding, builds confidence, and fosters high levels of learner satisfaction (Elfrink et al., 2012).

State Anxiety: The term state anxiety describes a transient emotional response to a situation that involves feelings of tension, nervousness, and apprehension. State anxiety often produces physiological or behavioral changes in an individual, such as increased heart rate, sweating, and visible discomfort (Kent, 2006)

Trait Anxiety: Trait anxiety refers to an individual's tendency to experience baseline anxiousness. A person who has high trait anxiety is more likely to see situations

as threatening and experience state anxiety as compared with an individual who has low trait anxiety (Kent, 2006).

Assumptions

There are several assumptions for my study. The first assumption was that learners would complete the survey instruments in their entirety and answer questions truthfully. This assumption is necessary to obtain accurate data. A second assumption in this study was that the high-fidelity simulation experiences each learner participates in are complex and require students to think critically and apply nursing knowledge from current and prior courses. This assumption is necessary to ensure that the level of difficulty in each simulation is appropriate for the learners' experience. A third assumption in this study was that learners experience varying emotions during simulation experiences, which affects cognitive load and perceived simulation effectiveness. This assumption is necessary because data were collected on these concepts to determine their relationships. A fourth assumption in this study was that the simulation practices at the institution where the data were collected are similar to practices in other simulation programs. This assumption is necessary for the study's findings to be applicable outside the data collection facility.

Scope and Delimitations

This study uses a quantitative design to test the hypotheses that relationships exist among the concepts of anxiety, cognitive load, and perceived simulation effectiveness. Participants were asked to share information on their state anxiety, trait anxiety, perceived cognitive load, and the perceived simulation effectiveness to explore the

relationships between these concepts. Pre-licensure BSN students were the target population, as these concepts had not been studied among them previously. The inclusion criteria for participants include enrollment in the third through eighth semesters of an eight-semester nursing program and participation in high-fidelity simulation experiences as a required course. Students who were repeating the course in which the simulation experience was occurring were excluded from the sample. I considered a qualitative design to explore students' individual experiences and perceptions about the concepts. However, I ultimately decided to focus on the collective data from a group to evaluate whether a measurable relationship exists among anxiety, cognitive load, and perceived simulation effectiveness. I chose the survey instruments based on their usability and the commitment of each. Because participants were asked to complete surveys within a limited timeframe, it was important that each survey be kept short.

I chose Sweller's cognitive load theory as a theoretical framework because of its focus on cognitive capacity. Previous research has identified that emotional state can affect cognitive load and that performance and problem-solving can be negatively impacted when cognitive load is high (Fredericks et al., 2021; Josephsen, 2015). The cognitive load theory helps establish the connection between learner anxiety and simulation effectiveness. I considered using Lazarus and Folkman's theory of transactional coping and stress. However, I did not use it because it focused solely on how a person coped with a situation or stressor, rather than on how the stressor affected their ability to navigate experiences effectively.

Because the study sample was limited to a specific student population, the generalizability of the findings may be limited. The use of a quantitative design supports the potential applicability of the findings to similar educational settings. The results may offer valuable insights for nursing programs with comparable student populations and simulation experiences, and they can serve as a foundation for future research across diverse academic and clinical environments.

Limitations

While the concepts of anxiety, cognitive load, and simulation effectiveness are not exclusive to pre-licensure BSN students, the findings of this study may not be generalized because I used convenience sampling. A limitation of this study is that all participants are traditional college students enrolled in the same nursing program, thereby limiting participant diversity within the sample (Gray & Grove, 2020; Allmark, 2004). An additional limitation of this study is that all simulations were conducted in the same simulation environment, using the same equipment.

The simulation experiences were also facilitated by faculty from a single program who conduct simulation encounters based on prior training, existing knowledge, institutional simulation culture, and standardized practices. Simulation experiences conducted at other institutions or simulation centers may use different equipment, scenarios, and faculty with varying simulation experience. Variation in faculty approaches to simulation and differences in facility resources could lead to variation in learner anxiety, cognitive load, or perceived simulation effectiveness. Uniformity in this study's equipment, faculty, and environment could be a limitation because there are many

different simulator brands, and the environments from one location to another could elicit varying stress or emotional responses. A potential bias in this study arises from participants being enrolled as students at the institution where I am employed. Participants in this study were not enrolled in any courses that I teach to avoid bias or perceived influence.

Significance

After completion of a pre-licensure nursing program, students must pass the NCLEX exam to become licensed as a registered nurse. The NCLEX requires significant critical thinking and clinical judgment to obtain a passing score; nursing students must develop these skills in a pre-licensure program. My study is significant because high-fidelity simulation has been shown to improve critical thinking and clinical decision-making skills (Kapucu, 2017); therefore, it is frequently used in nursing education (Carey & Rossler, 2023; Josephsen, 2015; Smiley, 2019). The findings of this study provide insight into factors that may affect the effectiveness of a pre-licensure BSN student's simulation experience. Nursing faculty and simulation facilitators can use the results of my study to inform the development of future simulation-based learning experiences, ensuring learners get the most from high-fidelity simulations.

High-fidelity simulation experiences can replace traditional clinical experiences in which students care for real patients and develop critical thinking skills (NCSBN, 2016). High-fidelity simulations also require significant faculty and staff expertise, as well as physical and financial resources (NCSBN, 2016; Carey & Rossler, 2023). To avoid wasting educational resources and provide students with meaningful learning, it is

imperative that high-fidelity experiences are constructed to be highly effective learning experiences that will affect positive social change.

Additionally, there is a significant need for new graduate nurses to enter the profession with adequate clinical judgement. Nursing programs must be intentional about integrating learning activities into the pre-licensure curriculum to ensure that new graduate nurses have the knowledge and skills to provide safe and effective patient care (Dickison et al., 2019). Providing insight into how to make simulation experiences more effective gives students better opportunities to develop their critical thinking and clinical judgement and positively affects social change.

Summary

In summary, the purpose of this study is to examine the relationships among anxiety, cognitive load, and perceived simulation effectiveness in pre-licensure BSN students. The high-fidelity simulation experiences in this study are part of the existing curriculum in this BSN program. The theoretical foundation of this study was Sweller's cognitive load theory, which states that learners have a fixed amount of cognitive capacity. When learners encounter stressors or large numbers of tasks, cognitive load increases, which makes learning and problem-solving more challenging (Jung & Roh, 2022; Lewis, 2019; Sweller, 1988). Participants completed the STAIS-5 and the STAIT-5 prior to beginning a simulation experience to evaluate pre-simulation anxiety. At the conclusion of the simulation experience, students completed the Cognitive Load Measurement – Naïve Rating Questionnaire to measure cognitive load, and the SET-M to evaluate perceived simulation effectiveness. The findings of this study provide insight

into the relationship between anxiety and cognitive load and the effectiveness of a pre-licensure BSN student's simulation experience. Educators can use the results of this study to assist in the development of future simulation-based learning experiences. I present further discussion of the literature review, theoretical framework, and key concepts in Chapter 2.

Chapter 2: Literature Review

Introduction

Simulation is a widely used engaged learning modality in nursing education that helps learners develop clinical judgement (Smiley, 2019). High-fidelity simulation experiences are designed to be highly realistic, allowing learners to manage patient care and respond to changes in the patient's condition in a safe, controlled environment (Carey & Rossler, 2023). In recent years, simulation use in nursing curricula has increased dramatically, and pre-licensure programs can substitute up to fifty percent of traditional clinical hours with simulation experiences (National Council of State Boards of Nursing, 2016; Smiley, 2019). High-fidelity simulation use will likely continue to grow as technology advances and educators become more comfortable with the simulation environment (Smiley, 2019).

High-fidelity simulations often require advanced equipment, realistic environments, and scenarios that mimic real-life to provide learners with a realistic patient care experience (Carey & Rossler, 2023). Although high-fidelity simulation is considered an effective learning tool, participating in simulation scenarios can be stressful for learners and may cause anxiety or fear throughout the experience (Kapucu, 2017). While some stress is expected during simulation experiences, significant levels of negative emotions can reduce learners' ability to think critically and may negatively impact learning (Alconero-Camarero et al., 2018; Mills et al., 2016). High levels of stress or negative emotions may increase cognitive load, making critical thinking and problem-solving more challenging (Josphehsen, 2015; Lewis, 2019).

Cognitive load is the mental effort required to process information while completing tasks (Sweller, 1988). Significant stress, large numbers of tasks, and complex problems are examples of conditions that can increase an individual's cognitive load (Sweller, 1988; Josephsen, 2015). High-fidelity simulation can include factors that increase learners' cognitive load; however, excessive levels of cognitive load can negatively impact the learning experience (Josephsen, 2015; Jung & Roh, 2022; Lewis, 2019).

In nursing education, evaluating simulation effectiveness focuses on assessing various aspects of the learning experience. Educators often observe learners' behaviors during simulation exercises and gather data on their performance, including their ability to apply clinical knowledge and skills in simulated scenarios (Johnston et al., 2019). Additionally, educators may collect feedback from learners through post-simulation debriefing sessions or surveys to gauge their perceptions of the experience (Johnston et al., 2019; Leighton et al., 2015). Simulation can also be used to evaluate learners' ability to apply knowledge in a clinical setting without putting patients at risk. To fully understand simulation as a modality, a complete assessment of the learner's experience is needed. The learner's perception of the simulation experience must be evaluated to ensure it was meaningful and effective in facilitating learning (Leighton et al., 2015). Understanding simulation effectiveness is essential for improvement in simulation-based education and informing future instructional design decisions. Therefore, an investigation is needed to determine the relationships among anxiety, cognitive load, perceptions of

simulation as an effective modality for facilitating successful learning, and its ability to develop critical thinking and clinical judgment skills.

The purposes of this quantitative study are to determine if there is a (a) relationship between pre-simulation encounter anxiety and the post-simulation perceived effectiveness of high-fidelity simulation as a meaningful learning experience in pre-licensure BSN students; (b) a relationship between pre-simulation encounter anxiety and post-simulation encounter perceptions of cognitive load in pre-licensure BSN students; and (c) a relationship between pre-simulation encounter anxiety and post-simulation encounter perceptions of simulation effectiveness mediated by perceived cognitive load. In Chapter 2, I present a discussion of the literature search strategy, the theoretical foundation guiding this study, and a literature review of high-fidelity simulation, learner anxiety, cognitive load, and simulation effectiveness.

Literature Search Strategy

I conducted a literature search using the following databases: APA PsychInfo, CINAHL Plus with Full Text, MEDLINE with Full Text, ProQuest Nursing & Allied Health Database, PubMed, and ScienceDirect. The key terms used for the literature search were *simulation*, *high-fidelity simulation*, *simulation in nursing education*, *anxiety AND simulation*, *cognitive load AND simulation*, and *simulation effectiveness*. Articles selected for this study addressed high-fidelity simulation in nursing education, the relationship between anxiety and simulation, the relationship between simulation and cognitive load, and simulation effectiveness. The scope of the literature review included peer-reviewed journals with full-text access. Articles that were not in the English

language were excluded. Articles used were published between 2015 and 2024. No substantial number of articles on simulation effectiveness were located in the most recent 10 years; therefore, publication-year criteria were expanded to include literature from 2010 to 2024. The literature on cognitive load theory also includes the original book on the theory.

Theoretical Foundation

Sweller's cognitive load theory was selected as the theoretical foundation for this study because of its focus on the role of cognitive capacity in problem-solving. Cognitive load theory served as the link between learner anxiety and simulation effectiveness. The cognitive load theory was introduced by John Sweller in 1988 and is a prominent framework in educational psychology because it proposes a relationship between the cognitive processing ability of the human mind and learning (Josephsen, 2015; Krieglstein et al., 2022). According to Sweller (1988), cognitive load refers to the amount of mental effort required to process information while completing learning tasks or solving problems. The cognitive load theory states that learners have a limited capacity for processing information, and when this capacity is exceeded, learning efficiency decreases (Reedy, 2015; Sweller, 1988). After the original cognitive load theory was published, Sweller continued to research cognitive processing and later distinguished between three categories of cognitive load: intrinsic, extraneous, and germane (Krieglstein et al., 2022; Sweller, 2011).

Intrinsic cognitive load represents the complexity of the learning material itself (Sweller et al., 2011). It is determined by the complexity of the subject matter and the

learner's prior knowledge and expertise. For instance, learning complex medical procedures such as endotracheal intubation or cardiac defibrillation would impose a high intrinsic cognitive load due to the intricate nature of the content (Reedy, 2015). Intrinsic cognitive load is essential for learning as it reflects the inherent difficulty of the task, but excessive intrinsic load can overwhelm learners and impede learning (Reedy, 2015; Sweller et al., 2011).

Extraneous cognitive load refers to the mental effort required to process irrelevant or unnecessary information that is not directly related to the learning task (Krieglstein et al., 2022; Sweller et al., 2011). This type of cognitive load is considered detrimental to learning as it diverts cognitive resources away from the task at hand. Examples of extraneous cognitive load include poorly designed instructional materials, distracting visuals, or irrelevant information presented during a learning activity (Josephsen, 2015). Effective instructional design aims to minimize extraneous cognitive load to optimize learning outcomes.

Germane cognitive load is the mental effort devoted to the process of learning and constructing schemas or mental models that facilitate understanding and retention of the material (Josephsen, 2015; Krieglstein et al., 2022). Germane cognitive load represents the cognitive resources allocated to the meaningful processing and integration of new information into existing knowledge structures. Unlike intrinsic and extraneous cognitive load, germane cognitive load is considered beneficial for learning as it contributes to schema acquisition and long-term retention of knowledge (Reedy, 2015).

Cognitive load theory has served as a theoretical foundation of many prior simulation research studies due to the cognitive requirements of learners during simulation-based learning experiences. Simulation can be a highly complex experience; therefore, learners can encounter high levels of cognitive load, which can overwhelm working memory and negatively affect their ability to solve problems or critically think (Jung & Roh, 2022; Josephsen, 2015; Lewis, 2019). The cognitive load theory suggests that instructional design should aim to manage cognitive load effectively by minimizing extraneous cognitive load and optimizing germane cognitive load (Reedy; 2015). By understanding the relationships between intrinsic, extraneous, and germane cognitive load, educators can design learning experiences that effectively meet learning outcomes and promote meaningful understanding of complex concepts in nursing education.

Literature Review Related to Key Variables and/or Concepts

Concepts selected for the literature review include high-fidelity simulation, anxiety and simulation, cognitive load and simulation, and perceived simulation effectiveness. While research exists on these concepts, currently, the literature does not include research on how anxiety, coupled with cognitive load, affects nursing students' perceived effectiveness of high-fidelity simulation as a meaningful learning experience.

High-fidelity simulation

High-fidelity simulation has emerged as a valuable instructional tool in nursing education, offering students immersive learning experiences that closely resemble real-world clinical scenarios (Carey & Rossler, 2023). High-fidelity simulation involves the use of sophisticated technology, including computerized manikins, simulated patient

environments, and realistic medical equipment, to replicate clinical situations (Carey & Rossler, 2023). These experiences provide students with opportunities to apply theoretical knowledge and practice clinical skills, bridging the gap between classroom learning and clinical practice (Hayden et al., 2014; Kapucu, 2017).

By engaging in realistic simulation scenarios, learners can develop critical thinking, clinical decision-making, and problem-solving skills in a risk-free setting (Mills et al., 2016; Hayden et al., 2014). Additionally, high-fidelity simulation allows educators to standardize learning experiences and provide students with consistent opportunities to practice skills and procedures without putting patients at risk (Mills et al., 2016). High-fidelity simulation has been shown to be an effective modality for teaching and assessing knowledge and skills in nursing education, leading to improved student confidence and competence in clinical practice (Hayden et al., 2014; Carey & Rossler, 2023).

Anxiety and Simulation

Anxiety can be broadly defined as a psychological state characterized by feelings of apprehension, worry, or nervousness, often accompanied by physiological symptoms such as increased heart rate, increased respiratory rate, or muscle tension (American Psychological Association, 2018). Anxiety is a normal human response to perceived threats or stressful situations and can be divided into two categories: State anxiety and Trait anxiety. State anxiety describes a temporary emotional response to a situation that involves feelings of tension, nervousness, and apprehension that often produce physiological or behavioral changes in an individual, such as increased heart rate, sweating, and visible discomfort (Kent, 2006). The term trait anxiety refers to an

individual's propensity to experience a consistent level of anxiousness as a baseline. An individual who has high trait anxiety is more inclined to identify a situation as threatening and thus more likely to experience state anxiety as compared with a person who has lower trait anxiety (Kent, 2006).

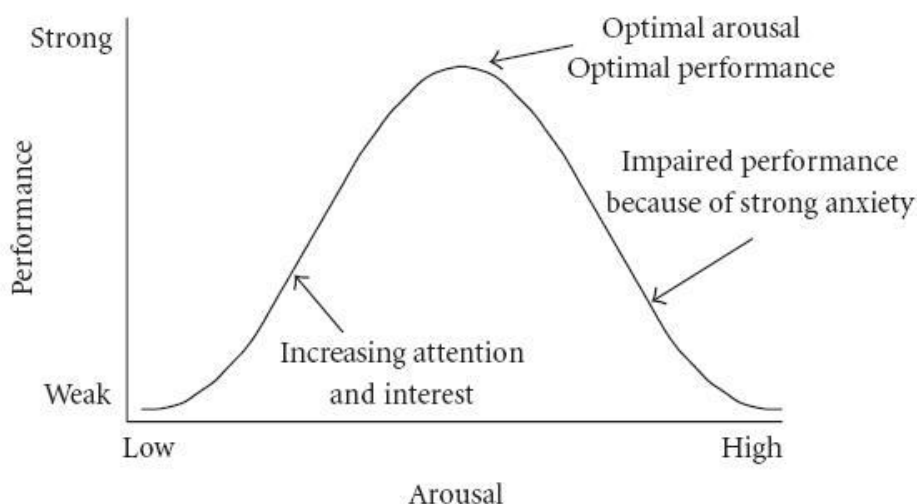
Anxiety during simulation experiences in nursing education is a multifaceted phenomenon that can influence learners' performance and overall educational outcomes (Fredericks et al., 2021; Mills et al., 2016; Kapucu, 2017). During high-fidelity simulation experiences, learners can encounter feelings of anxiety and stress that stem from various sources, including the pressure to perform well, fear of making errors, and the realistic nature of the simulation environment (Kapucu, 2017; Mills et al., 2016; Wheeler et al., 2021). Additionally, the presence of evaluators or peers observing the simulation can also increase anxiety levels, as students may feel scrutinized and judged during their performance (Mills et al., 2016; Nichols, 2018; Wheeler et al., 2021).

During high-fidelity simulation experiences, a moderate level of anxiety may serve as a motivating factor for learners to improve focus and engagement with the learning task (Mills et al., 2016). However, significant anxiety can impair cognitive functioning and lead to decreased performance (Alekhine-Fauquet et al., 2014; Nichols, 2018). The Yerkes-Dodson law states that peak performance occurs with intermediate levels of stress, but too little or too much stress results in poorer performance (Diamond et al., 2007; Ogunbiyi et al., 2021). This relationship can be displayed by the Yerkes-Dodson Curve, as shown in Figure 1 (Diamond et al., 2007; Ogunbiyi et al., 2021). The relationship between stress and performance highlights the importance of effectively

managing anxiety in nursing education settings (Kapucu, 2017; Wheeler et al., 2021). Excessive levels of anxiety can negatively impact learners' cognitive processes, such as critical thinking and decision-making, ultimately hindering their ability to effectively engage in the learning experience (Kapucu, 2017). As nursing simulation becomes a more popular pedagogical tool in nursing education, it is imperative that educators recognize the role of anxiety in simulation experiences.

Figure 1

Yerkes-Dodson Curve



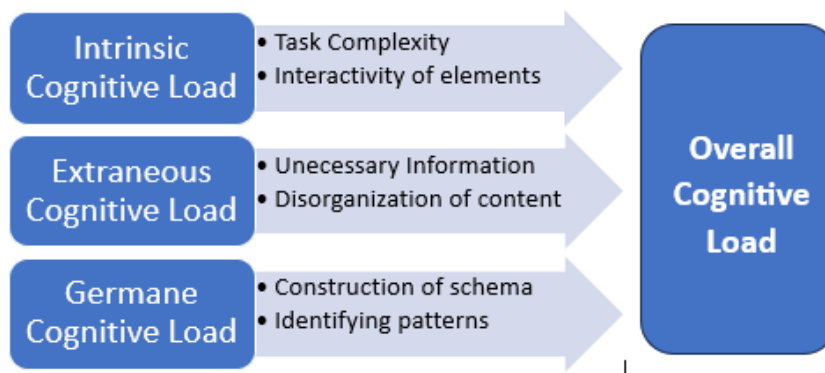
Note. Source: Original figure from “The Temporal Dynamics Model of Emotional Memory Processing: A Synthesis on the Neurobiological Basis of Stress-Induced Amnesia, Flashbulb and Traumatic Memories, and the Yerkes-Dodson Law”, by Diamond et al., 2007 in *Neural Plasticity*. File made publicly available via Wikimedia Commons - Public Domain

Cognitive Load and Simulation

Cognitive load refers to the mental effort required to process new information during learning activities (Sweller, 1988). Because learners have a fixed processing capacity, instructional design should aim to manage cognitive load effectively to optimize learning outcomes (Sweller, 1988). Factors such as the complexity of tasks, the number of simultaneous tasks, and the degree of novelty can all contribute to increased cognitive load (Josephsen, 2015). Understanding cognitive load is essential for educators as it informs the design of learning materials and activities to promote effective learning (Sweller, 1988).

Figure 2

Cognitive Load



Note. Figure created based on information from “Cognitive load theory and nursing simulation: An integrative review” by Josephsen, 2015, in *Clinical Simulation in Nursing*.

The purpose of using high-fidelity simulations is to closely replicate real clinical experiences which may impose a significant cognitive load on learners due to the complexity of the scenarios and the need to integrate multiple sources of information (Carey & Rossler, 2023; Lewis, 2019). According to Josephsen (2015), high cognitive load during simulation activities can impair students' ability to process information effectively, leading to decreased performance and learning outcomes. In a 2019 study, researchers examined the relationship between cognitive load, anxiety, and performance during a simulated subarachnoid block scenario and found that higher cognitive load was correlated with increased anxiety levels, which ultimately decreased performance outcomes (Lewis, 2019). Because simulation experiences have been found to increase cognitive load, it is imperative that educators consider the factors that impact cognitive load when designing and implementing simulation-based learning experiences. By aligning simulation activities with learners' cognitive abilities and providing appropriate levels of challenge, educators can create meaningful learning experiences that promote deep understanding and skill acquisition in nursing students (Lewis, 2019).

Perceived Simulation Effectiveness

Learner perceptions of simulation effectiveness play a crucial role in shaping participants' experiences and outcomes. Perceived simulation effectiveness is influenced by various factors, including the realism of simulation, the relevance of the scenarios to clinical practice, and the supportiveness of the learning environment (Leighton et al., 2015). Learners' perceptions of simulation effectiveness are often positive when they perceive simulations as meaningful, engaging, and aligned with their learning needs

(Smiley, 2019). Additionally, learners value simulations that provide opportunities for reflection, collaboration, and feedback, as these elements enhance their learning experience and promote skill acquisition (Johnston et al., 2018).

Educators may gather insight on the perceived effectiveness of a simulation experience from learners through post-simulation debriefing sessions or surveys (Leighton et al., 2015; Taçgın, 2020). Evaluations may be done with formal data collection or through informal discussion, but a focus is typically placed on understanding the learners' experiences to ensure that the simulation was effective in facilitating learning (Leighton et al., 2015). A data collection instrument named the Simulation Effectiveness Tool (SET) was developed in 2012 to survey learners about simulation prebriefing, the scenario itself, and the post-simulation debriefing (Elfrink et al., 2012). The tool was updated three years later to capture data from virtual simulation experiences in addition to live simulations (Leighton et al., 2015). This instrument allows learners' perceptions of simulation effectiveness to be obtained more easily and objectively through a Likert scale and provides educators with valuable feedback to guide further simulation design (Elfrink et al., 2012).

High-fidelity simulation is a powerful tool in nursing education, offering realistic clinical scenarios that enhance student learning by allowing them to apply theoretical knowledge and develop clinical skills (Carey & Rossler, 2023). However, anxiety is a significant factor that can influence learners' performance and outcomes in these simulations, with both state and trait anxiety playing a role (Kapucu, 2017). Research indicates that while moderate anxiety can motivate learners, excessive anxiety can impair

cognitive functioning and negatively impact learning (Mills et al., 2016). Understanding the relationships between anxiety, cognitive load, and perceived simulation effectiveness is crucial to optimizing learning (Lewis, 2019). These previous studies laid the foundation for my research questions, suggesting that pre-simulation anxiety may influence both perceived simulation effectiveness and cognitive load, potentially mediated by learners' perceptions of cognitive load during the simulation experience.

Summary and Conclusions

Researchers have examined anxiety, cognitive load, and perceived simulation effectiveness as independent factors associated with learners' high-fidelity simulation experiences. The literature identifies that simulation is a widely used teaching modality in nursing education because it allows learners build critical thinking skills and develop clinical judgement (Smiley, 2019). However, participating in high-fidelity simulation scenarios can be stressful for learners and may cause anxiety or fear throughout the experience (Kapucu, 2017; Wheeler et al., 2021). While mild stress levels can improve performance, significant levels of negative emotions can reduce learners' ability to think critically and may negatively impact learning and overall performance (Alconero-Camarero et al., 2018; Mills et al., 2016; Diamond et al., 2007).

During simulation experiences, high levels of stress or negative emotions may cause an increase in levels of cognitive load, which can make problem-solving more difficult (Josephsen, 2015; Lewis, 2019). Excessive cognitive load has been found to negatively impact learning experiences and performance outcomes (Jung & Roh, 2022; Josephsen, 2015; Lewis, 2019). To ensure that simulation experiences are effective and

meaningful to learners, evaluation of student perceptions of the simulation experience is necessary (Leighton et al., 2015).

While there are a significant number of studies on the role of anxiety in simulation experiences and the relationship between cognitive load and performance (Josphehsen, 2015; Lewis, 2019), there is a lack of evidence on the relationship between anxiety, cognitive load, and how these variables impact nursing students' perceived effectiveness of high-fidelity simulation experiences. Further discussion of the gap in the literature and the need to investigate the relationships between anxiety, cognitive load, and simulation effectiveness can be found in chapter 3.

Chapter 3: Research Method

Introduction

The purposes of this quantitative study are to determine if there was a (a) relationship between pre-simulation encounter anxiety and the post-simulation perceived effectiveness of high-fidelity simulation as a meaningful learning experience in pre-licensure BSN students; (b) a relationship between pre-simulation encounter anxiety and post-simulation encounter perceptions of cognitive load in pre-licensure BSN students; and (c) a relationship between pre-simulation encounter anxiety and post-simulation encounter perceptions of simulation effectiveness mediated by perceived cognitive load. In Chapter 3, I present a discussion of the research design and rationale, the population, sampling and sampling procedures, recruitment, and data collection procedures. I also present explanations of the instruments, data analysis methods, threats to validity, and ethical procedures.

Research Design and Rationale

I conducted a correlational study to examine the relationships between anxiety, cognitive load, and pre-licensure BSN students' perceived effectiveness of high-fidelity simulation. The independent variable in this study was learner pre-simulation anxiety. The dependent variables are learner cognitive load and learner perceived simulation effectiveness. Cognitive load was also investigated as a mediator between pre-simulation anxiety and perceived simulation effectiveness because it may provide a better understanding of how pre-simulation anxiety may influence learner perceptions of simulation effectiveness.

Correlational studies are commonly used to examine relationships between variables that the researcher has not manipulated. This design allows a researcher to not only determine if a relationship exists between variables, but it can also determine if the relationship between variables is positive or negative (Gray & Grove, 2020). In this study, none of the variables were manipulated, and the relationship between them was observed without intervention and without time or resource constraints. Therefore, a correlational research design was selected as the appropriate method for this study. The use of a correlational research design allows for the exploration of the relationships between anxiety, cognitive load, and simulation effectiveness. This research design is consistent with other studies in the discipline that have explored relationships among variables in the simulation environment (Jung & Roh, 2022). Identifying factors that may affect simulation-based learning will allow educators to design experiences that are more beneficial to the learners (Bae & Shin, 2024) and will ultimately advance knowledge of simulation as a teaching method in nursing education.

Methodology

Target Population

The target population for this study was nursing students enrolled in a pre-licensure Bachelor of Science in Nursing program at a school of nursing in the southeastern United States. Students were at the sophomore, junior, or senior level who were enrolled in a clinical course in which high-fidelity simulation experiences were an existing part of the curriculum. The target population of students enrolled in these courses was 150 to 175 students.

Sampling and Sampling Procedures

The sampling strategy I used was non-probability convenience sampling. I selected this strategy due to the ability to obtain participants more easily. Although it is less generalizable than other sampling methods, it should yield a representative sample of the target population. I recruited individuals from a pre-licensure BSN program in the southeastern United States (U.S). The demographic profile of this institution consisted of a predominantly Caucasian female student body, which is similar to the demographic profile of the U.S. nursing workforce (National Center for Education Statistics, 2024; Smiley et al., 2023). The inclusion criteria for participants include enrollment in the third through eighth semesters of an eight-semester nursing program and participation in high-fidelity simulation experiences as an existing course requirement. Students who were repeating the course in which the simulation experience was occurring were excluded from the sample.

I conducted two a priori sample size calculations to determine the sample size needed for this study using G*Power Version 3.1.9.7, (Faul et al., 2007). For research questions 1 and 2, I entered the following parameters into the G*Power program: exact test family using a bivariate normal model correlation test. The type of power test selected was a priori to determine the required sample size. The level of statistical significance was set to 0.05 ($\alpha = 0.05$) to minimize the risk of type 1 error. The power level was set to 0.8 ($1 - \beta = 0.8$) because the closer the power level is to 1.0, the lower the risk of type 2 error. A medium effect size of 0.3 ($r = 0.3$) was chosen to evaluate the

strength of the relationship between variables. The determined sample size with these parameters was 67 (Appendix A).

For research question 3, I used multiple regression as the statistical analysis approach to evaluate cognitive load as a mediating variable between pre-encounter anxiety and perceived simulation effectiveness. Using the G*Power program, the following parameters were used to determine sample size: F test family, linear multiple regression, fixed model test. The type of power test selected was a priori and the level of statistical significance was set to 0.05 ($\alpha = 0.05$) to minimize the risk of type 1 error. The power level was set to 0.8 ($1 - \beta = 0.8$) to minimize the risk of type 2 error. A medium effect size of 0.15 ($r = 0.15$). The determined sample size with these parameters was 68 (Appendix B).

Based on the sample size calculation and to account for attrition and possible data loss due to unanswered questions, a target of 82 or more participants was recruited (20% more than 68). There are approximately 150-175 students in the program who would meet the criteria for this study at any given time; therefore, it was feasible to obtain the sample size needed from the potential pool of participants. I chose a medium effect size to ensure that any relationships identified are meaningful without requiring a large sample size. Use of a medium effect size was consistent with existing research in the field (Cazzell & Anderson, 2016; Shin & Kim, 2015).

Recruitment, Participation, and Data Collection

I recruited participants from a pre-licensure BSN program. I provided information to the students prior to the simulation experience by sharing a short presentation

following a regularly scheduled class session. The presentation took 3-5 minutes and included the study's purpose, background, risks, and benefits (Appendix C). I screened interested individuals for suitability using the inclusion criteria as a guide (Appendix D). They were also asked if this was their first attempt on the course. Students who were repeating the course were excluded from the study because they may have completed the same or a very similar simulation activity during a previous course attempt. Prior exposure to similar scenarios has been found to change learners' approach to problem-solving in simulation experiences and thus to alter students' cognitive load and overall perception of the simulation (Heitzmann et al., 2023). Any student who did not answer "yes" to all screening questions (Appendix D) was not enrolled in the study.

Informed Consent Procedure

After receiving information about the study, participants were provided with a written informed consent form (Appendix E) for signature and were told that they could elect to remove themselves from the study at any point. The informed consent form included a brief background on the study, data collection procedure, the time commitment for the participant, the risks and benefits of participation, a confidentiality statement, a voluntary participation statement, and contact information.

Data Collection

I collected data using three different instruments: the short version of the Spielberger State-Trait Anxiety Inventory (STAI), the Cognitive Load Measurement – Naïve Rating Questionnaire, and the Simulation Effectiveness Tool – Modified (SET-M). Students were also asked to complete a questionnaire to provide demographic questions

such as their age, gender, the year, and course they were taking in the program. Each of the data collection instruments was transcribed into an electronic survey on the Microsoft Forms platform, and participants were provided with a QR code that linked to the response collection form.

Prior to the simulation experience, participants were asked to complete the short version of the Spielberger State-Trait Anxiety Inventory (STAI) and the demographic questionnaire (each takes 3-5 minutes). This was completed prior to simulation prebriefing or any interaction with the simulation environment. Following simulation debriefing, participants were asked to complete the Cognitive Load Measurement – Naïve Rating Questionnaire to measure cognitive load, and the SET-M to evaluate perceived simulation effectiveness (each takes 3-5 minutes). After participants had completed the questionnaires, they were thanked for their time.

Instrumentation and Operationalization of Constructs

I used three tools plus a demographic questionnaire to collect data for this study. The first instrument that was used in this study is the shortened version of the Spielberger State-Trait Anxiety Inventory (STAI; Appendix F). This original STAI was a 40-question instrument that was developed by Spielberger et al. in 1983 and has been used extensively as a tool to study anxiety. The length of the original instrument made it a less desirable option for data collection than more abbreviated tools; therefore, researchers shortened the instrument and divided it into two sections: the first is the STAIS-5, measuring state anxiety, and the second is the STAIT-5, measuring trait anxiety (Zsido et al., 2020).

Both sections are five questions each, asking the participants to rate their feelings using a Likert scale ranging from 1 (not at all) through 4 (very much so). Although the STAIS-5 and STAIT-5 have not yet been widely used in nursing education, their strong psychometric properties and successful applications in healthcare-related populations, such as medical patients and students in high-stress environments, support their appropriateness for use with nursing students (Shawahna et al., 2023; Silang et al., 2023). This instrument was found to be reliable with a mean Cronbach's alpha of 0.86 for the STAIT-5, and 0.91 for the STAIS-5 (Zsido et al., 2020). Validity for the shortened version of the Spielberger State-Trait Anxiety Inventory (STAIS-5 and STAIT-5) was established through psychometric testing conducted by Zsido et al. (2020), who demonstrated that the abbreviated forms retained strong construct validity and reliability when compared to the original 40-item STAI. The shortened scales have since been used in multiple studies to effectively measure both state and trait anxiety with minimal loss of precision, supporting their appropriateness for use in time-limited data collection settings. Permission was obtained by the author to use the instrument for this study, and documentation of the author's approval is included as Appendix G.

The second tool used was the Cognitive Load Measurement – Naïve Rating Questionnaire (Appendix H), which was used to measure learners' perceived cognitive load. The instrument has a total of eight statements that evaluate intrinsic (ICL), extraneous (ECL), and germane cognitive load (GCL). The participants read the statements and rated each using a 7-point Likert scale ranging from “absolutely wrong” to “absolutely right.” The Cognitive Load Measurement - Naïve Rating Questionnaire has

been used to collect data on cognitive functioning and instructional design in various learning environments (Quintero-Manes et al., 2022; Klepsch & Seufert, 2020)

Reliability generalization showed that the mean Cronbach's alpha was 0.81 for the ICL scale, alpha = 0.86 for the ECL scale, and alpha = 0.67 for the GCL scale with three items (Klepsch et al., 2017). Validity was established by comparing the ratings of the learners with the theoretically predicted outcomes; all tasks were designed to be related to high or low ICL, ECL, and GCL, and it was determined that the scales were able to differentiate as expected (Klepsch et al., 2017). The Cognitive Load Measurement – Naïve Rating Questionnaire has been used to collect data on cognitive functioning and instructional design in various learning environments, including among university students, teacher education candidates, and learners in health-related and technical training settings (Klepsch & Seufert, 2020; Quintero-Manes et al., 2022). Its adaptability across disciplines makes it appropriate for use with nursing students engaged in complex, simulation-based learning tasks.

The third tool that I used was the Simulation Effectiveness Tool – Modified (SET-M; Appendix I), which is a modified version of the original Simulation Effectiveness Tool. The original Simulation Effectiveness Tool was published in 2012 and was modified in 2015 for use with virtual debriefing (Elfrink et al., 2012; Leighton et al., 2015). The SET-M measures the perceived effectiveness of a simulation experience using 19 statements that are rated on a 3-point Likert scale from “strongly agree” to “do not agree” (Leighton et al. 2015). The items are categorized into three groups: prebriefing, scenario, and debriefing. The SET-M is most commonly used by nurse

educators to collect data on the effectiveness of both in-person and virtual healthcare simulation experiences (Sharoff, 2022; Shin et al., 2020). The reliability for the SET-M was good ($\alpha = .936$), and the SET-M demonstrates sound validity with factor analysis confirming a structure consistent with the original instrument. Content validity was supported through expert review during the tool's development to ensure that the items accurately reflected core components of simulation-based learning. The author granted permission to use the SET-M in this, and documentation of the author's approval can be found in Appendix J.

I also collected demographic data (Appendix K). The data included participants' characteristics, such as age, gender, ethnicity, the number of nursing school semesters completed, and current course enrollment. Participants were provided a QR code that enabled them to complete the questionnaire electronically.

Data Analysis

I downloaded my data from the Microsoft Forms platform as an Excel file compatible with SPSS version 29.0 (IBM Corp., 2023), which I used for data analysis. The Excel file was then uploaded into SPSS as a data set. Prior to analysis, I reviewed the data and screened it for missing values and inconsistencies by comparing the SPSS data set with the original data collected from the participants. Next, a primary analysis was performed to check that assumptions for each planned test were not violated. The research questions answered in this study are as follows:

RQ1: What is the relationship between pre-simulation encounter anxiety and the post-simulation perceived effectiveness of high-fidelity simulation as a meaningful learning experience in pre-licensure BSN students?

H₀1: There is no relationship between pre-simulation encounter anxiety and post-simulation perceived simulation effectiveness as a meaningful learning experience in pre-licensure BSN students.

H_A1: There is a relationship between pre-simulation encounter anxiety and post-simulation perceived simulation effectiveness as a meaningful learning experience in pre-licensure BSN students.

RQ2: What is the relationship between pre-simulation encounter anxiety and post-simulation encounter perceptions of cognitive load in pre-licensure BSN students?

H₀2: There is no relationship between pre-simulation encounter anxiety and post-simulation encounter perceptions of cognitive load in pre-licensure BSN students.

H_A2: There is a relationship between pre-simulation encounter anxiety and post-simulation encounter perceptions of cognitive load in pre-licensure BSN students.

RQ3: What is the relationship between pre-simulation encounter anxiety and post-simulation encounter perceptions of simulation effectiveness mediated by perceived cognitive load?

H₀3: There is no relationship between pre-simulation encounter anxiety and post-simulation encounter perceptions of simulation effectiveness mediated by perceived cognitive load.

H_{A3}: There is a relationship between pre-simulation encounter anxiety and post-simulation encounter perceptions of simulation effectiveness mediated by perceived cognitive load.

I used Pearson correlation to analyze Research questions 1 and 2 to determine if a relationship exists between learner anxiety, cognitive load, and perceived simulation effectiveness. Results were interpreted by evaluating the Pearson correlation coefficient. This value falls between -1 and +1, with a negative number indicating a negative linear correlation and a positive number indicating a positive correlation. A value of 0 indicates no correlation. The strength of the correlation between variables can be determined by evaluating the distance from 0. Data assumptions for Pearson Correlation include continuous variables, paired variables, and independence of observations. Additionally, variables should have a linear relationship, follow a normal distribution, and homoscedasticity is assumed (Laerd Statistics, 2020). A visual inspection of the data was performed, and a histogram and scatterplot was created to examine distribution patterns and linearity (Van den Berg, n.d.).

I analyzed research question 3 using multiple linear regression to determine if cognitive load was a mediating variable between learner anxiety and perceived simulation effectiveness. I interpreted the results by using the adjusted R-squared value. The adjusted R-squared value falls between 0 and 1, with a larger value indicating that changes in the dependent variable can be explained by the mediating variable. Data assumptions for multiple linear regression include two or more independent variables, the dependent variable measured on a continuous scale, independent observations of

variables, normal distribution within the population, homogeneity of variance and linearity between variables, and no significant outliers (Laerd Statistics, 2020) these assumptions were examined by visual inspection of the data, creation of a histogram to examine distribution patterns, and creation of a scatterplot to assess homoscedasticity and linearity (Van den Berg, n.d.).

Threats to Validity

External Validity

One potential threat to external validity in this study was sampling bias. I recruited participants using convenience sampling from a pre-licensure BSN program at a single school. Because the participants have similar educational backgrounds and clinical experiences, as well as some similarities in demographic data, the findings are less generalizable to nursing students from different regions or institutions (Gray & Grove, 2020; Allmark, 2004). To decrease this threat, participants were recruited from several different courses within the program.

Social desirability bias may also affect external validity, as this study relies on self-report surveys. Instruments that include survey questions containing terms such as anxious, nervous, or other terms that a learner may identify as socially undesirable were used for data collection, therefore it was possible that participants altered their responses to be more socially desirable (Creswell & Cresswell, 2018). Additionally, experimenter effects, such as unintentional verbal or nonverbal cues during recruitment or data collection, may influence participants' responses. To minimize these threats, I followed a

written script during recruitment presentations and when providing the participants with instructions for completing the survey.

Internal Validity

Several threats to internal validity were pertinent to this study. History can impact results if external events during the study period affected participants' anxiety levels or perceptions (Creswell & Creswell, 2018). Factors that could affect a participant's emotional state or cognitive functioning, such as recent sleep patterns, upcoming academic requirements, or extracurricular activities, could impact reported anxiety and perceptions of cognitive load and simulation effectiveness.

Experimental mortality also affects the internal validity of this study. Participants had the right to withdraw from the study at any time for any reason, but losing participants can affect a study's validity (Creswell & Creswell, 2018). To minimize this threat, data collection occurred immediately before a simulation experience began and immediately following the simulation debriefing.

Construct Validity

The primary threat to construct validity in this study was mono-operation bias; relying on a single method to measure constructs like anxiety, cognitive load, and perceived simulation effectiveness might not fully capture these complex variables. To minimize this threat, the instruments used for data collection were selected based on the composition of the survey questions, and a careful assessment of the reliability and validity of each tool (Lambert & Newman, 2023).

Ethical Procedures

Before data collection, I obtained approval from the Institutional Review Board (IRB) from both Walden University and the institution where the study was performed. I included a description of the purpose of the study, risks and benefits, informed consent process, how privacy and confidentiality of participants were maintained, recruitment procedures, and the ability for participants to withdraw from the study for any reason at any time in the IRB application. I was granted IRB approval (IRB No. 202506018) and was permitted to proceed with my study. The IRB approval letter can be found in Appendix J.

I recruited participants by providing a short presentation to pre-licensure students who are scheduled to complete simulation experiences for their courses. The presentation included the study's purpose, a brief description of how data would be collected, the time commitment for participation, and the risks and benefits associated with participation. I shared that participation in the study was voluntary and that they may withdraw from the study at any time for any reason, and I also included a description of how I would maintain participant confidentiality. My contact information was shared for any questions or concerns about the study (Appendix C). Finally, I provided a written informed consent form for signature (Appendix E).

An ethical concern in this study was that participants were students at the institution where I am employed. While none of the participants were students with whom I had a direct teaching relationship, many of them were familiar with me as an employee of the institution. My role at the institution includes administration of the

simulation center, therefore students often interact with me during simulation experiences and psychomotor skills practice time. I addressed this concern by sharing study information with potential participants during the recruitment presentation. This presentation included statements that participation in the study was voluntary, that participants could withdraw from the study at any point for any reason, and that participant privacy and confidentiality would be maintained.

Another ethical concern was maintaining the confidentiality of participant responses. Participants were given a code at the beginning of data collection to avoid using the participant's name or any other identifiable information. Data collected was identified by the participant's code, and results were reported anonymously to maintain confidentiality. All data was stored in a password-protected, encrypted file that is regularly backed up. Access to the study data was only directly available to me, however the data was accessible to the dissertation committee if review of the data was necessary for completion of the dissertation process. Data collected in this study will be maintained on a secure server for five years and will then be destroyed.

Summary

In Chapter 3, I addressed the research design, population, sampling and recruitment procedures, data collection, data analysis, and potential threats to validity. In summary, the study utilized a correlational design to explore the relationships between pre-encounter anxiety, perceived cognitive load, and the perceived effectiveness of high-fidelity simulation. The target population for this study was pre-licensure BSN students who were enrolled in a clinical course requiring simulation experiences. Nonprobability

convenience sampling was chosen as the method for this study, and a statistical power analysis was performed to calculate the necessary sample size.

I used three instruments: the Shortened version of the Spielberger State-Trait Anxiety Inventory (STAIS-5 and STAIT-5), the Cognitive Load Measurement – Naïve Rating Questionnaire, and the Simulation Effectiveness Tool – Modified (SET-M). Data was analyzed using SPSS software, with Pearson correlation for the first two research questions and multiple regression for the third. Potential threats to study validity and ethical considerations were identified and addressed in this chapter as well. I present the results of the study in Chapter 4.

Chapter 4: Results

Introduction

The purpose of this correlational study was to examine the relationships between pre-simulation anxiety, cognitive load, and perceived simulation effectiveness in pre-licensure Bachelor of Science in Nursing (BSN) students. Learner anxiety was measured using the shortened Spielberger State-Trait Anxiety Inventory (STAI-5 and STAI-5), cognitive load was assessed using the Cognitive Load Measurement - Naïve Rating Questionnaire, and perceived simulation effectiveness was evaluated using the Simulation Effectiveness Tool–Modified (SET-M). These variables were examined to better understand factors that may influence the effectiveness of high-fidelity simulation as a meaningful learning experience. Three research questions and corresponding hypotheses guided this study.

RQ1: What is the relationship between pre-simulation encounter anxiety and the post-simulation perceived effectiveness of high-fidelity simulation as a meaningful learning experience in pre-licensure BSN students?

H₀1: There is no relationship between pre-simulation encounter anxiety and post-simulation perceived simulation effectiveness as a meaningful learning experience in pre-licensure BSN students.

H_A1: There is a relationship between pre-simulation encounter anxiety and post-simulation perceived simulation effectiveness as a meaningful learning experience in pre-licensure BSN students.

RQ2: What is the relationship between pre-simulation encounter anxiety and post-simulation encounter perceptions of cognitive load in pre-licensure BSN students?

H₀2: There is no relationship between pre-simulation encounter anxiety and post-simulation encounter perceptions of cognitive load in pre-licensure BSN students.

H_A2: There is a relationship between pre-simulation encounter anxiety and post-simulation encounter perceptions of cognitive load in pre-licensure BSN students.

RQ3: What is the relationship between pre-simulation encounter anxiety and post-simulation encounter perceptions of simulation effectiveness mediated by perceived cognitive load?

H₀3: There is no relationship between pre-simulation encounter anxiety and post-simulation encounter perceptions of simulation effectiveness mediated by perceived cognitive load.

H_A3: There is a relationship between pre-simulation encounter anxiety and post-simulation encounter perceptions of simulation effectiveness mediated by perceived cognitive load.

Pearson correlation analyses were used to address research questions 1 and 2, and multiple linear regression analysis was conducted to examine the mediating role of cognitive load for research question 3. This chapter presents the results of the data analysis for each research question and includes a description of the data collection procedures, participant characteristics, data screening, assumptions, and descriptive statistics for the study variables. Tables were used to summarize key statistical findings where appropriate.

Data Collection

Timeframe, Recruitment, & Response Rate

Data collection for this study occurred over a 10-week period from September 23, 2025, through December 5, 2025. Recruitment also took place during this time frame. Students were informed of the study prior to their simulation experiences and were invited to participate voluntarily. Those who elected to participate completed the pre-simulation survey instruments prior to simulation prebriefing and completed the post-simulation surveys following the simulation debriefing, consistent with the procedures outlined in Chapter 3.

A total of 107 participants participated in the study, 107 completed the pre-simulation survey instrument, and 104 participants completed the post-simulation surveys. Participants were required to enter a unique code on both the pre- and post-surveys to enable data matching. A total of 90 matched pairs of data were available for analysis. This exceeded the minimum sample size of 82 participants established through the a priori power analysis. All participants met the inclusion criteria. There were no discrepancies between the data collection procedures implemented and the plan described in Chapter 3. All survey instruments were administered using the Microsoft Forms platform, and data were collected at the designated pre- and post-simulation time points. No deviations, interruptions, or unforeseen challenges occurred during the data collection process.

Baseline Descriptive Statistics & Demographic Characteristics

Baseline descriptive and demographic characteristics were examined to describe the sample and provide context for interpretation of the study findings. Participants ranged in age from 18 to 26 years, and were predominantly female (93.3%); male participants comprised 6.7% of the total sample. The majority of participants identified as Caucasian (77.8%), followed by Hispanic/Latino (10.0%), Asian/Pacific Islander (6.7%), Black/African American (3.3%), and Other (2.2%). These demographic characteristics reflect the population enrolled in the program where data were collected, and the gender identity and ethnicities of the sample align with the demographic profile of the U.S. nursing workforce (National Center for Education Statistics, 2024; Smiley et al., 2023).

Participants represented a range of progression points within the nursing program. More than half of the sample (54.4%) were enrolled in semesters seven or eight of the eight-semester curriculum, while 30.0% were enrolled in semesters three or four, and 15.6% were enrolled in semesters five or six. This distribution indicates that the majority of participants had substantial exposure to clinical coursework and simulation experiences prior to participation in the study. Inclusion of students across multiple semesters supports examination of variables across multiple levels of academic and clinical experience while remaining consistent with the study's inclusion criteria.

Because nonprobability convenience sampling was used, careful consideration was given to the representativeness of the sample and implications for external validity. The use of a single institution and convenience sampling limits generalizability, but the proportional similarity between the study sample and the broader population of pre-

licensure nursing students suggests that the findings may be transferable to nursing programs with comparable student demographics, curricular structures, and simulation practices.

Results

Descriptive Statistics

Descriptive statistics were calculated for the primary study variables. Mean scores for state anxiety ($M = 9.33$, $SD = 2.51$), trait anxiety ($M = 11.30$, $SD = 3.57$), and the total scale score on the shortened STAI ($M = 20.63$, $SD = 5.06$) indicated moderate levels of anxiety within the sample prior to participating in simulation experiences. The mean perceived simulation effectiveness score measured by the SET-M was 49.48 ($SD = 5.79$), suggesting generally positive perceptions of simulation effectiveness. Mean total cognitive load was 35.62 ($SD = 4.99$), which reflects the cognitive demands associated with participation in high-fidelity simulation experiences. These baseline descriptive findings provided an appropriate foundation for subsequent inferential analyses addressing the research questions.

Assumptions

The assumptions associated with Pearson correlation and multiple linear regression were evaluated to ensure the appropriateness of the planned analyses. Variables included in the analyses were continuous and measured on an interval scale, satisfying the measurement requirements for both Pearson correlation and multiple linear regression. Independence of observations was met, as each participant contributed a single set of responses, and no repeated measures were included in the dataset.

The assumptions of normality and linearity were examined visually using histograms, normal probability plots, and scatterplots for the primary study variables (Figures 3-8). Distributions for pre-simulation anxiety, cognitive load, and perceived simulation effectiveness demonstrated acceptable approximation to normality, and scatterplots indicated linear relationships among variables included in the correlational and regression analyses, supporting the assumption of linearity. Additionally, homoscedasticity was assessed through visual inspection of residual plots, which demonstrated relatively constant variance across predicted values, indicating that the assumption of homoscedasticity was met. Examination of standardized residuals revealed no extreme outliers or influential cases that would unduly affect the regression results.

Figure 3

Histogram of SET-M Data with STAI Score as Independent Variable

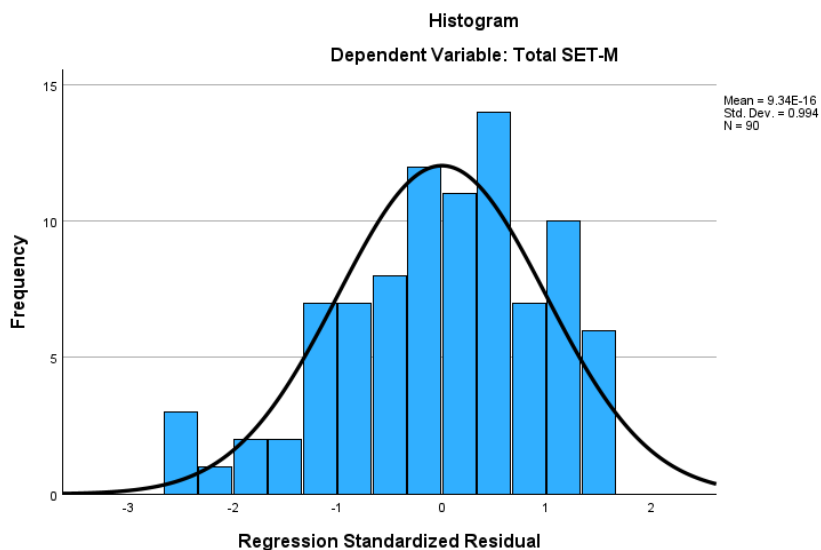
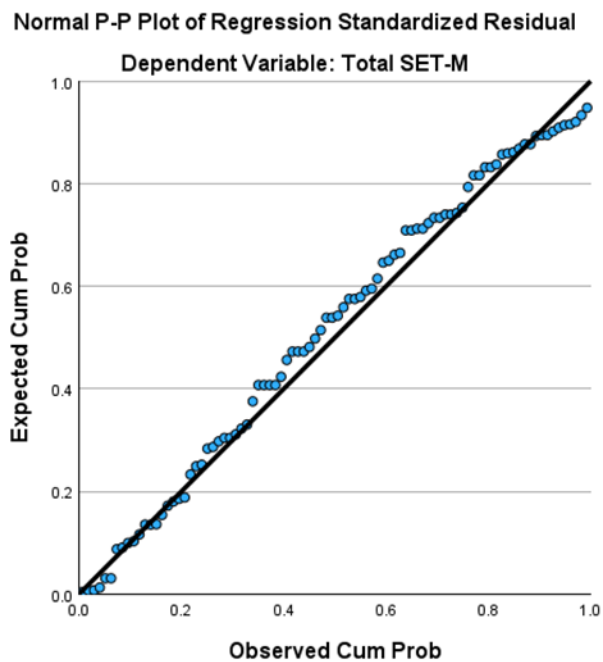


Figure 4

Normal Probability of SET-M with STAI Score as Independent Variable

**Figure 5**

Homoscedasticity Scatterplot of SET-M Data with STAI Score as Independent Variable

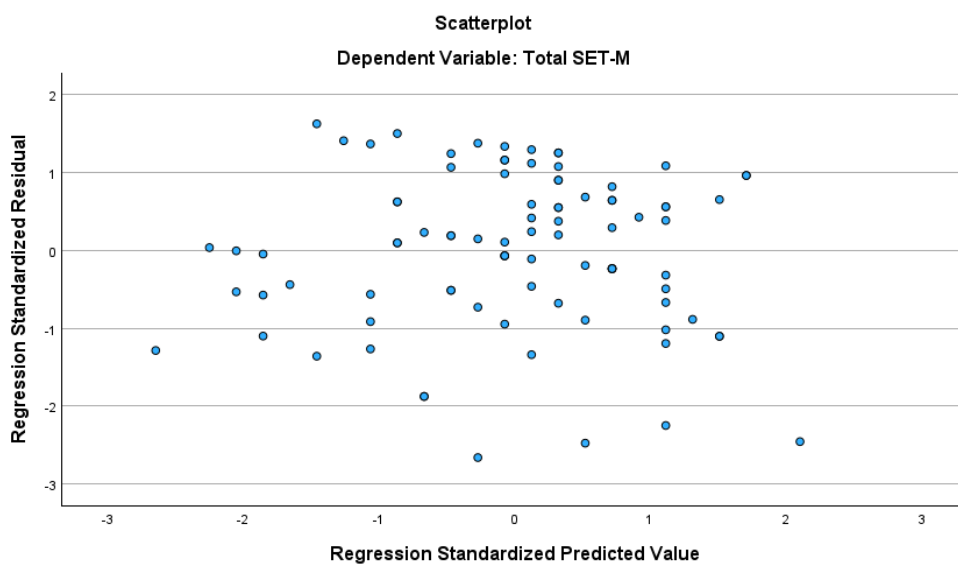


Figure 6

Histogram of SET-M Data with Cognitive Load as Independent Variable

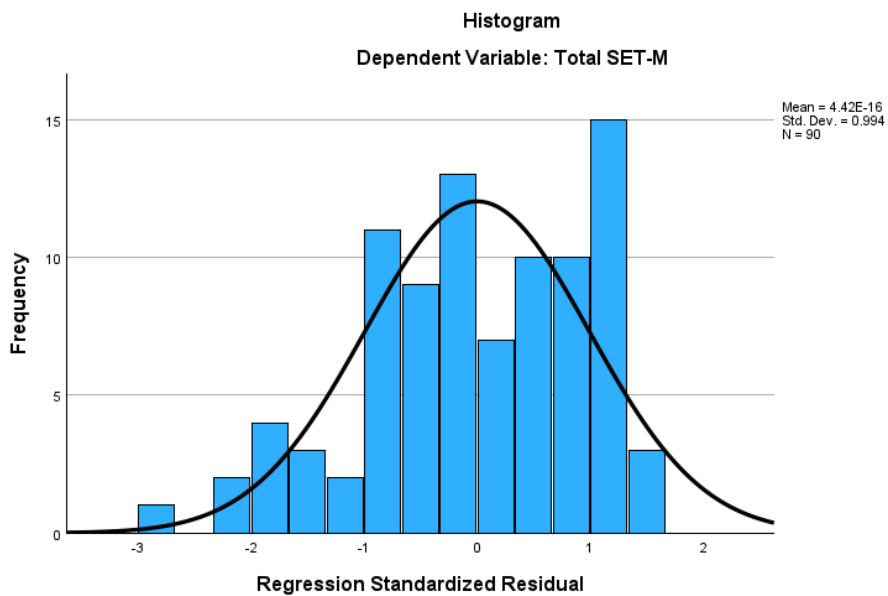


Figure 7

Normal Probability of SET-M Data with Cognitive Load as Independent Variable

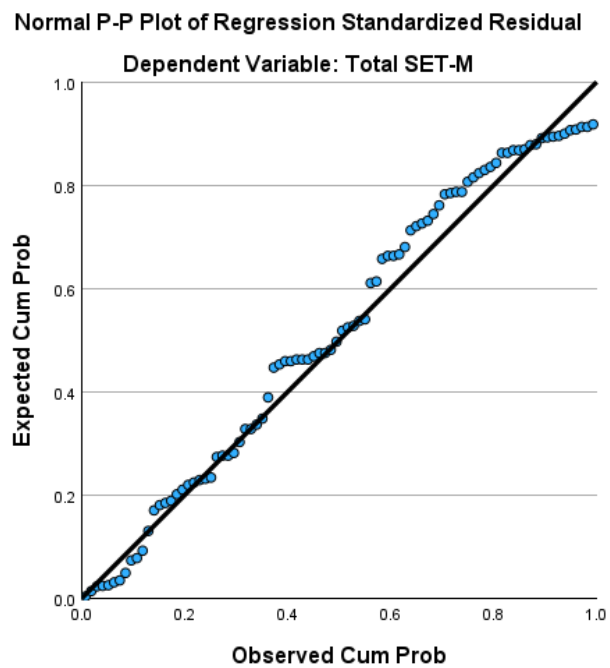
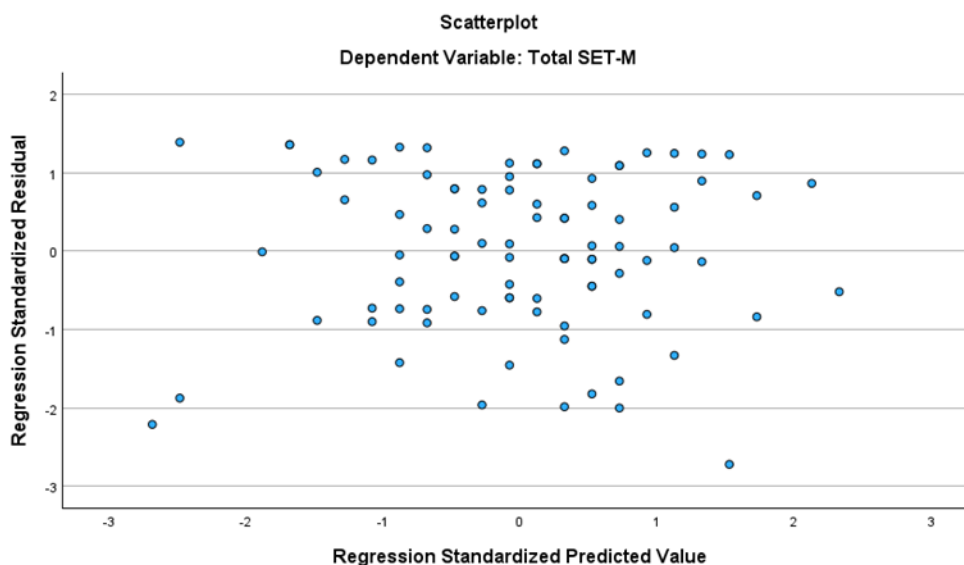


Figure 8

Homoscedasticity Scatterplot of SET-M Data with Cognitive Load as Independent Variable



Analysis

Research Question 1

Research Question 1, “What is the relationship between pre-simulation encounter anxiety and the post-simulation perceived effectiveness of high-fidelity simulation as a meaningful learning experience in pre-licensure BSN students?” was analyzed using Pearson correlation to examine the relationship between pre-simulation anxiety and perceived simulation effectiveness (Table 1). Pre-simulation anxiety was examined using the shortened version of the State Trait Anxiety Inventory (STAI). The STAI is made up of two sub-scales, state anxiety and trait anxiety. Together (total scale score), they capture overall anxiety. The subscales and the total scale scores were examined. A Pearson correlation revealed a non-significant relationship between state anxiety and

perceived simulation effectiveness, $r(88) = -.200, p = .059$. Similarly, the relationship between trait anxiety and perceived simulation effectiveness was not statistically significant, $r(88) = -.151, p = .154$. Examination of the total scale score for the measure also revealed a non-significant relationship with perceived simulation effectiveness, $r(88) = -.206, p = .051$).

Although the direction of the relationships suggested a weak negative association between anxiety and perceived simulation effectiveness, the effect sizes were small and did not reach statistical significance at the $\alpha = .05$ level. These findings indicate that pre-simulation anxiety was not significantly associated with perceived simulation effectiveness in this sample.

Table 1

Pearson Correlation RQ1

Variable	<i>n</i>	<i>M</i>	<i>SD</i>	1	2	3	4
1. Total Score State Anxiety	90	9.33	2.513	-			
2. Total Score Trait Anxiety	90	11.30	3.574	.360**	-		
3. Total Score STAI	90	20.63	5.056	.752**	.886**	-	
4. Total SET-M	90	49.48	5.789	-.200	-.151	-.206	-

Note. * $p < .05$. ** $p < .01$.

Research Question 2

Research Question 2, was “What is the relationship between pre-simulation encounter anxiety and post-simulation encounter perceptions of cognitive load in pre-licensure BSN students?” This question was also evaluated using Pearson correlation (Table 2). Results demonstrated that neither state anxiety ($r(88) = -.050, p = .641$) nor trait anxiety ($r(88) = .063, p = .558$) was significantly correlated with total cognitive load.

The total shortened STAI score similarly showed no significant relationship with total cognitive load ($r(88) = .019, p = .856$).

Further examination of cognitive load subscales revealed no statistically significant relationships between anxiety and intrinsic (ICL), extraneous (ECL), or germane cognitive load (GCL; Table 2). Effect sizes across all correlations were small, indicating minimal practical significance. Based on these findings, pre-simulation anxiety was not significantly associated with perceived cognitive load in this sample.

Table 2

Pearson Correlation R2

Variable	<i>n</i>	<i>M</i>	<i>SD</i>	1	2	3	4	5	6	7
1. Total Score State Anxiety	90	9.33	2.513	-						
2. Total Score Trait Anxiety	90	11.30	3.574	.360**	-					
3. Total Score STAI	90	20.63	5.056	.752**	.886**	-				
4. Total ICL	90	10.26	2.042	-.078	-.020	-.053	-			
5. Total GCL	90	17.98	2.389	-.085	.074	.010	.238*	-		
6. Total ECL	90	7.39	3.027	.037	.058	.059	.273**	.011	-	
7. Total Cognitive Load	90	35.62	4.989	-.050	.063	.019	.689**	.583**	.723**	-

Note. * $p < .05$. ** $p < .01$.

Research Question 3

For research Question 3, “What is the relationship between pre-simulation encounter anxiety and post-simulation encounter perceptions of simulation effectiveness mediated by perceived cognitive load?” analysis was completed using multiple linear regression to examine whether perceived cognitive load mediated the relationship between pre-simulation anxiety and perceived simulation effectiveness (Tables 3 & 4).

Results indicated that pre-simulation anxiety did not significantly predict perceived simulation effectiveness ($B = -.236, \beta = -.206, p = .051$).

In the second model, total cognitive load was added as a potential mediating variable (Tables 3 & 4). The model remained non-significant, ($B = -.041, \beta = -.036, p = .735$) indicating that cognitive load did not significantly predict perceived simulation effectiveness. The change in explained variance between models was minimal, indicating that the inclusion of cognitive load did not support a mediation effect. Effect sizes across both regression models were small, and confidence intervals were not calculated, as neither predictor demonstrated statistical significance. Based on these findings, the null hypothesis for Research Question 3 was not rejected.

Table 3

Model Summary for RQ3

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.206a	.043	.032	5.696
2	.209b	.044	.022	5.725

Note. a. Predictors: (Constant), Total Score on STAI – Shortened; b. Predictors: (Constant), Total Score on STAI - Shortened, Total Cognitive Load

Table 4*Regression Coefficients for RQ3*

	Variable	Unstandardized Coefficients		Standardized Coefficients	<i>t</i>	<i>p</i>
		<i>B</i>	<i>SE</i>	β		
Model 1	Constant	54.350	2.536		21.428	<.001
	Total Score on STAI - Shortened	-.236	.119	-.206	-1.977	.051
Model 2	Constant	55.806	4.987		11.190	<.001
	Total Score on STAI - Shortened	-.235	.120	-.206	-1.960	.053
	Total Cognitive Load	-.041	.122	-.036	-.340	.735

Summary

Findings from the statistical analyses indicated that pre-simulation anxiety was not significantly associated with perceived simulation effectiveness or perceived cognitive load. Although weak negative relationships were observed between anxiety and perceived simulation effectiveness, these relationships between these variables were not statistically significant. Additionally, cognitive load did not mediate the relationship between pre-simulation anxiety and perceived simulation effectiveness. In summary, the results suggest that pre-simulation anxiety and cognitive load did not have a statistically significant influence on students' perceptions of simulation effectiveness in the study sample.

In Chapter 5, these results will be discussed further, including interpretations of findings, implications for nursing education and simulation practice, limitations of the study, and recommendations for future research. The chapter concludes with consideration of the implications for positive social change and how the findings may

inform the design of effective, learner-centered simulation experiences in pre-licensure nursing education.

Chapter 5: Discussion, Conclusions, and Recommendations

Introduction

Because high-fidelity simulation is widely used in nursing education, determining factors that may influence a learner's experience is necessary to construct effective simulation activities (Carey & Rossler, 2023). While anxiety, cognitive load, and simulation effectiveness have been explored individually, a gap in the literature exists that connects these factors to explore their combined impact on students' learning experiences. The purpose of this quantitative, correlational study was to examine the relationships between pre-simulation anxiety, cognitive load, and perceived simulation effectiveness in pre-licensure BSN students.

The findings of this study indicated that pre-simulation anxiety was not significantly related to perceived simulation effectiveness or to perceived cognitive load. Additionally, it was determined that cognitive load did not mediate the relationship between pre-simulation anxiety and perceived simulation effectiveness. Overall, the results suggest that pre-licensure BSN students' perceptions of simulation effectiveness were not significantly influenced by their levels of pre-simulation anxiety or perceived cognitive load within this sample. This chapter provides an interpretation of these findings including a discussion of the implications for nursing education, consideration of study limitations, recommendations for future research, and an exploration of the study's contributions to positive social change.

Interpretation of the Findings

The findings of my study extend existing knowledge in nursing education while also challenging some assumptions commonly reported in the literature. Previous research has stated that anxiety is prevalent among nursing students surrounding high-fidelity simulation experiences and that excessive anxiety can negatively impact a learner's performance, confidence, and critical thinking (Kapucu, 2017; Mills et al., 2016; Wheeler et al., 2021). However, this study did not support this finding.

It is important to recognize that learner-perceived simulation effectiveness is a distinct construct separate from concepts such as performance, confidence, and critical thinking. Much of the supporting literature for my study focuses on observable demonstrations of knowledge and skills, whereas perceived simulation effectiveness reflects learners' subjective evaluation of the educational value and meaningfulness of the simulation experience.

Similarly, my study found that pre-simulation anxiety was not significantly associated with learners' cognitive load, and no statistically significant relationship was found between cognitive load and perceived simulation effectiveness. Prior studies have reported that high-fidelity simulation can impose substantial cognitive demands and that increased cognitive load may negatively affect learning and performance (Josephsen, 2015; Lewis, 2019; Jung & Roh, 2022). In contrast, my findings suggest that the presence of anxiety prior to a simulation experience may not directly translate into increased cognitive load during the experience, particularly in structured educational simulation

environments where learners may have developed coping strategies or familiarity with simulation processes.

The lack of a mediating effect of cognitive load further extends current knowledge by providing evidence that cognitive load did not explain the relationship between anxiety and perceived simulation effectiveness in this sample. This distinction highlights the importance of differentiating between cognitive and emotional factors that influence performance versus those that shape learners' perceptions of educational value.

The cognitive load theory suggests that learning is optimized when intrinsic cognitive load is appropriately matched to learner expertise, extraneous load is minimized, and germane load is supported (Sweller, 1988; Sweller et al., 2011). The absence of significant relationships among anxiety, cognitive load, and perceived simulation effectiveness suggests that the simulation experiences in this study may have enabled learners to manage extraneous cognitive load and to engage in germane processing. If learners were able to allocate sufficient cognitive resources to learning tasks despite experiencing anxiety, problem solving and learning could still occur (Sweller, 1988; Sweller et al., 2011). This is consistent with cognitive load theory's emphasis on instructional design rather than on emotional state alone.

Interpretations did not exceed the scope of the data or findings. This study examined perceived simulation effectiveness rather than objective measures of learning or performance, and its conclusions are accordingly limited. While anxiety and cognitive load did not significantly influence perceptions of simulation effectiveness, these findings do not suggest that anxiety or cognitive load are irrelevant to learning outcomes in all

contexts. Rather, the results indicate that, within this sample of pre-licensure BSN students and in the context of structured, high-fidelity simulation experiences, anxiety and cognitive load did not significantly alter learners' perceptions of simulation effectiveness.

One possible explanation for the findings of this study is that the simulation experiences in which data were collected included a structured prebriefing prior to starting the scenario, as well as pre-simulation preparation activities assigned by the faculty. Strong prebriefing practices, including clear expectations and thorough orientation to the simulation environment and equipment, may enable learners to engage more effectively with the scenario, regardless of their emotional state (Perisco et al., 2024). In addition, the simulation scenarios were intentionally designed to align with learners' academic level and clinical experience, meeting students where they were in the curriculum. At the data collection institution, the faculty and simulation personnel collaborate to create scenarios that are clinically relevant and structured to minimize extraneous cognitive load. This includes deliberately avoiding unnecessary or distracting elements, such as unfamiliar or nonessential technology, excessive information in medical records, and medications or interventions that are not directly related to the stated learning objectives. By reducing these demands, learners can focus their cognitive resources on essential clinical reasoning, decision-making, and skill performance. From this perspective, it is possible that the thoughtful design of the scenarios and the simulation program's facilitation practices could have reduced the anxiety- and cognitive-load-related effects observed in other studies (Silva et al., 2023). This hypothesis remains

consistent with the cognitive load theory and suggests that well-designed simulation experiences may buffer the potential negative effects of anxiety and cognitive demands on learners' perceptions of effectiveness.

Limitations of the Study

This study has several limitations that should be considered when interpreting the findings. The first is the use of a nonprobability convenience sampling strategy. Participants were recruited from a single pre-licensure BSN program at one institution in the southeastern United States, resulting in a sample with relatively similar demographic and educational characteristics. Although the demographic profile of the sample is similar to other undergraduate nursing programs and aligns with the demographic profile of the U.S. nursing workforce (National Center for Education Statistics, 2024; Smiley et al., 2023), the findings may not be generalizable to nursing students enrolled in programs with a more diverse student profile, or those with different curriculum structures or simulation practices.

Limitations related to internal validity should also be acknowledged. Data were collected using self-report surveys, which may introduce response bias, including social desirability and response fatigue. It is possible that participants may have underreported anxiety or overreported positive perceptions of simulation effectiveness based on perceived expectations. Although standardized and validated instruments were used to minimize measurement error, self-report data remains subject to individual interpretation and the respondent's emotional state when they are completing the surveys.

The instruments used in this study had strong psychometric properties, but limitations emerged from the distribution of scores within the sample. Scores on SET-M were consistently high throughout the sample, indicating generally positive perceptions of simulation effectiveness. The small range of SET-M scores may have limited the ability to detect statistically significant relationships between perceived simulation effectiveness and other study variables. Having limited variability in the scores on the instrument for the dependent variable and may have contributed to the non-significant findings observed in this study.

Additional limitations include the uniformity of the simulation environment and facilitation practices. All simulations occurred within the same simulation center, using similar equipment, standardized scenarios, and faculty facilitators. While this consistency strengthened internal validity by reducing variability across simulation experiences, it can limit the external validity of the findings. Simulation practices, faculty facilitation styles, and learner support vary widely across institutions and may have an impact on variables such as learner anxiety, cognitive load, and perceptions of simulation effectiveness in other settings.

Recommendations

Based on the findings in this study, more research is needed to address the limitations identified previously. Because this study relied on nonprobability convenience sampling from a single institution, future studies should consider a multisite design that include pre-licensure nursing programs with varying curricula, student demographics, and simulation practices. Conducting additional studies with a larger, more diverse

sample would provide stronger evidence on the relationships among anxiety, cognitive load, and perceived simulation effectiveness.

Because this study focused on learners' perceived simulation effectiveness rather than objective measures of learning or performance, future research would benefit from examining both subjective and objective constructs simultaneously. Incorporating performance-based assessments, clinical judgment rubrics, or faculty evaluation tools alongside perception-based instruments may provide a more thorough understanding of the impact of anxiety and cognitive load during high-fidelity simulation experiences.

Finally, longitudinal research designs may offer insight into how repeated exposure to simulation influences anxiety, cognitive load, and perceptions of effectiveness over time. Pre-licensure nursing students often participate in multiple simulation experiences throughout their academic programs, and familiarity with simulation may impact learners' emotional state and cognitive processes. Examining these variables across multiple simulation encounters could provide insight into learners' anxiety, cognitive load, and perceived simulation effectiveness as it relates to learners' exposure to simulation experiences. These recommendations extend the current study's contributions without exceeding its boundaries.

Implications

Although pre-simulation anxiety and cognitive load did not significantly influence learners' perceptions of simulation effectiveness, the findings suggest that pre-licensure BSN students may be able to engage meaningfully in simulation-based learning despite anxiety or altered cognitive demands. At the individual level, this study supports the use

of high-fidelity simulation as a learning activity that, in this sample, was not diminished by emotional or cognitive stressors. Recognizing that anxiety does not undermine learners' perceived simulation effectiveness may help educators respond to learner concerns and promote resilience and confidence amongst nursing students.

At the organizational level, the findings support the continued integration of high-fidelity simulation into pre-licensure nursing education. The results of this study suggest that simulation experiences that have been thoughtfully designed and implemented are perceived by students as meaningful and effective learning activities. The data collection facility follows the Standards of Best Practice: SimulationSM published by the International Nursing Association for Clinical Simulation and Learning (INACSL) to ensure that learners are adequately prepared to participate in simulation-based experiences (McDermott et al., 2021). Specifically, the institution conducts a structured prebriefing prior to each scenario, during which learners are oriented to their roles and expectations within the simulation experience and provided with information on the use of recording equipment, as well as the roles of any faculty, facilitators, staff, and other professionals, as applicable. During prebriefing, learners are also oriented to all factors necessary to achieve the learning objectives, including a review of objectives, scenario context, equipment, manikins or other technology during the prebriefing (McDermott et al., 2021). In addition to the structured debriefing, the course faculty requires that learners complete preparatory assignments before the simulation to ensure each student has the knowledge needed to meet the learning outcomes. Following the evidence-based

standards of practice was likely a reason that the simulation was perceived as an effective learning experience by the learners (Persico et al., 2024).

Nursing programs and simulation centers may use these findings to guide faculty on the importance of instructional design strategies while acknowledging the emotional and cognitive experiences associated with high-fidelity simulation participation. Collectively, the findings support positive social change by informing evidence-based educational practices that prepare nursing students for entry into the profession while promoting safe, structured, and meaningful learning experiences.

Conclusion

This study contributes to the growing body of evidence on simulation-based learning in nursing education by examining the relationships among pre-simulation anxiety, cognitive load, and perceived simulation effectiveness in pre-licensure BSN students. The findings indicate that, within this sample, pre-simulation anxiety and perceived cognitive load were not significantly associated with learners' perceptions of simulation effectiveness. These results suggest that high-fidelity simulation can remain a meaningful and effective educational strategy even when learners experience emotional or cognitive demands, highlighting the importance of thoughtful instructional design rather than simply eliminating anxiety.

Learners may experience variations in anxiety and cognitive load during simulation-based learning, but these variables did not diminish students' perceptions of the activity's overall effectiveness. When simulation experiences are intentionally designed and implemented, students may be able to engage, learn, and reflect effectively

despite their emotional and cognitive responses. This study reinforces the need to focus on evidence-based simulation design and learner support, thereby advancing simulation as a critical component of pre-licensure nursing education.

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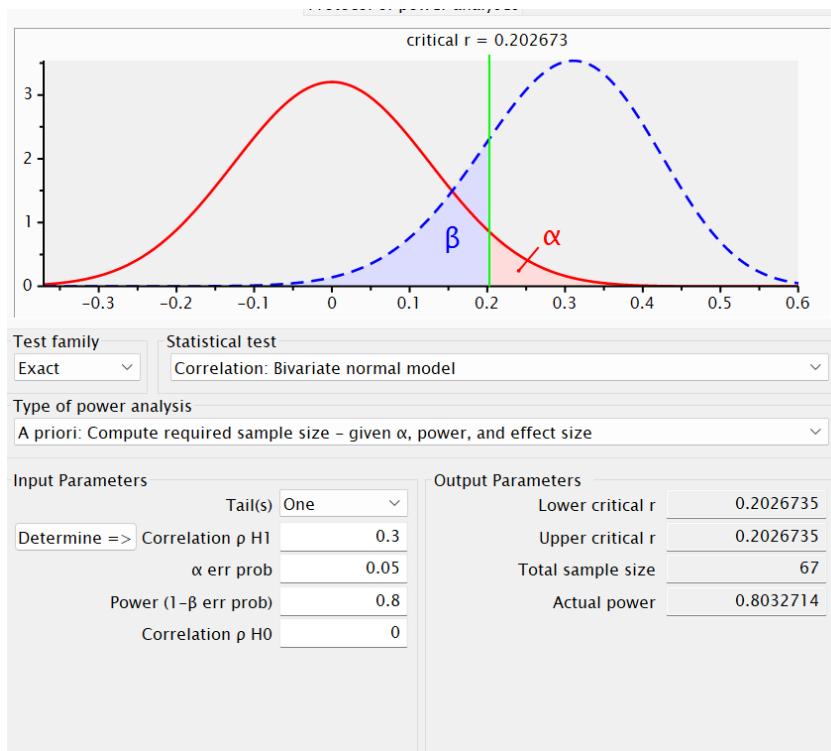
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Appendix A: Power Analysis for R1 and R2

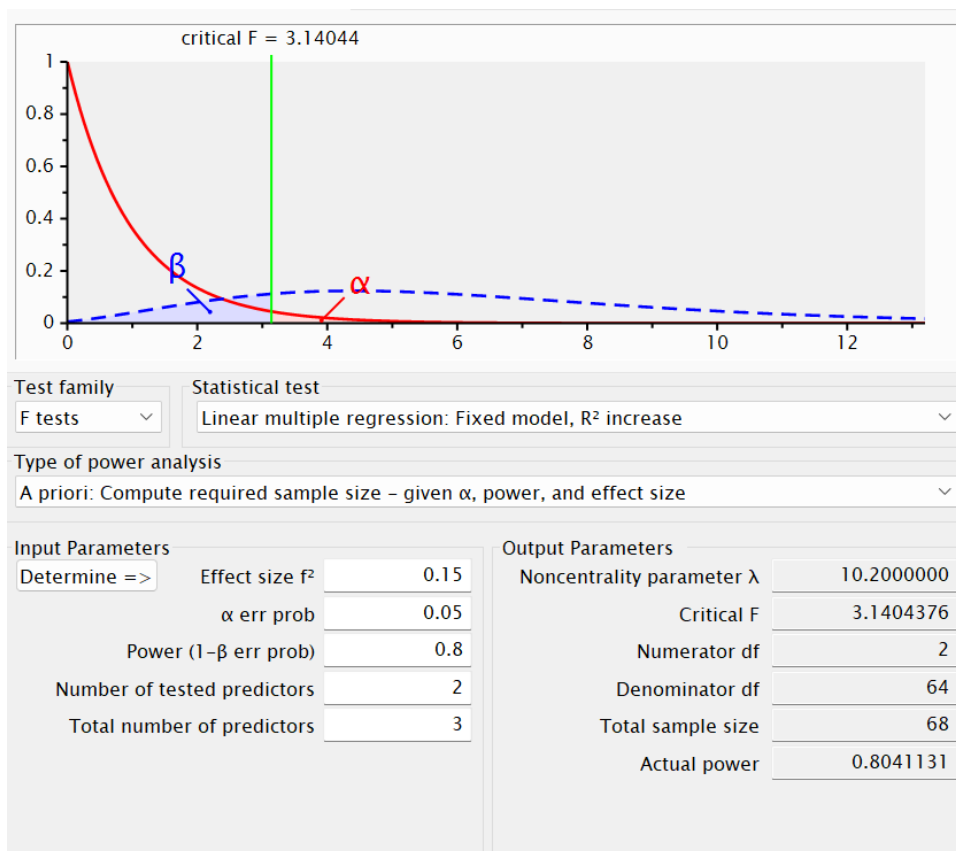
Figure A1

Power Analysis for R1 and R2



Note: This power analysis was performed using G*Power version 3.1.9.7, created by Faul et al. to determine sample size for research questions 1 and 2.

Appendix B: Power Analysis R3

Figure B1*Power Analysis for R3*

Note. This power analysis was performed using G*Power version 3.1.9.7, created by Faul et al. to determine sample size for research question 3.

Appendix C: Study Informational Presentation Flyer & Script

RESEARCH PARTICIPANTS NEEDED

📌 Study Purpose
 This study seeks to identify **relationships between pre-simulation anxiety, cognitive load, and learner perceptions of simulation effectiveness** among nursing students. Your participation will help expand understanding and improve simulation practices in nursing education.

📄 What's Involved?
 Participation involves completing **three short surveys** and a demographic questionnaire:

Before Simulation (approx. 6–10 min total):

- Demographic Questionnaire (3–5 min)
- Shortened Spielberger State-Trait Anxiety Inventory (STAIS-5 & STAIT-5) (3–5 min)

After Simulation (approx. 6–10 min total):

- Cognitive Load Measurement – Naïve Rating Questionnaire (3–5 min)
- Simulation Effectiveness Tool – Modified (SET-M) (3–5 min)


These surveys will be completed **electronically** and will not interfere with your course activities.

🔒 Confidentiality
 Your identity will remain **completely anonymous**. A unique code will be assigned to you; no names or contact details will be collected. Data will be stored in a **password-protected, encrypted file** on a secure server.

✓ Voluntary Participation
 Participation is **entirely voluntary**. You may choose to withdraw at any time without penalty. Your choice will not impact your academic standing or course performance.

⚠️ Risks & Benefits
 There are no known risks beyond those encountered in your normal educational experiences. While there is no compensation, your participation contributes to the **advancement of simulation in nursing education**.

🗣️ Questions?
 Contact:
Brittany Behrens



I'm happy to answer any questions before or on the day of your simulation.

My name is Brittany Behrens, and I am currently completing a study for my PhD program dissertation. The purpose of this study is to identify relationships between self-reported levels of anxiety prior to engaging in high-fidelity simulation, cognitive load, and the

effect of these variables on learner perceptions of simulation effectiveness in pre-licensure BSN students. Data will be collected electronically through the use of three surveys and a demographic questionnaire. Participation in this study is completely voluntary. If you choose to participate, you will be given a unique code so that your responses can be completely anonymous. Because the course that you are enrolled in already includes high-fidelity simulation experiences, there is no additional time burden beyond completing the questionnaire. Each questionnaire is estimated to take approximately five minutes. By participating in this study, you will be providing data that adds to the body of knowledge surrounding simulation in nursing education. I am happy to answer any questions that you might have today, or on the date of your simulation.

Appendix D: Screening Form

Are you currently a student in the pre-licensure BSN program?	YES	NO
Are you currently enrolled in a course that requires participation in a high-fidelity simulation experience?	YES	NO
Is this your first attempt taking this course?	YES	NO

Appendix E: State-Trait Anxiety Inventory – Shortened Version

STAI-5

A number of statements which people have used to describe themselves are given below. Read each statement and then circle the number at the end of the statement that indicates HOW YOU FEEL RIGHT NOW, that is, at this moment. There are no right or wrong answers. Do not spend too much time on any one statement but give the answer which seems to describe your present feelings best. Thank you.

Item nr.		Not at all	Somewhat	Moderately so	Very much so
1	I feel upset.	1	2	3	4
2	I feel frightened.	1	2	3	4
3	I feel nervous.	1	2	3	4
4	I am jittery.	1	2	3	4
5	I feel confused.	1	2	3	4

STAIT-5

A number of statements which people have used to describe themselves are given below. Read each statement and then circle the number at the end of the statement that indicates HOW YOU GENERALLY FEEL. There are no right or wrong answers. Do not spend too much time on any one statement but give the answer which seems to describe how you generally feel. Thank you.

Item nr.		Not at all	Somewhat	Moderately so	Very much so
1	I feel that difficulties are piling up so that I cannot overcome them.	1	2	3	4
2	I worry too much over something that really doesn't matter.	1	2	3	4
3	Some unimportant thoughts run through my mind and bothers me.	1	2	3	4
4	I take disappointments so keenly that I can't put them out of my mind.	1	2	3	4
5	I get in a state of tension or turmoil as I think over my recent concerns and interests.	1	2	3	4

Appendix F: Permission for Use of the STAIS-5 and the STAIT-5

Re: STAIS-5 and STAIT-5 permission for use

Dr. Zsidó András Norbert [REDACTED]

Mon 7/24/2023 3:48 AM

To: Brittany Behrens <[REDACTED]>

Dear Brittany,

Thank you for reaching out. The journal editor Dr. Lynn DeLisi informed me that you don't need any permission to use the questionnaire, please feel free to do so, just make sure to cite the paper in your publications.

Thanks,
Andras

András Norbert ZSIDÓ, PhD FPsyS
Research Fellow
Institute of Psychology, University of Pécs

Principal Investigator: Visual Cognition and Emotion Lab
<https://vicelab.btk.pte.hu/>



FIATAL KUTATÓK AKADÉMIÁJA
HUNGARIAN YOUNG ACADEMY

Feladó: Brittany Behrens <[REDACTED]>

Elküldve: 2023. július 22., szombat 20:20

Címzett: Dr. Zsidó András Norbert <[REDACTED]>

Tárgy: STAIS-5 and STAIT-5 permission for use

Ritkán kap e-mailt a(z) [REDACTED] címről. [Miért fontos ez?](#)

Good Afternoon Dr. Zsido,

My name is Brittany Behrens and I am currently enrolled in Walden University's PhD in Nursing Education Program. My research focus will be on determining if a relationship exists between learner anxiety and simulation effectiveness. I am in the early stages of my dissertation and looking for an instrument that I can use to evaluate learner anxiety.

I have seen the STAIS-5 and the STAIT-5 used in the literature and I believe it would be an ideal instrument for data collection in for my study. Are these instruments available for use in doctoral research? If so, what is the process to obtain permission for use?

Thank you,
Brittany Behrens

Appendix G: Cognitive Load Measurement – Naïve Questionnaire

Type of Load	Item – German	Item - English
ICL	Bei der Aufgabe musste man viele Dinge gleichzeitig im Kopf bearbeiten.	For this task, many things needed to be kept in mind simultaneously.
ICL	Diese Aufgabe war sehr komplex.	This task was very complex.
GCL	Ich habe mich angestrengt, mir nicht nur einzelne Dinge zu merken, sondern auch den Gesamtzusammenhang zu verstehen.	I made an effort, not only to understand several details, but to understand the overall context.
GCL	Es ging mir beim Bearbeiten der Lerneinheit darum, alles richtig zu verstehen.	My point while dealing with the task was to understand everything correct.
GCL*	Die Lerneinheit enthielt Elemente, die mich unterstützten, den Lernstoff besser zu verstehen.	The learning task consisted of elements supporting my comprehension of the task.
ECL	Bei dieser Aufgabe ist es mühsam, die wichtigsten Informationen zu erkennen.	During this task, it was exhausting to find the important information.
ECL	Die Darstellung bei dieser Aufgabe ist ungünstig, um wirklich etwas zu lernen.	The design of this task was very inconvenient for learning.
ECL	Bei dieser Aufgabe ist es schwer, die zentralen Inhalte miteinander in <u>Verbindung zu bringen</u> .	During this task, it was difficult to recognize and link the crucial information.

Note . ICL, intrinsic cognitive load; ECL, extraneous cognitive load; GCL, germane cognitive load. *Item only useful if GCL is varied on purpose in a given learning material (e.g., through prompts). All items are rated on 7-point Likert scales from “*absolutely wrong*” to “*absolutely right*.”

*The Cognitive Load Measurement – Naïve Rating Questionnaire is available for non-commercial and educational use and does not require the authors’ permission (Klepsch et al., 2017).

Appendix H: Simulation Effectiveness Tool – Modified

1

Simulation Effectiveness Tool - Modified (SET-M)

After completing a simulated clinical experience, please respond to the following statements by circling your response.

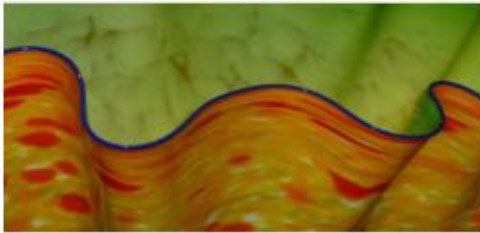
PREBRIEFING:	Strongly Agree	Somewhat Agree	Do Not Agree
Prebriefing increased my confidence. (PREBRIEFING)	3	2	1
Prebriefing was beneficial to my learning. (PREBRIEFING)	3	2	1
SCENARIO:			
I am better prepared to respond to changes in my patient's condition. (LEARNING)	3	2	1
I developed a better understanding of the pathophysiology. (LEARNING)	3	2	1
I am more confident of my assessment skills. (LEARNING)	3	2	1
I felt empowered to make clinical decisions. (LEARNING)	3	2	1
I developed a better understanding of medications. (Leave blank if no medications in scenario) (LEARNING)	3	2	1
I had the opportunity to practice my clinical decision making skills. (LEARNING)	3	2	1
I am more confident in my ability to prioritize care and interventions (CONFIDENCE)	3	2	1
I am more confident in communicating with my patient. (CONFIDENCE)	3	2	1
I am more confident in my ability to teach patients about their illness and interventions. (CONFIDENCE)	3	2	1
I am more confident in my ability to report information to health care team. (CONFIDENCE)	3	2	1
I am more confident in providing interventions that foster patient safety. (CONFIDENCE)	3	2	1
I am more confident in using evidence-based practice to provide care. (CONFIDENCE)	3	2	1
DEBRIEFING:			
Debriefing contributed to my learning. (DEBRIEFING)	3	2	1
Debriefing allowed me to communicate my feelings before focusing on the scenario* (DEBRIEFING)	3	2	1
Debriefing was valuable in helping me improve my clinical judgment. (DEBRIEFING)	3	2	1
Debriefing provided opportunities to self-reflect on my performance during simulation. (DEBRIEFING)	3	2	1
Debriefing was a constructive evaluation of the simulation. (DEBRIEFING)	3	2	1
What else would you like to say about today's simulated clinical experience?			

*revised 4/3/20 for use in virtual debriefing

Leighton, K., Ravert, P., Mudra, V., & Macintosh, C. (2015). Update the Simulation Effectiveness Tool: Item modifications and reevaluation of psychometric properties. *Nursing Education Perspectives*, 36(5), 317-323. Doi: 10.5480/1 5-1671.

Original Simulation Effectiveness Tool (SET) developed by Medical Education Technologies, Inc (METI, now CAE Healthcare) for Program for Nursing Curriculum Integration (PNCI) (2005)

Appendix I: Permission for Use of the SET-M



Evaluating Healthcare Simulation

July 22, 2023

Dear Brittany,

The authors of the Simulation Effectiveness Tool - Modified (SET-M) are pleased to grant permission for you to use this instrument in your study of simulation effectiveness.

Please ensure you have the most current version (4/3/20). If not, reach out to me as the website is currently down. Don't hesitate to reach out with any questions.

Warm regards,

Kim

Kim Leighton, PhD, RN, CHSE, CHSOS, ANEF, FSSH, FAAN



Appendix J: Demographic Data Questionnaire

What is your age?

- a. 18 to 26 years old
- b. 27 to 35 years old
- c. 36 to 44 years old
- d. 45 years or older

What is your gender?

- a. Male
- b. Female
- c. I prefer not to answer

What is your ethnicity?

- a. Caucasian
- b. Black/African American
- c. Hispanic/Latino
- d. American Indian or Alaska Native
- e. Asian/Pacific Islander
- f. Other

How many semesters have you been in the nursing program?

- a. 1-2
- b. 3-4
- c. 5-6
- d. 7-8
- e. 8 or more semesters

This simulation experience is required by which of the following courses?

- a. NUR 2202
- b. NUR 3510
- c. NUR 4570
- d. NUR 4585
- e. NUR 4595

Appendix K: IRB Approval Letter



July 31, 2025

RE IRB Application/Protocol No. 202506018

Dear Brittany Behrens,

We have reviewed and approved your IRB titled "Anxiety, Cognitive Load, and Simulation Effectiveness in Pre-licensure BSN Students."

Your project has been granted **expedited status**. You may begin collecting data at your convenience, **effective July 31, 2025**. Please ensure that you conduct your research in accordance with the approved protocol.

You may only deviate from this protocol for the safety of participants, and any such deviations must be reported to the IRB in writing as soon as possible. Additionally, please notify the IRB chairperson immediately in writing of any adverse occurrences.

If your project **extends beyond one year**, you must submit a continuation to the IRB. The IRB may request additional progress reports, which should be provided promptly. Upon completion or termination of the project, you must submit a project closure form.

If you need to change any methods, please submit a request for modification and receive approval before implementing the new methods.

I wish you success with your project.

Sincerely,

Jose Dominguez

Jose Dominguez, PT, PhD, OCS

Assistant Professor

Florida Southern College School of Physical Therapy

Digitally signed by Jose Dominguez
Date: 2025.07.31 05:30:32 -0400

