EFFECTIVENESS OF A VIRTUAL SIMULATION PROGRAM AS A NOVEL APPROACH TO IMPROVE CLINICAL JUDGMENT IN PRELICENSURE NURSING STUDENTS

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Abstract

Problem: Limited clinical placement opportunities for practicing decision-making skills have widened the academic-practice gap. Research shows a disturbing decline in entry-level competency among newly graduated registered nurses. Innovative strategies like virtual patient simulation may foster decision-making skills and prepare prelicensure nursing students for practice. However, research is lacking in examining virtual patient simulation (VPS) as an effective approach for developing clinical judgment in prelicensure nursing students. The American Association for Academic Nursing has determined that clinical judgment is an essential nursing attribute. Moreover, the National Council of State Boards of Nursing developed the Next Generation National Council Licensure Exam based on a clinical judgment model. Identifying effective novel teaching strategies is imperative for nursing programs to prepare nursing students for entry-level practice.

Methodology: The study guided by the Tanner Clinical Judgment Model, integrating the three learning domains (cognitive, affective, and psychomotor), was used as the conceptual framework for the virtual simulation intervention. This quasi-experimental study with repeated measures mixed design examined the effectiveness of VPS in acquiring clinical judgment compared to high-fidelity mannequin simulation (HFMS). The study also investigated the efficacy of virtual patient simulation as a primer for HFMS using the Lasater Clinical Judgment Rubric among third-year Bachelor of Nursing prelicensure students, controlling for previous experiences in Healthcare and Virtual Technology and Age. Participants were assigned to the control group (n = 48) and received three HFMS scenarios, and the intervention group (n = 46) received three VPS, followed by three HFMS scenarios. Repeated measures using the Lasater Clinical Judgment Rubric measured clinical judgment at pretest (T1) and posttest (T2) for the HFMS (control group) and pretest (T1) and posttests (T2 and T3) for the VPS (intervention) group.

Results: Mixed ANCOVA and mixed MANCOVA examined the differences in the change of self-perceived clinical judgment total scale score and subscale scores, respectively, from pretest to posttest between the HFMS and VPS groups. Statistical analyses were performed using an alpha level of .05. The mixed ANCOVA showed the interaction effect of Time by study group for the self-perceived clinical judgment total scale score was not significant for either group between T1 and T2 (p = .33) and between T1 and T3 (p = .12). The interaction effect of Time by study group using mixed MANCOVA for the self-perceived clinical judgment subscale scores were also not significant between T1 and T2 (p = .54) and between T1 and T3 (p = .65). The results indicated that both groups showed similar increases over time for the self-perceived clinical judgment total scale and subscale scores between HFMS and VPS among third-semester pre-licensure nursing students.

Discussion: The findings showed that the self-perceived clinical judgment total scale and subscale scores improved across the repeated measures, and students benefited from HFMS, VPS, and combined simulation approaches. Both approaches were similarly effective in fostering students' clinical judgment development.

Implications: Virtual patient simulation is as effective as high-fidelity mannequin simulation and offers nursing programs another learning approach for promoting clinical judgment among prelicensure nursing students.

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Dedication

I am dedicating my dissertation to two people, my 'Tia Elena,' who passed away almost three years ago. She did not get to see me finish, but she is in my thoughts, and I am grateful that I had the opportunity to be with her in her final moments. The second is my baby 'sister' Carmin. She is a warrior as she fights cancer every day. She is resilient and strong, and I am humbled by her courage.

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Chapter 1: Introduction

Introduction

Clinical environments are rapidly changing, and nursing programs struggle to find clinical placements for students (Copeland, 2020). According to the National League for Nursing (2016), the primary impediments to admitting qualified nursing students are the lack of clinical placement sites (Copeland, 2020) and faculty (American Association of Colleges of Nursing, 2018). Contributing factors include higher patient acuity (American Nurses Association, 2024), nursing shortages, retirements, and increased patient-to-nurse ratios (Gupta, 2022). These factors negatively impact nursing programs' ability to offer students opportunities for learning clinical judgment and widen the academic-practice gap between prelicensure nursing programs (Copeland, 2020) and practice readiness. For these reasons, innovative learning strategies such as high-fidelity mannequin and virtual patient simulations are needed to augment dwindling practice opportunities.

Statement of the Problem

The decrease in clinical placement opportunities affects students' options for practicing decision-making skills, resulting in a decline in clinical competency among NGRNs (Kavanagh & Sharpnack, 2021). The Carnegie Foundation for the Advancement of Teaching study found a significant gap between nursing practice and education (Benner et al., 2010), and the academic-practice gap continues to widen. Evidence demonstrates that NGRNs' ability to make sound decisions has declined (Kavanagh & Sharpnack, 2021) since 2005, when Del Bueno found only 35% met entry-level expectations for clinical judgment (CJ) despite having vast theoretical knowledge.

Clinical judgment is achieved by recognizing the salient aspects of a clinical situation, interpreting its significance, taking appropriate actions, and learning from experiences (Tanner, 2006). However, the lack of faculty and clinical settings are major barriers to preparing the nursing workforce (Fraher et al., 2015). A seminal study by the National Council of State Boards of Nursing (NCSBN) found that high-quality simulation experiences promote the attainment of knowledge (Haerling, 2018) and CJ (Reid et al., 2020). Despite the challenges, nursing programs need to offer innovative educational approaches that rely less on faculty and clinical sites to foster learning. By 2018, 65% of nursing programs had adopted virtual simulation, and almost half were expected to adopt virtual reality within five years (Wolters Kluwer, 2018). The COVID-19 pandemic accelerated the use of virtual simulation, and nursing programs were forced to deliver theory and clinical courses online (Hargreaves et al., 2021). Virtual platforms have been adopted as a replacement for in-person clinical sites, and research shows this online modality may foster decision-making skills, critical-thinking, and clinical reasoning to prepare prelicensure nursing students for practice (Fogg et al., 2020; Padilha et al., 2019; Sim et al., 2022). However, research examining virtual patient simulation as an effective approach for developing CJ in prelicensure nursing students is lacking.

Virtual simulation platforms have gained popularity among nursing programs (Wolters Kluwer, 2018) and, as an economical option (Haerling, 2018), may be comparable to high-fidelity mannequin simulation (HFMS) for attaining CJ. Virtual patient simulation (VPS) is immersive, providing realistic clinical situations without the risk of patient harm (Foronda et al., 2017). Few studies have examined VPS as a teaching approach for acquiring CJ, and inconclusive findings have failed to determine its effect on CJ development compared to HFMS among prelicensure nursing students. The current decline in NGRN competency demands adopting educational practices that narrow the academic-practice gap (Kavanagh & Sharpnack, 2021).

Significance to Nursing

The decline in competency and CJ among NGRNs is alarming (Hickerson et al., 2016; Huston et al., 2018), involving 49% to 53% of medical errors (Kiernan, 2018). Aggregate studies conducted in 2011-2015 (Kavanagh & Szweda, 2017) and 2016-2020 (Kavanagh & Sharpnack,

2021) of more than 10,000 NGRNs showed a decline in the acceptable range of competency from 23% to 14%. Furthermore, a 2020 study reported only 9% of more than 1,000 NGRNs demonstrated acceptable competency (Kavanagh & Sharpnack, 2021). The disturbing decline in entry-level competency illustrates the gap between nurse training programs and NGRNs' performance in delivering safe patient care (Burns & Poster, 2008). Nursing programs rely on a variety of teaching methodologies. However, decreased clinical placement opportunities, shorter hospital stays (Jessee, 2021; Kavanagh & Szweda, 2017), and a decrease in the availability of experienced nurses (Copeland, 2020) have negatively affected students' options for practicing decision-making skills in patient care settings (Wolters Kluwer, 2018).

Virtual patient simulation is immersive, providing realistic clinical situations without the risk of patient harm (Foronda et al., 2017). VPS can replicate real-world patient care situations and ease the shortage of clinical sites (Aebersold, 2018) and available faculty (Fang & Kesten, 2017). Virtual patient simulation can be accessed remotely, and students can complete scenarios independently. Virtual simulation platforms are less-resource intensive than HFMS, which requires classroom space, faculty, time, and financial resources for purchasing mannequins (Haerling, 2018). This digital platform offers various patient care environments for students to assess, care, make clinical decisions, and observe patient outcomes based on their actions (Yang et al., 2024)

However, low to modest and mixed evidence from a systematic review and meta-analysis of 51 trials showed that in comparison to traditional education, virtual simulation might improve knowledge outcomes and foster clinical reasoning and critical thinking skills (Kononowicz et al., 2019). Nursing programs are challenged to provide students with quality clinical instruction, and evaluating VPS is vital to understanding its benefits as a strategy for promoting CJ development among nursing students.

Knowledge Gap

The Strategic Practice Analysis (NCSBN, 2018) found that CJ is directly linked to more than 46 percent of the tasks performed by entry-level nurses. Clinical practicums in nursing programs responsible for teaching CJ face challenges in providing students with the opportunities to develop the decision-making skills necessary to provide safe and competent care (Ayed et al., 2022; Kononowicz et al., 2019; Yang, 2021). While HFMS is effective in fostering CJ (Klenke-Borgmann, 2020), the need for simulation-trained instructors further strains programs' ability to use this teaching approach. In response to these challenges, nursing programs have expanded their use of virtual platforms to replace real-time bedside experiences (Jimenez, 2022; Shea & Rovera, 2021) and offset the cost, space, and faculty needed for HFMS. Virtual simulation platforms have been designed as stand-alone simulations with prebriefing, patient scenarios, and debriefing components. Haerling (2018) examined the monetary terms and utility of HFMS and VPS. The factors considered in this calculation included personnel (faculty and simulation staff), facilities, durable equipment, including mannequins and computers, patient scenarios, and consumable supplies (moulage, gloves, etc.) (Haerling, 2018). Findings from this study postulated that the cost per student to deliver a mannequin simulation was approximately $37 compared to $11 for virtual simulation (Haerling, 2018). The difference in costs between modalities makes VPS a more affordable option, requiring fewer resources with the flexibility for remote access without the presence of an instructor (Brown et al., 2021). Extant literature has also found that having access to different patient care scenarios improves mastery through repeated practice (Borg Sapiano et al., 2018; Fogg et al., 2020; Goldsworthy et al., 2022), increases students' knowledge (Fogg et al., 2020; Gu et al., 2017), and promotes critical thinking (Goldsworthy et al., 2022) and clinical reasoning skills (Padilha et al., 2019). However, findings have been mixed when determining the effect of VPS on clinical judgment compared to HFMS. Confounding variables (Fogg et al., 2020), missing data (Hudder et al., 2021), and studies focused on NGRNs (Luo et al., 2021) have led to inconclusive study findings. Previous research has also studied the effects of VPS combined with HFMS. Findings have found that virtual simulation followed by mannequin simulation led to significantly higher scores in reflective thinking, self-confidence, problem-solving, and clinical reasoning (Park et al., 2022); however, students prefer in-person simulation more than virtual simulation environment for critical thinking (Han & Jin, 2024). Little is known about combining multiple simulations or mixed simulations to foster CJ. For these reasons, further research examining VPS as a stand-alone and primer for developing CJ is imperative for providing nursing programs with additional learning approaches.

Research Purpose

The proposed study 1) compared the change in self-perceived CJ between HFMS and VPS and 2) evaluated the change in self-perceived CJ when VPS serves as a primer for HFMS among third-year bachelor prelicensure nursing students while controlling for experiences in Healthcare and Virtual Technology, and Age. The findings of this study may offer prelicensure nursing programs an innovative, low-cost, less resource-intensive option for teaching and learning CJ.

Conceptual Definitions of Variables

Clinical Judgment

Clinical judgment is a higher-order cognitive process (Dickinson et al., 2019) involving "skill in recognizing cues about a clinical situation, generating and weighing hypotheses, taking action and evaluating outcomes to arrive at a satisfactory clinical outcome" (NCSBN, 2018). Clinical judgment is the nurse's decision or conclusion about a patient's situation based on experience, patient engagement, situational context, and reflection (Tanner, 2006).

High-Fidelity Mannequin Simulation (HFMS)

Instructors use HFMS to create environments that mimic real-life patient care scenarios (Garrett et al., 2010). High-fidelity mannequins simulate human physiologic functions such as blinking eyes, radial and pedal pulses, and cardiac and respiratory sounds with vocalizing words and sounds (Lioce, 2020; Wolters Kluwer, 2018). The instructor is responsible for 'driving' the scenario (Goldsworthy et al., 2022) and facilitating debriefing sessions to evaluate learning.

Virtual Patient Simulation (VPS)

VPS is a self-directed, interactive platform mediated by the learner who assumes the nursing role. It offers a trial-and-error approach with the benefit of repeating patient scenarios (Cant & Cooper, 2014). VPS recreates reality by simulating real-life clinical situations (Lioce, 2020) and uses avatars to portray virtual humans capable of facial expressions and physical responses (Lioce, 2020). Upon completion of the VPS, the program presents the user with a computer-generated feedback report detailing the user's actions, performance, and areas of improvement (Leibold & Schwarz, 2017).

Teaching and Learning

The learning process involves the memorization of facts, recognition, reasoning, and developing appropriate behaviors (Fry et al., 2009). Teaching can enhance learning when prior knowledge is used as a starting point (National Research Council, 2000) and then transformed into new knowledge (Fry et al., 2009). Yet, this transformation depends on the thinking, reflecting, and practicing opportunities learners receive to build new knowledge (Fry et al., 2009). Nursing students experience knowledge gaps in their abilities to think, practice, and reflect as a nurse. Still, educators can design instructional plans and learning opportunities to further students' understanding of the nursing role (Bastable, 2023). Bloom et al. (1956) and Krathwohl et al. (1964) developed the three domains of learning (cognitive, affective, and psychomotor) to foster the growth and development of learners' knowledge, attitude, and skills (Bloom et al., 1956). Using lesson plans and teaching strategies that impact the three learning domains can transform learners' knowledge, attitudes, and behaviors (Bastable, 2023; Menix, 1996).

Cognitive

The cognitive domain, known as the "thinking" domain, is associated with learners' capacity for acquiring information (Bastable, 2023, p. 450), intellectual ability, knowledge, and information (Aubrey & Riley, 2019). Cognitive skills are gained from various experiences, including methodologies used in affective and psychomotor learning (Bastable, 2023). Cognitive learning is achieved from teaching strategies utilizing lectures, reading, instructional audiovisual media (Pierce & Gray, 2013), case studies, group discussions (Bussard, 2020), computer-assisted instruction (Bastable, 2023), and simulation (Billings & Halstead, 2020; Pierce & Gray, 2013).

Affective

The affective domain is the "feeling" domain involving emotions, interests, beliefs, attitudes, and values (Bastable, 2023, p. 454). Affective learning fosters the learners' personal growth (Billings & Halstead, 2020) and influences their motivation for learning in the cognitive and psychomotor domains (as cited in Bastable, 2023). The learner values what they know and changes their behavior to incorporate professional values into their way of life (Vinson, n.d.). Strategies to help the learner acquire affective behaviors include role-modeling and role-playing, simulation (Bastable, 2023), probing, reflection (Pierce & Gray, 2013), storytelling (Bussard, 2020), and interactive videos (Vinson, n. d.).

Psychomotor

The psychomotor domain represents the "skills" domain. It involves the acquisition of fine and gross motor abilities, including manipulating equipment, performing procedures (Bastable, 2023, p. 456), and developing manual or physical competencies (Billings & Halstead, 2020). Developing psychomotor skills requires the integration of the cognitive and affective learning domains (Bastable, 2023). The cognitive domain conveys knowing the principles and processes related to the skill (Bastable, 2023), but the affective domain helps the learner value the skill learned. Strategies for developing this domain include skill-based activities, manipulation of devices, modeling (Pierce & Gray, 2013), self-instruction (Bastable, 2023), arranging the sequence of the activity in a correct order via demonstrations (Vinson, n.d.), and performing patient care in clinical settings (Bussard, 2020).

Sound CJ develops through assessment, critical thinking, clinical reasoning, intuition, and reflection (Manetti, 2019; Tanner, 2006). These skills integrate the thinking, practicing, and feeling learning domains. Assessment needs cognitive and psychomotor skills to ask pertinent questions, listen to concerns, perform physical assessments, and recognize patterns. Critical thinking and clinical reasoning require cognitive skills to employ theoretical and clinical knowledge, anticipate potential outcomes, and prioritize actions (Manetti, 2019). Affective skills are needed for reflection (Manetti, 2019), and self-evaluation of the patient care experience leads to analyzing areas of improvement and development of CJ (Benner et al., 2010; Manetti, 2019). Therefore, teaching strategies and learning opportunities that support students' transformation of knowledge, skills, and attitudes are critical for adopting the skills and behaviors needed to achieve sound CJ.

Chapter Summary

Nurses care for patients with comorbidities and conditions requiring complex treatment plans. NGRNs are entry-level nurses expected to care for patients and make decisions based on limited theoretical and clinical experience. The widening academic-practice gap observed across the last 20 years is alarming. Nursing students need teaching and learning strategies to access remotely and bridge the classroom and clinical settings. VPS is a less resource-intensive option that may foster cognitive, affective, and psychomotor learning. Although HFMS remains a cornerstone of nursing education, nursing programs have expanded their use of virtual platforms to offset the costs of mannequin simulations. Although VPS offers flexibility and accessibility for remote learning, understanding its impact on students' knowledge and CJ is important for understanding its effectiveness as a simulation strategy.

Chapter 2: Literature Review

Introduction

Chapter 2 provides a literature review to determine the state of the science related to the problem and the conceptual framework guiding this study. The databases utilized for the literature review included the UNLV Library Database, Google, Google Scholar, CINAHL, Embase, The Cochrane Library, PubMed, National Council State Boards of Nursing, and the American Association of Colleges of Nursing. Some of the key terms used for this review include “virtual simulation AND clinical judgment,” “game-based simulation AND clinical judgment,” “Tanner Clinical Judgment Model,” “Lasater Clinical Judgment Rubric,” and a combination of these terms relevant to the research problem.

Critical Thinking, Clinical Reasoning, and Clinical Judgment

Clinical judgment has been used interchangeably with critical thinking and clinical reasoning. However, recent literature has made a more apparent distinction between these three terms (Gonzalez, 2018; Jessee, 2021). Critical thinking and clinical reasoning are integral to achieving sound CJ (Gonzalez, 2018; Manetti, 2018). Critical thinking encompasses data assessment and interpretation, identifying a possible course of action, potential outcomes, and action prioritization (Jessee, 2021; Klenke-Borgmann et al., 2020; Manetti, 2018). Clinical reasoning is needed to grasp changes in situations as they unfold, generate hypotheses, and recognize trends and trajectories before considering an appropriate action (Benner et al., 2010; Klenke-Borgmann et al., 2020; Tanner, 2006). Critical thinking and clinical reasoning processes build on nurses' knowledge and experience to make patient care decisions in clinical situations (Jessee, 2021; Tanner, 2006).

The National Council of State Boards of Nursing-Clinical Judgment Model (NCSBN-CJM)

Dickison et al. (2019) emphasized that "sound clinical judgment is at the core of competent and safe client care" (p. 72). CJ is based on nurses' ability to recognize, analyze, hypothesize, respond, and evaluate outcomes (Dickison et al., 2019). Nurses encounter multi-layered issues in caring for patients, making it imperative to investigate and measure nursing students' CJ abilities and development (Dickison et al., 2019). The NCSBN Strategic Practice Analysis Executive Summary (2018) reported that CJ is a number one high-priority skill and a crucial attribute of professional nursing (AACN, 2021). To ensure NGRNs have the decision-making skills to safely and competently care for patients, the NCSBN launched the Next Generation (NextGen) NCLEX state board exam in April 2023 (ATI, 2023). The NCSBN-CJM comprises three theoretical frameworks, including the Tanner Clinical Judgment Model, which depicts the observations, cognitive operations, and contextual factors that affect and lead nurses to achieve CJ (Dickison et al., 2019). The four-layered clinical judgment framework illustrates the connections between the observations and cognitive operations required to achieve CJ, including the individual and environmental factors affecting nurses' decision-making abilities (Dickison et al., 2019).

Technology-Based Learning

Online learning is accessible to educators and students, and new graphic technology allows learners to immerse themselves in virtual worlds that simulate real-world settings (Moos & Marroquin, 2010). The use of technology has increased across all generations (Vogels, 2019), and today's nursing applicants are the first 'digital native' generation. Generation Z is considered the "Net generation" growing up with technology as their preferred learning method (Bastable, 2023, p. 499) and expecting accessible learning activities (MacRae et al., 2021). Online learning environments use various multimedia tools, including animation, video, and audio presentations (Moos & Marroquin, 2010), making it an engaging learning strategy for digital learners.

Learning Benefits of Virtual Patient Simulation

High-fidelity mannequin simulation has been a cornerstone of nursing education, but its delivery requires the purchase of mannequins, ample classroom space, and personnel, which is more costly than VPS (Haerling, 2018). VPS programs are scalable and accessible from any remote location, making them a viable teaching and learning option (Cant & Cooper, 2014; Chen et al., 2022; Sapiano et al., 2018). VPS scenarios also offer repeatability, building on pattern recognition to reinforce knowledge (Cendan & Lok, 2012). A systematic review of randomized controlled trials and a quasi-experimental study found VPS fosters cognitive, affective, and psychomotor learning (Haerling, 2018; Shorey & Ng, 2021). Significant improvements have been observed in theoretical knowledge in various content areas related to assessment (Bryant et al., 2015; Cobbett & Snelgrove-Clarke, 2016; Shorey & Ng, 2021), chronic and deteriorating conditions (Haerling, 2018; LeFlore et al., 2012), and skill-related principles (Dubovi et al., 2017; Tan et al., 2017). The results of the affective and psychomotor domains using VPS demonstrated improvement in self-confidence (Tan et al., 2017; Shorey & Ng, 2021) and performance-related skill sets (Shorey & Ng, 2021; Smith et al., 2016).

Clinical Judgment Findings in Virtual Patient Simulation Studies

Virtual patient simulation may foster decision-making skills (Bastable, 2023), increase knowledge, and improve performance (Fogg et al., 2020). Yet, findings have been inconclusive in demonstrating VPS as an approach for developing CJ in prelicensure nursing students. Fogg et al. (2020) examined the development of CJ among 234 senior-level bachelor nursing students enrolled in a child-health course after delivering five virtual scenarios across the semester as a component of the pediatric clinical rotation. Students demonstrated a significant increase in CJ in all domains of the LCJR (noticing p =.000, interpreting p =.002, responding p =.001, reflecting p =.01) between the first and final case. However, self-perceived increases in CJ may have resulted from concomitant didactic and direct care clinical experiences between the completion of the first and last virtual scenario (Fogg et al., 2020). Hudder et al. (2021) compared virtual simulation to lab-based learning of newborn assessment using infant mannequins among 36 bachelor students, measuring student satisfaction, self-confidence, knowledge, and CJ. Results from the pretest to posttest showed a significant improvement in students' newborn assessment knowledge (p = .03). In contrast, student satisfaction and self-confidence were significantly lower (*p* = .001) in the virtual simulation group compared to the lab group. However, an analysis of CJ using the LCJR was not conducted due to missing data, and the study could not offer comparison data related to CJ. In a third study, Luo et al. (2021) compared the impact of three learning modalities on NGRNs: high-fidelity simulation, virtual simulation, and case study. The study measured CJ's perceptions of self-confidence and assessed the design features for each simulation modality among NGRNs. Although the level of CJ was significantly higher among the virtual simulation group (*p* = .014) compared to the case study and high-fidelity simulation groups, the study only compared post-intervention measurements between the three groups.

An extensive literature review has found research studies comparing CJ among various learning modalities; however, in previous studies, raters have evaluated participants in simulations (Haerling, 2018; Mariani et al., 2013; Reid et al., 2020; Strickland et al., 2017) or simulation ratings have been compared between raters and participants. No studies have compared the self-perceived CJ using HFMS and VPS, using a pretest-posttest design among prelicensure nursing students. Its findings would provide valuable evidence for nursing education about CJ development using VPS.

Blended Learning and Simulation as a Primer

Blended learning combines face-to-face instruction with computer-mediated instruction (Graham, 2005). The use of blended approaches is expected to grow as the availability of digital learning technologies increases (Graham, 2005) and instructors seek different modalities to foster student engagement (Fry et al., 2009). Computer-mediated instruction and face-to-face activities provide students with learning activities (Graham, 2005) to suit various learning needs (Fry et al., 2009). A systematic review and meta-analysis of virtual patients' effectiveness in comparing blended learning with traditional education found improvement in communication skills and clinical reasoning compared to traditional educational strategies (Kononowicz et al., 2019). The combination of computer-based simulation with HFMS can significantly improve critical thinking, problem-solving processes, and clinical performance more than virtual simulation alone, demonstrating the synergistic effect of the two simulation modalities (Kim et al., 2019).

Although blending teaching modalities shows promise in promoting learning retention (Graham, 2005), not much is known about the most effective delivery sequence in mixed simulation between VPS and HFMS (Foronda et al., 2020). Lesson planning that helps students transition from one learning activity to another (Addison, 2022) can promote learning readiness. Priming is a strategy that presents students with a new topic in preparation for participation in a future learning activity (Addison, 2022). Exposure to a primer activity allows the learner to learn content to recall later and use it to build new knowledge (Addison, 2022). Priming enables long-term knowledge retention and highlights content areas needing further interpretation and study (Addison, 2022). Park et al. (2022) conducted a quasi-experimental crossover design between VPS and HFMS to examine the differences in problem-solving, clinical reasoning, reflective thinking, satisfaction with the practicum, and self-confidence when the simulation modalities were administered in a different sequence. Findings revealed that the group who received VPS first, followed by HFMS, showed significantly higher scores for reflective thinking and self-confidence than the group who received HFMS, followed by VPS (Park et al., 2022). VPS may have served as a primer for improving participants' ability to assess and select appropriate clinical interventions in HFMS (Park et al., 2022). Han and Jin (2024) also compared in-person simulation with the combination of virtual and in-person simulations to investigate satisfaction, self-confidence, and the degree to which students' learning needs were met using these modalities.

Although the virtual plus in-person simulation showed higher mean scores than the in-person simulation alone, results did not show significant differences in learning satisfaction and self-confidence between modalities (Han & Jin, 2024). However, in-person simulation was rated higher in knowledge, communication, nursing process, and critical thinking than combined simulation modalities (Han & Jin, 2024).

Priming activities can influence cognitive, affective, and psychomotor behaviors and may improve students' readiness for learning and retaining new information. Students may use virtual simulation to increase knowledge, self-confidence, and efficiency in preparation for an in-person simulation (Han & Jin, 2024; Luctkar-Flude et al., 2021). Exploring the VPS as a primer to HFMS will offer insight into its combined effect for promoting CJ compared to HFMS alone.

Inclusion/Exclusion of Potential Covariates

The items included in the sociodemographic survey were identified based on literature to support using these items as covariates in statistical analyses (Fawaz & Hamdan-Mansour, 2016; Weatherspoon et al., 2015). Although socioeconomic status is typically used as a control variable in other nursing education studies, it was not included in this study because a review of the existing literature from similar study populations indicates that income or social status were not significant predictors in the primary outcome (European Medicines Agency, 2016; Raab et al., 2000) of clinical judgment using simulation.

Chapter Summary

Nursing students receive significant theoretical knowledge, but programs are challenged to provide high-quality patient care experiences for students to apply their knowledge. Simulation is an effective teaching strategy for student learning and improving clinical performance; however, the current generation of nursing students expects accessible and convenient learning activities (MacRae et al., 2021). A literature review shows VPS is an immersive alternative option for the next generation of digital learners. VPS allows students to access patient scenarios repeatedly and remotely without instructor availability and classroom space limitations. Findings address a gap in the literature and offer vital information about VPS as a potential alternative for developing CJ and promoting practice readiness among prelicensure nursing students.

Conceptual Framework

Theoretical Underpinning

The Tanner Clinical Judgment Model (TCJM), based on over 200 studies, investigated nurses' thinking in practice (Tanner, 2006; Appendix A). Clinical judgment is based on experience, patient knowledge, situational context, reasoning patterns, and reflection (Tanner, 2006). The four phases of the TCJM (Tanner, 2006) are presented in a recurring pattern and serve as this study's underpinning. Tanner (2006) postulated that CJ is (1) influenced by what nurses bring to the situation rather than acquired objective data, (2) sound CJ requires knowing and engaging with the patient and understanding their typical response patterns, (3) CJ is influenced by situational context and the culture of the unit, (4) nursing patterns are used alone or in combination, and (5) a breakdown in CJ triggers reflection, necessary for the development of clinical knowledge and improvement of clinical reasoning. Nurses' background knowledge, attitudes, and experiences shape the approach to managing patient care and precede the four phases of the TCJM: *noticing*, *interpreting*, *responding*, and *reflecting* (Tanner, 2006).

The Four Phases of the TCJM

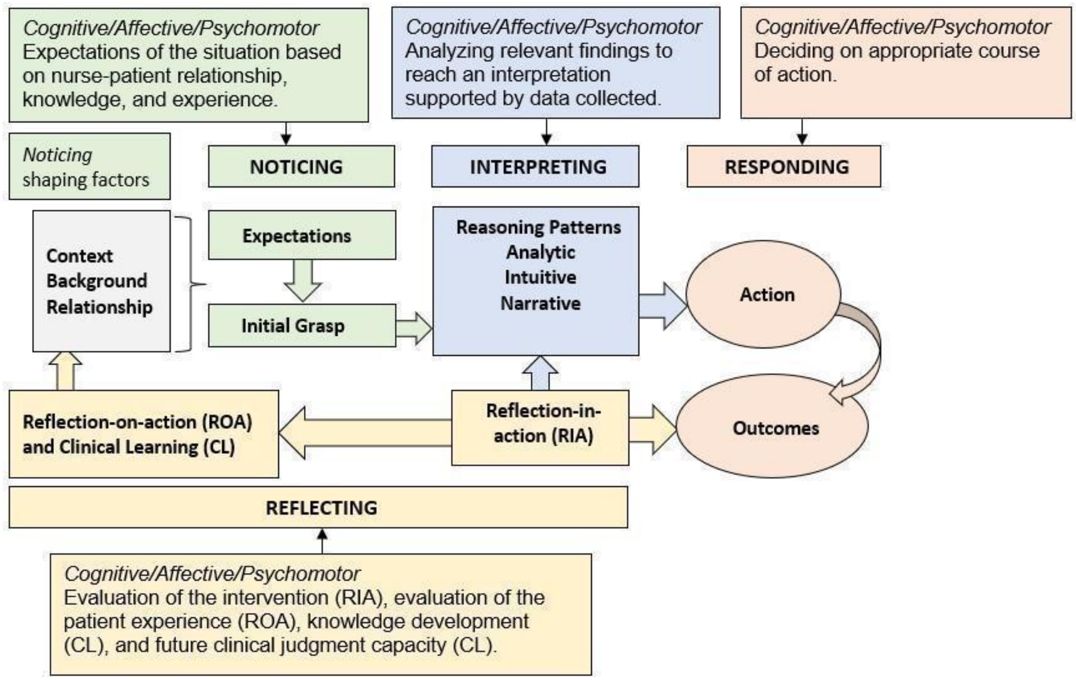
Noticing is influenced by the nurse's expectations about the situation and recognizing cues to understand patients' risks and needs (Jessee, 2021; Lasater, 2007; Tanner, 2006). In this phase, critical thinking is integrated with previous knowledge to recognize deviations from expected patterns shaping the nurse's initial grasp of the situation (Lasater, 2007; Tanner, 2006). The *interpreting* phase builds on the initial grasp and prioritizes cues relevant to the situation (Jessee, 2021). The nurse applies clinical reasoning to interpret the meaning of data, recognize patterns, generate hypotheses, and contemplate options and possible solutions (Jessee, 2021; Lasater, 2007; Tanner, 2006). In the *responding* phase, the nurse decides on a course of action appropriate for the situation (Tanner, 2006). The nurse's decision to act or not to act prevents, manages, or resolves the patient's problem (Jessee, 2021). In the *reflecting* phase, the nurse evaluates their actions based on the patient's response and also reflects on the overall patient care experience. ‘Reflecting-in-action’ means assessing the intervention and making modifications based on the "read" of the patient (Jessee, 2021; Tanner, 2006, p. 209). The nurse also reflects on the outcome of the decision-making process and its effectiveness in achieving sound CJ (Tanner, 2006). 'Reflecting-on-action' is the nurse's evaluation of their knowledge, experience, and reasoning patterns in managing a clinical situation (Tanner, 2006). The TCJM identifies the processes nurses undergo in practice to achieve CJ and represents "thinking like a nurse" (Tanner, 2006, p. 209).

Integration of the Learning Domains to the TCJM

Simulation-based learning provides nursing students opportunities to attain the knowledge, skills, and attitudes needed to learn how to ‘think like a nurse.’ The noticing, interpreting, responding, and reflecting phases serve as a step in the teaching-learning process for developing CJ. The TCJM captures nurses' thinking and reasoning processes that lead to judgments in complex and undetermined clinical situations (Tanner, 2006). As a framework, the TCJM may be used as an instructional guide for developing decision-making skills and gaining clinical knowledge (Tanner, 2006). The TCJM incorporates the four phases needed to obtain CJ, and each one serves as an essential step in the teaching-learning process. The goal of training programs is to support students' transition to the nursing role; however, learning how to be a nurse requires changes in students’ knowledge (cognitive), attitudes (affective), and skill behaviors (psychomotor) (Bastable, 2023). The conceptual model (see Figure 1) integrates the three learning domains (cognitive, affective, and psychomotor) into the TCJM.

Figure 1

Adaptation of the Tanner Clinical Judgment Model with Integration of the Learning Domains



Note: Integration of the three domains (cognitive, affective, psychomotor) and related knowledge, attitude, and skill behaviors. Adapted from *Thinking Like a Nurse: A Research-Based Model of Clinical Judgment in Nursing*, by C. Tanner, 2006, Journal of Nursing Education, 45(6), 204-211. (https://doi.org/10.3928/01484834-20060601-04). Copyright 2006 by Christine Tanner, Ph.D., RN.

The factors that shape the first phase of the TCJM, *noticing*, are based on the nurse's value perspectives, the typical patterns of the unit, previous knowledge, and relationship with the patient. This initial phase influences the nurse's *noticing* of the clinical situation, requiring the three learning domains (cognitive/affective/psychomotor) to understand and take action in a clinical situation. The *noticing* phase is the nurse's initial grasp stemming from their expectations of the situation (cognitive/affective), focused observations (cognitive/affective/psychomotor), recognition of typical responses (cognitive/affective), and collection of relevant data obtained from the patient and family members (cognitive/affective/psychomotor) (Tanner, 2006). This preliminary understanding of the patient's situation leads to the next phase, *interpreting*. In this phase, the nurse interprets data (cognitive), recognizes pattern deviations (cognitive/affective), and acquires further assessments and cues to generate hypotheses about the situation (cognitive/affective/psychomotor) (Tanner, 2006). In the *responding* phase, the nurse decides on a course of action (cognitive/psychomotor), evaluates the patient's response (cognitive/affective), and performs follow-up assessments (cognitive/psychomotor) (Tanner, 2006). The *responding* phase leads to the *reflecting* phase, which includes *reflection-in-action* and *reflection-on-action*. The nurse *reflects-in-action* and "reads" the patient's response to the intervention and make adjustments as needed based on assessment (cognitive/affective/ psychomotor) (Tanner, 2006, p. 209). Interventions requiring adjustments or a breakdown in the expected outcomes lead the nurse back to the interpreting phase to engage in the further appraisal of the patient's condition and readjust interventions based on the patient's response (cognitive/affective/psychomotor) (AL Sabei & Lasater, 2016; Tanner, 2006). After the patient care experience, the nurse *reflects-on-action* to evaluate their knowledge, experience, critical thinking, and clinical reasoning processes that led to the outcomes resulting from their actions (cognitive/affective) (Tanner, 2006). The overall reflection of the patient care experience contributes to the nurse's clinical knowledge development and capacity for exercising clinical judgment in future patient situations (Tanner, 2006).

Research Questions and Hypotheses

Research question 1a (R1a): Is there a statistically significant difference between the HFMS group and VPS group in the change of self-perceived CJ total scale score from T1 (pretest) to after each group receives their assigned intervention T2 (posttest) among third-year prelicensure nursing students, controlling for previous experience in Healthcare and Virtual Technology (VT) and Age?

Hypothesis 1a (H1a): There is a statistically significant difference between the HFMS group and VPS group in the change of self-perceived CJ total scale score from T1 (pretest) to after each group receives their assigned intervention T2 (posttest) among third-year prelicensure nursing students, controlling for previous experience in Healthcare and VT and Age.

Research question 1b (R1b): Is there a statistically significant difference between the HFMS group and VPS group in the change of self-perceived CJ subscale scores (noticing, interpreting, responding, reflecting) from T1 (pretest) to after each group receives their assigned intervention T2 (posttest) among third-year prelicensure nursing students, controlling for previous experience in Healthcare and VT and Age?

Hypothesis 1b (H1b): There is a statistically significant difference between the HFMS group and VPS group in the change of self-perceived CJ subscale scores (noticing, interpreting, responding, reflecting) from T1 (pretest) to after each group receives their assigned intervention T2 (posttest) among third-year prelicensure nursing students, controlling for previous experience in Healthcare and VT and Age.

Research question 2a (R2a): Is there a statistically significant difference between the HFMS group's change in the self-perceived CJ total scale score from T1 (pretest) to Endpoint (post-HFMS intervention) and the VPS group's change in the self-perceived CJ total scale score from T1 (pretest) to Endpoint (post-VPS and HFMS interventions) among third-year prelicensure nursing students, controlling for previous experience in Healthcare and VT and Age?

Hypothesis 2a (H2a): There is a statistically significant difference between the HFMS group's change in the self-perceived CJ total scale score from T1 (pretest) to Endpoint (post-HFMS intervention) and the VPS group's change in the self-perceived CJ total scale score from T1 (pretest) to Endpoint (post-VPS and HFMS interventions) among third-year prelicensure nursing students, controlling for previous experience in Healthcare and VT and Age.

Research question 2b (R2b): Is there a statistically significant difference between the HFMS group's change in the self-perceived CJ subscale scores (noticing, interpreting, responding, reflecting) from T1 (pretest) to Endpoint (post-HFMS intervention) and the VPS group's change in the self-perceived CJ subscale scores (noticing, interpreting, responding, reflecting) from T1 (pretest) to Endpoint (post-VPS and HFMS interventions) among third-year prelicensure nursing students, controlling for previous experience in Healthcare and VT and Age?

Hypothesis 2b (H2b): There is a statistically significant difference between the HFMS group's change in the self-perceived CJ subscale scores (noticing, interpreting, responding, reflecting) from T1 (pretest) to Endpoint (post-HFMS intervention) and the VPS group's change in the self-perceived CJ subscale scores (noticing, interpreting, responding, reflecting) from T1 (pretest) to Endpoint (post-VPS and HFMS interventions) among third-year prelicensure nursing students, controlling for previous experience in Healthcare and VT and Age.

Chapter Summary

Critical thinking and clinical reasoning are terms used interchangeably. However, based on the Tanner Clinical Judgment Model, these terms describe the nursing phases used to reach a decision or clinical judgment. The Next Generation NCLEX state board exam tests nursing students' ability to make safe and competent decisions in various patient care situations. Based on the Tanner Clinical Judgment Model, nursing programs seek the most effective teaching modalities in teaching and learning clinical judgment. High-fidelity mannequins can be cost- and time-prohibitive for nursing programs. Virtual simulation offers the ease and accessibility desired by digital native students. However, further research is needed to examine the impact of virtual patient simulation on education. Four research questions and hypotheses investigated the VPS modality further and studied its effects as a stand-alone simulation approach and primer for fostering clinical judgment.

Chapter 3: Methodology

Introduction

Chapter 3 provides an overview of the study's methodology, including its design, sample, measurement, procedure, and statistical analyses. The research design section includes the sample with inclusion and exclusion criteria, sample size, and setting. The procedure section comprises the delivery of the simulation activities and data collection protocol, instruments, and measures. The statistical analyses section explains the related statistical tests used for data analyses.

Research Design

A quasi-experimental design with repeated measures was used to examine the levels of self-perceived CJ with pre- and post-simulation interventions among third-year undergraduate nursing students attending a university in the southwest of the United States. A repeated measures design is appropriate because the design compares self-perceived CJ at three different time points (T1, T2, and T3; Polit & Beck, 2010). Repeated measures identify the changes in self-perceived CJ before participants receive a simulation activity at T1 and after the simulation activity at T2 for the HFMS group and T2 and T3 for the VPS group. This design identifies changes in self-perceived CJ across two to three time periods during the study. A quantitative approach is appropriate because self-perceived CJ compares students in the HFMS (control) and VPS (intervention) groups. The summer semester cohort served as the control group and received HFMS scenarios. The fall semester cohort served as the intervention group and received both VPS and HFMS scenarios. Due to participant scheduling constraints, a quasi-experimental approach using a non-random assignment was used.

Sample

A convenience sampling of N = 96 third-year undergraduate nursing students in a bachelor's nursing course were recruited for this study. Participant inclusion criteria were: (1) 18 years or older, (2) enrolled in the third year of the bachelor's nursing program, and (3) enrolled in the Nursing Care of Older Adults course. Participants were excluded if they were (1) dropped from the program, (2) could not attend the instructor-assigned HFMS session, or (3) were unable to complete the VPS scenarios.

A series of a priori power analyses were conducted using G*Power 3.1.9.7 (Buchner et al., 2022). Among the four proposed statistical tests, one for each of the main hypotheses, the mixed MANCOVA for testing H1b and H2b required a larger total sample size (N = 52; n = 26 per group) to yield a power of 0.8 or above at .05 alpha level with an estimated effect size (EF) of f = 0.4 (Luo et al., 2021). The actual sample size was N = 96, with power above .97 at a .05 alpha level. With everything else remaining the same, the sample size N = 96 yielded a power above .99 for H1a and H2a.

Setting

The HFMS component of the study was delivered in a clinical simulation center at the university where the program was offered. The HFMS scenarios were delivered in a high-fidelity simulation suite of five classrooms and two debriefing rooms. The classrooms assigned for each HFMS scenario were based on scheduling availability and set-up by the program's simulation technician. Each participant was assigned and completed the VPS scenarios remotely via the vSim® for Nursing by Laerdal platform. Participants accessed the scenarios from any location of their choice with internet connectivity. One of the benefits of VPS is its remote accessibility as an online asynchronous platform (Brown et al., 2021). There is an increasing trend in students using digital learning interventions at home (Kononowicz et al., 2019). Virtual simulation environments offer location flexibility (Coyne et al., 2021; Duff et al., 2016) and a convenient approach to learning outside the school environment (Chen et al., 2022). Extant research has found that student learning using computer-based interactive simulation in a formal classroom is equivalent to an informal environment such as a home or remote location (Makransky et al., 2019). Virtual simulation creates worlds with representations of real-life scenes and scenarios that foster a feeling of "being there" (Slater et al., 1994) or presence regardless of the physical location (Makransky et al., 2019). Reducing geographical barriers grants students access to learning strategies that bridge the gap between classroom and practice (Richardson et al., 2021). Therefore, to increase the external validity and generalizability of the findings to the population, the participants accessed and completed the VPS scenarios remotely via personal computers.

Measurement

Sociodemographic Survey

The sociodemographic survey (Appendix E) includes participants' gender, age, race, ethnicity, current educational level, previous work or volunteer Healthcare experience, and previous VPS and VT experience.

Lasater Clinical Judgment Rubric (LCJR)

The LCJR (Appendix B) assessment is based on the TCJM and measures the four phases (noticing, interpreting, responding, reflecting) of the TCJM (Lasater, 2007) and the development of CJ. The rubric has been used as a self-assessment for simulation performance (Kubin & Wilson, 2017; Mariani & Lengetti, 2021; Miraglia & Asselin, 2015; Strickland et al., 2017) in virtual simulation (Fogg et al., 2020; Hudder et al., 2021; Luo et al., 2021; Rim & Shin, 2022).

The LCJR comprises four domains and 11 subscales (Hudder et al., 2021; Lasater, 2007). Each domain has two to four subscales with a score range between 1 to 4 points: (1) *beginning,* (2) *developing,* (3) *accomplished,* and (4) *exemplary* (Fogg et al., 2020; Victor-Chmil & Larew, 2013). The lowest score of 1 point is the beginning level, and the highest score of 4 points is the exemplary level. The total score ranges between 11 and 44 points. The *noticing* domain has three subscales with scores ranging between 3 and 12 points. The subscales are focused observation, recognizing deviations from expected patterns, and information seeking (Lasater, 2007). One sample item representing this domain is "focuses observation appropriately; regularly observes and monitors a wide variety of objective and subjective data to uncover any useful information" (Lasater, 2007, p. 500). The *interpreting* and *reflecting* domains have two subscales, each with scores ranging between 2 and 8 points. The subscales for the *interpreting* domain include prioritizing data and making sense of data, and for the reflecting domain, evaluation/self-analysis and commitment to improvement (Lasater, 2007). A sample item of the *interpreting* domain is "focuses on the most relevant and important data useful for explaining the patient's condition" (Lasater, 2007, p. 500). A sample item of the *reflecting* domain "independently evaluates and analyzes personal clinical performance, noting decision points, elaborating alternatives, and accurately evaluating choices against alternatives" (Lasater, 2007, p. 501). The *responding* domain has four subscales with scores ranging between 4 and 16 points. The subscales for this domain are calm/confident manner, clear communication, well-planned intervention/flexibility, and being skillful (Lasater, 2007). A sample item of the *responding* subdomain is "assumes responsibility; delegates team assignments; assesses patients and reassures them and their families" (Lasater, 2007, p. 500). A total scale score of 11 points represents a *beginning* level of CJ, a score between 12 and 22 represents a *developing* level of CJ, a score between 23 and 33 points represents an *accomplished* level of CJ, and a score between 34 and 44 points represents an *exemplary* level of CJ (Victor-Chmil & Larew, 2013).

Cronbach's alpha was used to measure the internal consistency reliability of the Lasater Clinical Judgment Rubric. Studies addressing the reliability of the LCJR have shown very good reliability estimates (Johnson & Morgan, 2016), with internal consistencies for the overall measurement ranging between 0.82 (Cazzell & Anderson, 2016) and 0.974 (Adamson, 2011; Mariani et al., 2013), and between 0.88 and 0.931 for each of the four domains (Gubrud-Howe, 2008; Jensen, 2013). A study with test-retest reliability showed an intraclass correlation of 0.908 [ICC 3, 1] (Adamson & Kardong-Edgren, 2012), indicating excellent reliability (Koo & Li, 2016). Construct validity studies demonstrate the LCJR can differentiate between the four domains

(Adamson, 2011; Sideras, 2007) and between groups (Sideras, 2007). Construct validity was also established during the development of the tool by a highly qualified and diverse group of consultants who evaluated the descriptors of CJ used in the LCJR (Lasater, 2007; Sideras, 2007).

Controlling for Independent Variables

The empirical data showed that 98% (*N* = 94) of the participants had previous VPS experience and was not included in further analyses. Healthcare experience, VT experience, and Age (measured in years) were statistically controlled and included in the analytical model. Healthcare experience significantly correlates with CJ (Manetti, 2018), and technology experience has demonstrated a moderate correlation with students perceived ease of use using a virtual program (Padilha et al., 2018). Further analysis using a chi-square of independence showed an association between Age and study group.

Simulation Length and Frequency

A subgroup analysis of 12 randomized controlled trials related to virtual simulation found that virtual simulation was more effective in promoting clinical reasoning when studies implemented multiple scenarios greater than 30 minutes per scenario (Sim et al., 2022). Studies also found that the reliability and validity of assessment using HFMS were best when multiple scenarios were delivered (Shin et al., 2015). Simulation-based scenarios delivered via mannequin or virtually focused on building skills must be repeated more than once to achieve learning objectives (Bryant et al., 2020). Based on the literature and findings, the HFMS and VPS study groups received three scenarios based on diabetes, acute ischemic stroke, and gastrointestinal bleeding content to ensure participants had sufficient patient care experiences to complete the LCJR.

Procedure

The study was administered in a required gerontology course offered every semester to a new cohort of students where participation in simulation sessions meets clinical hours. The student investigator (SI) was in the classroom for the student's first scheduled class during the first week of the summer and fall semesters. Each potential participant received a Participation Folder with the following documents:

- Informed Consent (Appendix C)
- Email Address Consent form (Appendix D)
- Sociodemographic Survey Scantron (Appendix E)
- Pretest measurement (Appendix F)
- Instructions for Accessing vSim® for Nursing by Laerdal Online (Appendix G)
- Posttest measurement with a Qualtrics link and QR code (T2; Appendix H)
- Posttest measurement with a Qualtrics link and QR code (T3; second posttest measurement for the VPS group only; Appendix I)

The inside of each folder had a written number ranging between 100 and 299. The number was used to identify the class cohort and ensure the correct matching of scores between the pretest and posttest measurements. Folders created for the HFMS group (summer cohort) had numbers ranging from 100 to 199. Folders created for the VPS group (fall cohort) had numbers ranging from 200 to 299. The same assigned number was written on the Informed Consent, sociodemographic survey scantron, pretest, and posttest measurements. The assigned participant identification numbers were arbitrary and not personal identifiers. The pretest and posttest titles differentiated the measurements for comparison analysis between the different periods. The pretest measurement served as T1; the first posttest was T2, and the second posttest was T3 (only for the VPS group).

The SI (Student Investigator) created a roster using an Excel spreadsheet listing the assigned numbers for the HFMS and VPS groups. Participants also consented to provide their school email addresses so the SI could send posttest reminders. Once students consented to participate in the study, the participants' first and last names and email addresses were added to the spreadsheet and linked to their assigned identification numbers. Email addresses were used to send participants reminders to complete the online posttest measurement(s) if they chose to complete it online. A separate spreadsheet tracked pretest and posttest measurements for participants in both membership groups. Email addresses used for the study were discarded immediately after collecting the required data.

Recruitment, Informed Consent, and Collection of Pre-Intervention Data

In Week 1, the SI introduced the study to potential participants in each Nursing Care of Older Adults class session (see Figure 2). The SI presented the study to potential participants at the start of the first class session and 30 minutes later to the second class session in their assigned classroom. The SI administered a Participation Folder to all potential participants and discussed each document in the Participation Folder. Each student received an Informed Consent Form identifying the activity as research, the purpose of the study, inclusion criteria, a brief description of the study procedure, location of the study, approximate time commitment, compensation details, and the SI and PI contact information. Participants were given time to read the informed consent form, and the SI addressed questions and obtained consent. Participants in the control (HFMS) and intervention (VPS) groups consented to have their pretest and posttest responses used for analysis after completing the assigned simulation sessions. A two-minute introduction video describing the pretest measurement and instructions for completing the LCJR were presented to the participants. After the presentation, participants were allowed to ask questions from the SI.

The program director and course instructors approved the novel intervention as an activity instead of a course-scheduled virtual clinical activity assigned to all students. Completing the novel simulation did not add more time than what is already scheduled for students enrolled in this course to complete. The novel simulation was an alternative to one of the virtual activities already planned for the course. Completing the VPS scenarios received the same credit as one of the assigned virtual clinical activities planned for the course. Participants who withdrew from the study or chose not to complete the VPS scenarios were required to complete the planned virtual clinical activity for the course. Participants completed the sociodemographic survey scantron after the SI collected the consent forms. The scantron took approximately five minutes to complete. The survey was in scantron format to improve the accuracy of data collection, limit manual data extraction, and export data to SPSS for analyses. The SI collected the completed surveys, followed by instructions to complete the pretest measurement (T1) via paper and pencil. Participants selected only one descriptor for each of the 11 subscales. Participants could choose not to select a response for a subscale category. The SI collected the completed pretest measurements.

Remark Office OMR Software scanned the Sociodemographic Survey scantrons to collect and analyze data. Once all scantrons were collected, they were scanned using an existing scanner that could read the Remark Office OMR (Optical Mark Recognition) font and allowed the reading of any “fill-in-the-bubble” type forms (Remark, 2023). Responses were read by the software and converted to usable data for export into Excel or SPSS spreadsheets (Remark, 2023).

Administering Simulation Activities

HFMS (Control) Group

The course instructor scheduled participants in both sections to attend one HFMS session on Wednesday, Thursday, or Friday of the third week of the semester (see Figure 2). The sessions were scheduled in the morning and afternoon on each of the three days, and participants attended their assigned HFMS session based on a previously scheduled clinical calendar. The sessions were delivered in the UNLV Clinical Simulation Center High-Fidelity Simulation Suite and Debriefing Rooms by the course instructor, adjunct clinical instructors, and simulation technicians. The HFMS scenarios assigned for each session were developed by the course instructor and were related to acute onset diabetes mellitus with urinary tract infection, acute ischemic stroke, and gastrointestinal bleeding. Each instructor was responsible for facilitating and delivering the HFMS scenarios, and each scenario was approximately 45 minutes to one hour long. The sequenced delivery of the HFMS scenarios varied due to the availability of technicians, the simulation schedule, and the number of scheduled sessions in the simulation lab. The HFMS scenarios were not sequenced by complexity; each included a pre-briefing, delivery of the HFMS scenario and a debriefing at the scenario's conclusion.

VPS (Intervention) Group

All participants received an email at the end of the first week with instructions (Appendix G) for registering to the vSim® for Nursing by Laerdal platform, a code to access the scenarios, the SI's contact information, a Qualtrics link, and a QR code for completing the posttest measurement online after completing the third VPS scenario. Participants were assigned a vSim Video Tutorial and three VPS scenarios beginning Monday of Week 2 through Monday of Week 3 (see Figure 2). The video tutorial and VPS scenarios were accessible via personal computers. The video tutorial was approximately 14 minutes long, and each scenario was approximately 30 minutes to one hour. To minimize possible confounding variables, the VPS scenarios assigned to the participants were similar in number and content to the HFMS scenarios assigned and delivered to the control group. The content for the three VPS scenarios consisted of diabetes mellitus with hypoglycemia, acute ischemic stroke, and gastrointestinal bleeding. The sequence of VPS scenario completion varied by the participant and was not assigned in sequence or order of complexity. Participants completed the following components of the vSim scenarios: 1) Suggested Readings, 2) Pre-Simulation Quiz, 3) vSim, 4) Post-Simulation Quiz, and 5) Guided Reflection Questions.

The Suggested Readings section offered the situation, background, assessment, and recommendation. The section provided links to diseases and conditions, drugs, procedures, and clinical practice guidelines associated with the patient scenario in preparation for the vSim. The Pre-Simulation Quiz was a short quiz with questions to test the learner’s knowledge of the patient scenario. Upon submitting the quiz, the student received a report identifying the time to complete the quiz, the number of questions answered correctly and incorrectly, and rationales for all questions. Selecting the vSim tab launched the simulation for the selected patient scenario. The virtual patients and nurses appeared as avatars, and the learner assumed the nurse's role in caring for the patient. As the nurse, the learner could perform virtual actions related to patient safety, communication, assessments, and administering medications. Upon the conclusion of the vSim scenario, the student received a debriefing report with a simulation score and a list of actions performed during the scenario. The debriefing report identified correct actions as well as improvement tips. The Post-Simulation Quiz posed scenario questions related to assessments and interventions. Once the participant submitted the quiz, the learner received a report similar to the Pre-Simulation Quiz. The Guided Reflection Questions were completed independently to reinforce participants' learning experience.

Collection of Post-Intervention Data

HFMS (Control) Group

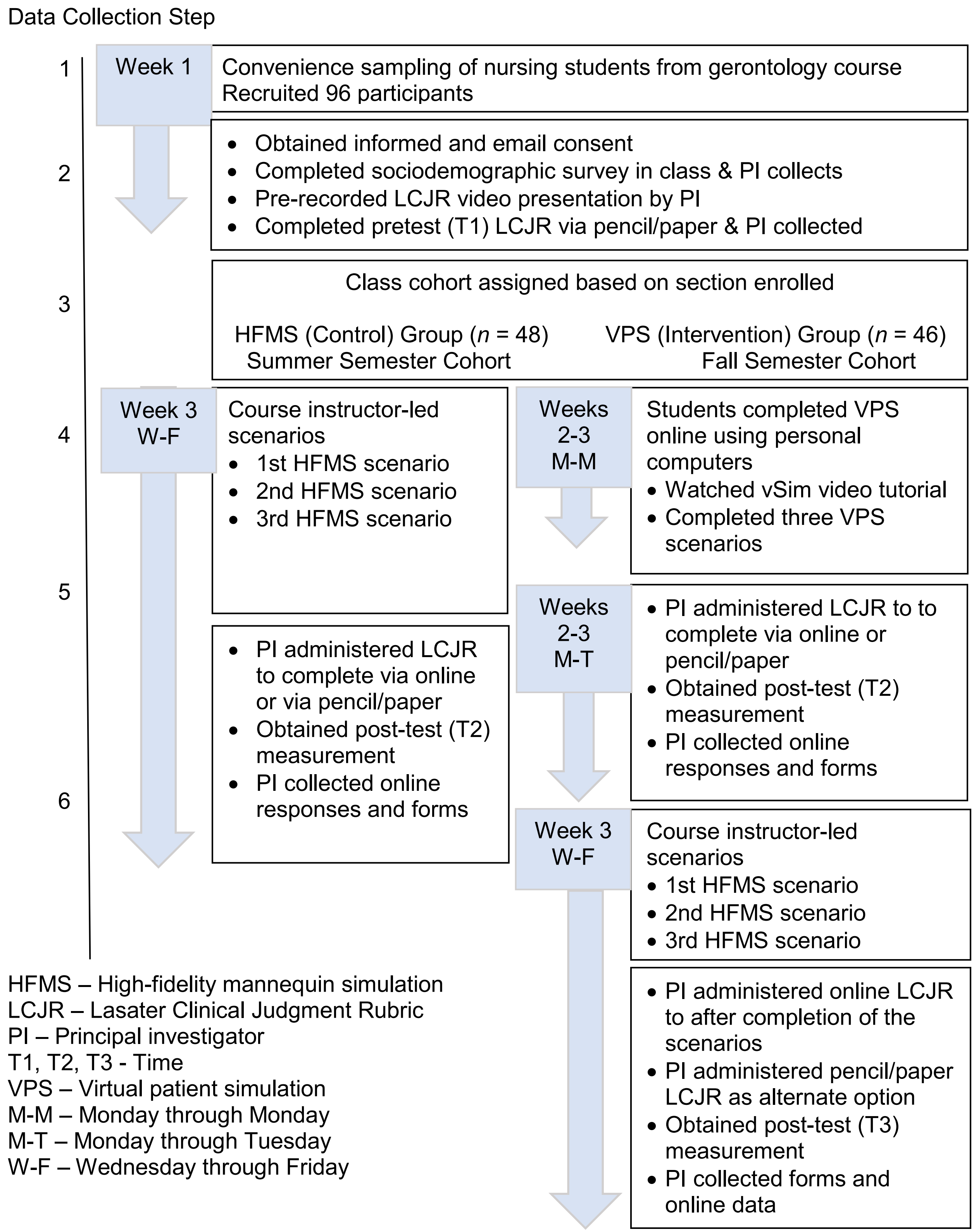
In Week 3, the SI was in person in the simulation lab on Wednesday, Thursday, and Friday. Immediately after participants completed the HFMS scenarios on Wednesday, Thursday, or Friday, the SI met them in a separate debriefing room to complete the posttest measurement (T2) using their assigned identification number in their Participation folder (see Figure 2). Participants selected only one descriptor for each of the 11 subscales. Participants could choose not to select a response for a subscale category. Participants also had the option to complete the posttest measurement online via Qualtrics. Participants could use their smartphones to scan the QR code or use their laptops to access the Qualtrics link. The Qualtrics survey had a forced response field for participants to enter their assigned number before completing the measurement. The online posttest measurement had radio buttons for participants to select only one descriptor for each of the 11 subscales. If participants missed a question, a message was displayed, providing the option to go back and complete the missed responses or submit the measurement with missing responses. If the participant did not have their Participation folder with the posttest measurement or did not recall their identification number, the SI had extra copies of the posttest measurement. The SI accessed the roster, matched the participant's name to their assigned number, and wrote their identification number on the posttest measurement or post-it note for the participant to complete online. The SI collected the completed paper posttest measurements.

VPS (Intervention) Group

The SI sent an email reminder during Week 2 to all participants with the SI's contact information, Qualtrics link, QR code to access the posttest measurement (T2), and instructions to complete the measurement using Qualtrics after completing the third VPS scenario (Appendix I). Participants could use their smartphones to scan the Qualtrics QR code or use their laptops to access the link. The Qualtrics survey had a forced response field for participants to enter their assigned number before completing the measurement. Radio buttons led participants to select only one descriptor for each of the 11 subscales. If a question was missed, a message was displayed when the participant attempted to submit the survey and provided the option to go back and complete the missed responses or submit the measurement with missing responses. The SI continued to send follow-up emails during Weeks 2 and 3 to remind participants to complete the vSim Video Tutorial, the three VPS scenarios, and the posttest measurement (T2) via Qualtrics by Tuesday of the third week.

Figure 2

Research Design Schema



HFMS – High-fidelity mannequin simulation
LCJR – Lasater Clinical Judgment Rubric
PI – Principal investigator
T1, T2, T3 - Time
VPS – Virtual patient simulation
M-M – Monday through Monday
M-T – Monday through Tuesday
W-F – Wednesday through Friday

Administering Second Simulation Activity

VPS (Intervention) Group

Starting Wednesday of Week 3, participants in the VPS group attended their instructor-led HFMS session on either Wednesday, Thursday, or Friday of the third week (see Figure 2). The sessions were scheduled in the morning and afternoon on each of the three days, and participants attended their assigned HFMS session based on a previously scheduled clinical calendar. The sessions were delivered in the UNLV Clinical Simulation Center High-Fidelity Simulation Suite and Debriefing Rooms by the course instructor, adjunct clinical instructors, and simulation technicians. The HFMS scenarios assigned for each session were the same as those delivered to the HFMS (control) group, and the content was related to acute onset diabetes mellitus with urinary tract infection, acute ischemic stroke, and gastrointestinal bleeding. Each instructor was responsible for facilitating and delivering the HFMS scenarios, and each scenario was approximately 45 minutes to one hour long. The sequenced delivery of the HFMS scenarios varied due to the availability of technicians, the simulation schedule, and the number of scheduled sessions in the simulation lab. The scenarios were not sequenced by complexity.

Collection of Post-Intervention Data

In Week 3, the SI was in person in the simulation lab on Wednesday, Thursday, and Friday. Immediately after participants completed the HFMS scenarios on Wednesday, Thursday, or Friday, the SI met them in a separate debriefing room to complete the posttest measurement (T3) using their assigned identification number (see Figure 3) in their Participation folder. Participants could complete the posttest measurement (T3) online via Qualtrics or paper/pencil. Participants could use their smartphones to scan the Qualtrics QR code or use their laptops to access the link. The Qualtrics survey had a forced response field for participants to enter their assigned number before completing the measurement. Radio buttons led participants to select only one descriptor for each of the 11 subscales. If a question was missed, a message was displayed when the participant attempted to submit the survey and provided the option to go back and complete the missed responses or submit the measurement with missing responses. The SI had extra copies of the posttest measurement for paper/pencil completion. Participants selected only one descriptor for each of the 11 subscales. Participants could choose not to select a response for a subdomain category. If the participant did not have their Participation folder or could not recall their identification number, the SI accessed the roster, matched the participant's name to their assigned number, and wrote their assigned number on another posttest measurement or a post-it note for the participant to complete online. The SI collected the completed paper posttest measurements.

Figure 3

Repeated Measures Nonequivalent Quasi-experimental Notation

	T1		T2		T3
N_S	O_1	X_1	O_2		
N_F	O_1	X_2	O_2	X_1	O_3

Time →

Note:
N_S - non-random assignment – Summer semester cohort
N_F – non-random assignment – Fall semester cohort
O_1 – first measurement, O_2 – second measurement, O_3 – third measurement
T1 – pretest, T2 – posttest, T3 – posttest
X1 – HFMS, X2 – VPS

Participants received a boxed lunch after completing each wave of posttest data collection and a $10 UNLV Bookstore gift card after completing the study. Participation in this study also gave participants 30-day free access to 20 virtual simulation scenarios provided by vSim® for Nursing by Laerdal, which could be completed at their leisure. Participation was voluntary and did not affect participants' course grades. Participant data, including outcome measures, were kept confidential and not shared with course instructors. To minimize contamination, participants were instructed not to share their simulation experiences or LCJR responses with the subsequent fall semester nursing cohort. Using two student cohorts in two semesters minimized potential participant sharing. The SI collected data from the sociodemographic survey and pretest and posttest measurements and were only viewed by the SI and PI for statistical analyses. All identifiable information collected from participants was stored in the UNLV Google Drive and kept confidential. Data collected during the study was not shared with course instructors, and data was not linked to any of the participants. The study did not publish participant identifiers used for data collection and analyses.

Statistical Analysis Plan

Descriptive statistics, internal consistency reliability analyses, and confirmatory factor analyses (CFA) were used to examine the psychometric properties of the results. Statistical analyses were conducted using version 29 of the IBM Statistical Package for the Social Sciences (SPSS). The sociodemographic factors were interpreted using means and standard deviations or percentages for continuous and categorical variables for the total sample. Chi-square tests assessed the bivariate association between the categorical demographic variables (i.e., gender, race, ethnicity) and the study group membership (HFMS and VPS). The assumption of normality was examined using a histogram, Q-Q plot, and the Shapiro-Wilk test. All tests were performed at the .05 alpha level. Correlations were analyzed within each time of data collection. A Pearson correlation (*r*) for each study group examined the relationship between the total scale and subscale scores and between subscales scores. Pearson correlation (r) was also used to explore the correlations within each total scale and subscales scores across time. The *R* package "lavaan" Version 4.3.1 was used for the CFA. The goodness-of-fit for the measurement model was assessed with the Chi-square (χ^2) test, Tucker-Lewis Index (TLI), goodness-of-fit index (GFI), normed fit index (NFI), comparative fit index (CFI), root-mean-squared error of approximation (RMSEA), standardized root mean square residual (SRMR), and Tucker Lewis index (TLI).

A mixed ANCOVA examined H1a and H2a where the DV was the self-perceived CJ total scale score, the between-subject factors included study group membership (HFMS vs. VPS), previous experience in Healthcare (Yes vs. No) and VT (Yes vs. No), and Age, and the within-subject factor was Time (pretest vs. posttest). For H1a, analyses were conducted between T1 (pretest) and after each group received their assigned intervention T2 (posttest). For H2a, analyses were conducted between T1 (pretest) and Endpoint (T2 for the HFMS group; T3 for the VPS group).

A mixed MANCOVA examined H1b and H2b where the DV was the self-perceived CJ subscale scores (noticing, interpreting, responding, reflecting), the between-subject factors included study group membership (HFMS vs. VPS), previous experience in Healthcare (Yes vs. No), and VT (Yes vs. No), and Age, and the within-subject factor was Time (pretest vs. posttest). For H1b, analyses were conducted between T1 (pretest) and after each group received their assigned T2 (posttest) intervention. For H2b, analyses were conducted between T1 (pretest) and Endpoint (T2 for the HFMS group; T3 for the VPS group).

Chapter Summary

The self-perceived CJ total scale and subscale scores were assessed using the Lasater Clinical Judgment Rubric at predetermined time points for two study groups. The HFMS (control) group was evaluated at two points, and the VPS (intervention) group was evaluated at three time points. The responses submitted at these time points were assessed using mixed ANCOVA and mixed MANCOVA statistical analyses. The study posed four hypotheses to compare the self-perceived CJ total scale and subscale scores at the pretest and posttest for each study group, controlling for previous experience in Healthcare and VT and Age. The study's research design and hypotheses were to evaluate and compare the differences in the magnitude of change over time by study group for self-perceived CJ total scale and subscale scores among third-year bachelor of nursing prelicensure students. The HFMS (control) group received a mannequin simulation modality, while the VPS (intervention) group received both a virtual and mannequin simulation modality. Evaluating the effects of receiving two different simulation modalities offers a further understanding of VPS's impact as a primer for improving CJ skills.

Chapter 4: Results

Chapter 4 focuses on the results examining the effectiveness of VPS compared to HFMS in acquiring clinical judgment. The chapter describes the sample and the instrument's psychometric characteristics. The analyses also included the results for each of the hypotheses established for this study.

Sample Description

The demographic characteristics of the study sample (*N* = 96) are shown in Table 1. Ninety-five participants completed the sociodemographic survey and pretest LCJR measurement, and 94 completed the study. A majority (81%) of the participants were female (n = 78), and 66% (n = 63) were between the ages of 18 and 22. More than two-thirds of the participants were non-Hispanic (77%, *n* = 74), and 66% (*n* = 63) did not have previous work or volunteer healthcare experience. Those who did have previous healthcare experience (31%, *n* = 30) included caregivers (7%, *n* = 7), nursing assistants (5%, *n* = 5), and medical assistants (3%, *n* = 3). Almost all participants had previous virtual patient simulation (VPS) experience (98%, *n* = 94), and 67% had previous virtual technology (VT) experience (*n* = 64). Sociodemographic variables that were statistically significant between study groups included Age (χ^2 = 18.39, *p* = .001) and previous work/volunteer healthcare experience (χ^2 = 5.24, *p* = .02).

Table 1

Sociodemographic Characteristics of Participants at Baseline and Comparison Between the HFMS and VPS Groups

Baseline Characteristics	HFMS		VPS		Total Sample			
	n	%	*n*	%	*N*	%	χ^2	*p*
Gender							2.06	.36
Female	39	81	39	81	78	81.3		
Male	7	15	8	17	15	15.6		
Prefer not to say	2	4			2	2.1		
Age Groups (yrs.)							18.39	.001***
18 - 22	41	85	22	46	63	65.6		
23 – 26	6	13	12	25	18	18.8		
27 - 30	1	2	5	10	6	6.3		
> 31	0	0	7	15	7	7.3		
Race							5.30	.26
American Indian/ Alaskan Native			2	4	2	2.1		
Asian	18	38	19	40	37	38.5		
Black/African American	7	15	6	13	13	13.5		
White	19	40	13	27	32	33.3		
Mixed Race	3	6	3	6	6	6.3	5.02	.41
Prefer not to say	1	2	4	8	5	5.2		
Ethnicity							1.67	.20
Not Hispanic	40	83	34	71	74	77.1		
Hispanic	8	17	13	27	21	21.9		
Education							.24	.62
Associate degree	5	10	6	13	11	11.5		
Bachelor's degree	21	44	18	38	39	40.6		
No response	22	46	24	50	46	47.9		
Previous work/volunteer healthcare experience							5.24	.02*
No	37	77	26	54	63	65.6		
Yes	10	21	20	42	30	31.3		
No response	1	2	2	4	3	3.1		

Baseline Characteristics	HFMS		VPS		Total Sample			
	n	%	*n*	%	*N*	%	χ^2	*p*
Type of previous work/volunteer healthcare experience								
Caregiver	2	4	5	10	7	7.3		
Hospital Transporter			1	2	1	1.0		
Medical Assistant			3	6	3	3.1		
Monitor Technician	1	2			1	1.0		
Nursing Assistant	4	8	1	2	5	5.2		
Phlebotomist			2	4	2	2.0		
Therapy Aide			1	2	1	1.0		
Other	4	8	13	27	17	17.7		
Number of months of work/volunteer healthcare experience							9.30	.10
1 - 6	3	6	6	13	9	9.4		
7 - 12	2	4	5	10	7	7.3		
13 -18	2	4	1	2	3	3.1		
19 -24	2	4	1	2	3	3.1		
> 25	1	2	7	15	8	8.3		
Previous VPS experience[a]							1.03	.31
No			1	2	1	1.0		
Yes	48	100	46	96	94	97.9		
Previous VT experience[b]							.02	.88
No	16	33	15	31	31	32.3		
Yes	32	67	32	67	64	66.7		

Note: *N* = 95 (*n* = 48 for the HFMS group and *n* = 47 for the VPS group).

$^*p < .05$, $^{***}p < .001$.

Correlations Between Study Variables

Pearson Correlation

Pearson correlation (r) examined the strength and direction of the relationship between the total scale and subscale scores, between the subscale scores, and within each time of data collection (see Tables 2 and 3).

For the HFMS group, the inter-subscale correlations were significant and ranged between .43 to .61 ($p < .05$ and $p < .001$) within T1 and .44 to .69 ($p < .05$ and $p < .001$) within T2. The relationship between the pretest and posttest scale scores was also significant, showing that participants who scored higher at T1 (pretest) tended to also score higher at T2 (posttest). The bivariate correlations between each of the subscale scores and the total scale score at T1 ranged from .74 and .87 ($p < .001$), and the bivariate correlations between each of the subscale scores and the total scale score at T2 ranged between .74 and .91 ($p < .001$). The bivariate correlation between the total scale score at T1 and T2 was .34 ($p = .017$). Bivariate correlations were also significant at the .05 level between T1 and T2 for the noticing ($r = .30$) subscale and at the .01 level for the responding ($r = .39$) subscale.

Table 2

Descriptive Statistics and Correlations of Study Variables for the HFMS Group

Variable	*M*	*SD*	1	2	3	4	5	6	7	8	9	10
Pretest (T1)												
1. Total LCJR	30.47	3.99	-									
2. Noticing	8.10	1.15	.80***	-								
3. Interpreting	5.25	.86	.76***	.44**	-							
4. Responding	11.23	1.81	.87***	.55***	.61***	-						
5. Reflecting	5.96	1.10	.74***	.55***	.48***	.43**	-					
Posttest (T2)												
6. Total LCJR	34.08	4.61	.34*	.27	.14	.32*	.25	-				
7. Noticing	9.08	1.51	.32*	.30*	.20	.28	.18	.86***	-			
8. Interpreting	5.92	1.07	.24	.18	.09	.17	.23	.78***	.62***	-		
9. Responding	12.29	1.85	.37*	.30*	.09	.39**	.24	.91***	.69***	.59***	-	
10. Reflecting	6.79	1.09	.16	.05	.08	.12	.16	.74***	.48***	.44**	.60***	-

Note. n = 48; The *Lasater Clinical Judgment Rubric* comprises four subscales (noticing, interpreting, responding, and reflecting) and 11 items.

**p* < .05, **p < .01, ****p* < .001.

The inter-subscale correlations for the VPS group (see Table 3) ranged between .38 to .64 ($p < .05$ and $p < .01$) within T1, .46 to .65 ($p < .001$) within T2, and .58 to .77 ($p < .001$) within T3. The bivariate correlations between each of the total scale score and subscale scores ranged from .65 and .92 ($p < .001$) at T1, .72 and .88 ($p < .001$) at T2, and .81 and .94 ($p < .001$) at T3. Results also showed significant bivariate correlations between the total scale score at T3 (.38, $p = .01$) and subscale scores (interpreting, .40, $p < .01$; responding, .38, $p < .05$; reflecting, .30, $p < .05$) at T3 except for the noticing subscale (.25, $p = .10$). Significant bivariate correlations between the responding subscale score at T1 and the total scale score at T3 (.42, $p < .01$) and subscales scores (noticing, .31, $p < .05$; interpreting, .44, $p < .01$; responding, .41, $p < .01$; reflecting, .30, $p < .05$) at T3 were also noted. The bivariate correlations were significant between the noticing subscale score at T2 and the total scale score at T3 (.36, $p < .05$). The bivariate correlations between the noticing subscale score at T2 and subscale scores (noticing, .33, $p < .05$; interpreting, .34, $p < .05$; responding, .34, $p < .05$) at T3 were also significant except for the reflecting subscale.

Table 3

Descriptive Statistics and Correlations of Study Variables for the VPS Group

Variable	*M*	*SD*	1	2	3	4	5	6	7	8	9	10
Pretest (T1)												
1. Total LCJR	29.83	4.42	-									
2. Noticing	8.00	1.27	.82***	-								
3. Interpreting	5.26	.98	.72***	.52***	-							
4. Responding	11.09	1.95	.92***	.64***	.54***	-						
5. Reflecting	5.65	1.04	.65***	.47**	.38**	.56***	-					
Posttest (T2)												
6. Total LCJR	30.85	4.46	.06	.01	.05	.12	.05	-				
7. Noticing	8.22	1.41	-.001	-.01	-.01	.06	-.01	.83***	-			
8. Interpreting	5.43	1.03	-.003	-.08	-.07	.05	.08	.83***	.61***	-		
9. Responding	11.22	1.92	.08	.01	.05	.16	-.01	.88***	.58***	.65***	-	
10. Reflecting	5.98	1.06	.11	.11	.19	.08	.15	.72***	.51***	.52***	.46**	-
Posttest (T3)												
11. Total LCJR	35.07	5.20	.38**	.27	.23	.42**	.20	.26	.36*	.24	.14	.13
12. Noticing	9.50	1.55	.25	.18	.20	.31*	.00	.25	.33*	.22	.20	.06
13. Interpreting	6.24	1.14	.40**	.28	.22	.44**	.24	.26	.34*	.33*	.12	.11
14. Responding	12.54	2.13	.38*	.25	.21	.41**	.19	.23	.34*	.21	.11	.11
15. Reflecting	6.78	1.10	.30*	.23	.18	.30*	.32*	.15	.20	.09	.04	.21

Variable	*M*	*SD*	11	12	13	14
Posttest (T3)						
Total LCJR	35.07	5.20	-			
Noticing	9.50	1.55	.87***	-		
Interpreting	6.24	1.14	.85***	.64***	-	
Responding	12.54	2.13	.94***	.73***	.77***	-
Reflecting	6.78	1.10	.81***	.62***	.58***	.71***

Note. n = 48 for T1, n = 46 for T2, n = 46 for T3. The *Lasater Clinical Judgment Rubric* comprises four subscales (noticing, interpreting, responding, and reflecting) and 11 items.

*$p < .05$, **p < .01, ***$p < .001$.

Psychometric Characteristics of the Instrument

Internal Consistency Reliability

The total scale score comprised of 11 items showed high internal consistency reliability at T1 (α = .86) and T2 (α = .89) (Field, 2018). However, the internal consistency reliability for the four subscales (noticing, interpreting, responding, reflecting) ranged between .44 and .76 at T1 and between .52 and .76 at T2 (see Table 4). A Cronbach's alpha value greater than 0.8 indicates a good relationship between the items in each dimension (Field, 2018). The findings showed that the self-perceived CJ total scale score, comprising 11 items, demonstrated high reliability and was consistent with the strong positive correlations between the total scale and subscale scores.

Table 4

Cronbach's Alpha for Self-Perceived Clinical Judgment LCJR Total Scale Score and Subscale Scores at T1 and T2

Scale	*M*	*SD*	Items	Cronbach's α
T1				
Total Scale Score	30.16	4.23	11	.86
Noticing	8.05	1.21	3	.56
Interpreting	5.27	.92	2	.44
Responding	11.15	1.87	4	.76
Reflecting	5.79	1.06	2	.69
T2				
Total Scale Score	32.50	4.79	11	.89
Noticing	8.66	1.52	3	.75
Interpreting	5.68	1.07	2	.52
Responding	11.77	1.95	4	.76
Reflecting	6.39	1.15	2	.72

Note: The *Lasater Clinical Judgment Rubric* comprises four subscales (noticing, interpreting, responding, and reflecting) and 11 items; $N = 94$.

Confirmatory Factor Analysis

Structural equation modeling analyzes the relationship between the variables and latent factors (Brown, 2015). Confirmatory factor analysis (CFA) results showed high interfactor correlations ranging between .81 and .99 (see Table 5). Nearly all variances (66% to 97%) are shared between the factors. Table 6 demonstrates the factor loadings based on the four-factor model, and Table 7 shows the factor loadings based on a single-factor model. The redundancy between the factors does not support a four-factor model; thus, a single-factor model adequately fits the data. As seen in Table 8, the goodness-of-fit indices are similar to those of the four-factor model (Model A) and the single-factor model (Model B). Although Model A has a lower chi-square compared to Model B, a chi-square difference test revealed that the difference in the goodness-of-fit between the two models is not statistically significant (χ^2 Δ = 6.70, *df* = 6, *p* = .35). Therefore, Model B was the most appropriate model due to it being more parsimonious.

Table 5

Confirmatory Factor Analysis Interfactor Correlations for the Lasater Clinical Judgment Rubric Subscales at Pretest (T1)

Subscales	Noticing	Interpreting	Responding	Reflecting
Noticing	1.00			
Interpreting	.96	1.00		
Responding	.91	.99	1.00	
Reflecting	.90	.85	.81	1.00

Note: N = 96.

Table 6

Factor Loadings of the Lasater Clinical Judgment Rubric (Four-Factor Model)

Lasater Clinical Judgment Rubric Item	Factor loading			
	1	2	3	4
1. Focused observation	**.56**			
2. Recognizing deviations from expected patterns	**.53**			
3. Information seeking	**.54**			
4. Prioritizing data		**.54**		
5. Making sense of data		**.53**		
6. Calm, confident manner			**.58**	
7. Clear communication			**.75**	
8. Well-planned intervention/flexibility			**.70**	
9. Being skillful			**.61**	
10. Evaluation/self-analysis				**.75**
11. Commitment to improvement				**.72**

Note. *N* = 96. Factor loadings above .30 are bold (Tavakol & Wetzel, 2020). Adapted from "Clinical Judgment Development: Using Simulation to Create an Assessment Rubric," by Kathie Lasater, 2007, *Journal of Nursing Education, 46*(11), p. 500.

Table 7

Factor Loadings of the Lasater Clinical Judgment Rubric (Single-Factor Model)

Lasater Clinical Judgment Rubric Item	Factor Loading 1
1. Focused observation	**.56**
2. Recognizing deviations from expected patterns	**.50**
3. Information seeking	**.52**
4. Prioritizing data	**.53**
5. Making sense of data	**.53**
6. Calm, confident manner	**.55**
7. Clear communication	**.74**
8. Well-planned intervention/flexibility	**.70**
9. Being skillful	**.57**
10. Evaluation/self-analysis	**.68**
11. Commitment to improvement	**.64**

Note. N = 96*.* Factor loadings above .30 are bold (Tavakol & Wetzel, 2020). Adapted from "Clinical Judgment Development: Using Simulation to Create an Assessment Rubric," by Kathie Lasater, 2007, *Journal of Nursing Education, 46*(11), p. 500.

Table 8

Goodness-of-Fit for the Lasater Clinical Judgment Rubric

Model	$\chi 2$	*df*	GFI	NFI	CFI	RMSEA	SRMR	TLI
A: Four-factor model with oblique rotation[a]	60.59**	38	.92	.82	.92	.08	.06	.89
B: Single-factor model[b]	67.29**	44	.90	.80	.92	.08	.06	.90

Note. N = 96. GFI = goodness-of-fit index; NFI = normed fit index; CFI = comparative fit index; RMSEA = root-mean-squared error of approximation; SRMR = standardized root mean square residual; TLI = Tucker Lewis index. [a] In Model A, the 11 items were loaded into four correlated factors of the Lasater Clinical Judgment Rubric (noticing, interpreting, responding, and reflecting). [b] In Model B, the 11 items of the Lasater Clinical Judgment Rubric (noticing, interpreting, responding, and reflecting) were loaded onto one factor.

** $p < .01$.

Hypotheses Testing

H1a-Group Difference in the Change of Self-Perceived CJ Total Scale Score from T1 (Pretest) to T2

Although results from the mixed ANCOVA showed a significant main effect of Time ($F(1, 85) = 8.28$, $p < .01$, $\eta^2 = .09$; see Table 9) from T1 (pretest) to T2 (after each group received their assigned intervention), a significant interaction of Time by study group was not found. However, results showed a significant Time by Age ($F(1, 85) = 4.90$, $p < .05$, $\eta^2 = .05$) interaction effect, indicating that younger students had a greater increase in the self-perceived CJ total scale score from T1 (pretest) to T2 (after each group received their assigned intervention) compared to older students. The main effect of the study group was also significant ($F(1, 85) = 8.44$, $p < .001$, $\eta^2 = .09$; see Table 9), with the HFMS (control) group scoring higher on average than the VPS (intervention) group on the self-perceived CJ total scale score (see Figure 4).

Table 9

Mixed ANCOVA Comparing the Means at T1 (Pretest) and T2 (Posttest) by Study Group for Self-Perceived CJ Total Scale Score

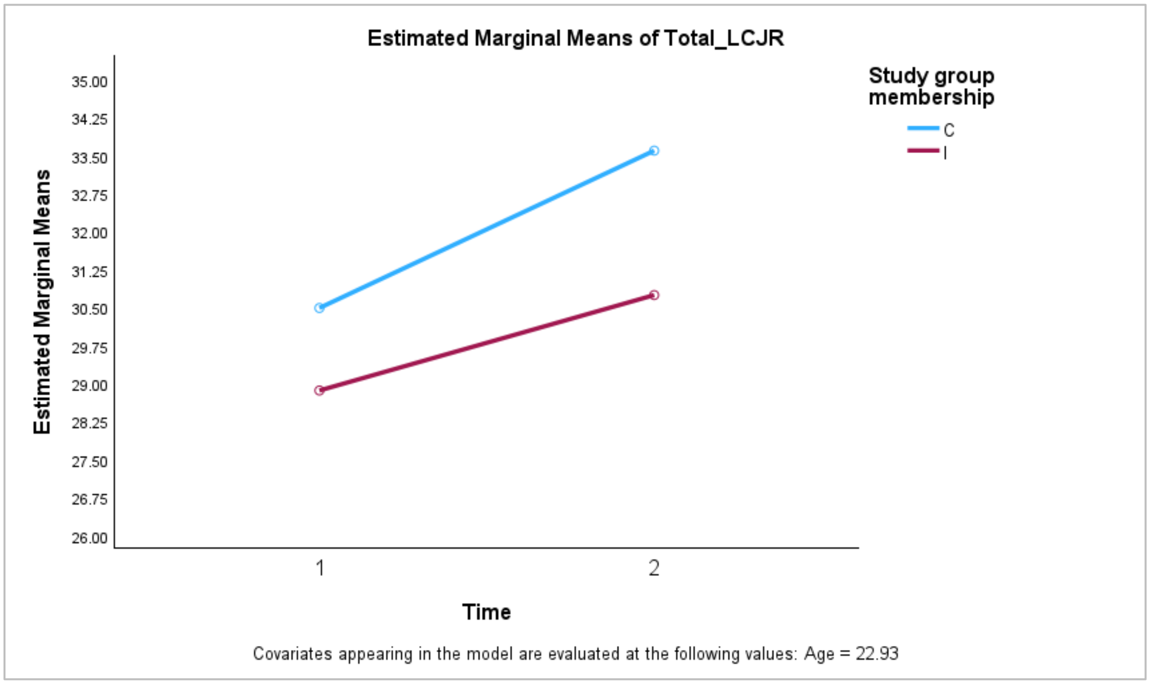
Source	*SS*	*df*	*MS*	*F*	η^2
Within					
Time	118.11	1	118.11	8.28**	.09
Time*Group	13.69	1	13.69	.96	.01
Time*HCExp	8.33	1	8.33	.58	.01
Time*VTExp	12.53	1	12.53	.88	.01
Time*Age	69.82	1	69.82	4.90*	.05
Error (Time)	1212.25	85	14.26		
Between					
Intercept	4385.80	1	4385.80	201.30***	.70
Group	183.89	1	183.89	8.44**	.09
HCExp	25.51	1	25.51	1.17	.01
VTExp	16.40	1	16.40	.75	.01
Age	9.97	1	9.97	.46	.01
Error	1851.95	85	21.79		

Note. $N = 90$. HCExp = Previous work/volunteer healthcare experience; VTExp = Previous virtual technology experience.

*$p < .05$; ** $p < .01$; ***$p < .001$.

Figure 4

Plot of Estimated Marginal Means Comparing the Means at T1 (Pretest) and T2 (Posttest) by Study Group for Self-Perceived CJ Total Scale Score



Note. N = 90 (n = 47 for the HFMS (C-control) group and n = 43 for the VPS (I-intervention) group).

H1b-Group Difference in the Change of Self-Perceived CJ Subscale Scores from T1 (Pretest) to T2

Using Pillai's trace, results from the mixed MANCOVA showed a significant main effect of Time (V = .00, F(4, 81) = 3.00, p < .05, η^2 = .13) from T1 (pretest) to T2 (after each group received their assigned intervention) for the self-perceived CJ subscale scores (noticing, interpreting, responding, and reflecting; see Table 10). Figures 5 through 8 are based on the results of the four mixed ANCOVAs for each self-perceived CJ subscale score, demonstrating the patterns over time between the study groups conducted following significant MANCOVA results. Although a significant interaction of Time by study group was not found, results showed a significant Time by Age (V = .89, F(4, 81) = 2.59, p < .05, η^2 = .11) interaction effect. Mixed ANCOVAs did not show significant increases for the self-perceived CJ noticing (F(1, 84) = 2.91, p = .09, η^2 = .03) and interpreting (F(1, 84) = 1.35, p = .25, η^2 = .02) subscale scores. However, significant increases were observed for the responding (F(1, 84) = 11.07, p < .01, η^2 = .12) and reflecting (F(1, 84) = 4.48, p < .05, η^2 = .05) subscale scores indicating that younger students had a greater increase in the self-perceived CJ responding and reflecting subscale scores from T1 (pretest) to T2 (after each group received their assigned intervention T2) compared to older students. The main effect of the study group was also significant for the self-perceived CJ noticing (F(1, 84) = 5.83, p < .05, η^2 = .07), responding (F(1, 84) = 6.20, p < .05, η^2 = .07), and reflecting (F(1, 84) = 12.28, p < .001, η^2 = .13) subscale scores with the HFMS (control) group scoring higher on average than the VPS (intervention) group in the self-perceived CJ noticing, responding, and reflecting subscale scores.

Table 10

Mixed MANCOVA Comparing the Means at T1 (Pretest) and T2 (Posttest) by Study Group for Self-Perceived CJ Subscale Scores

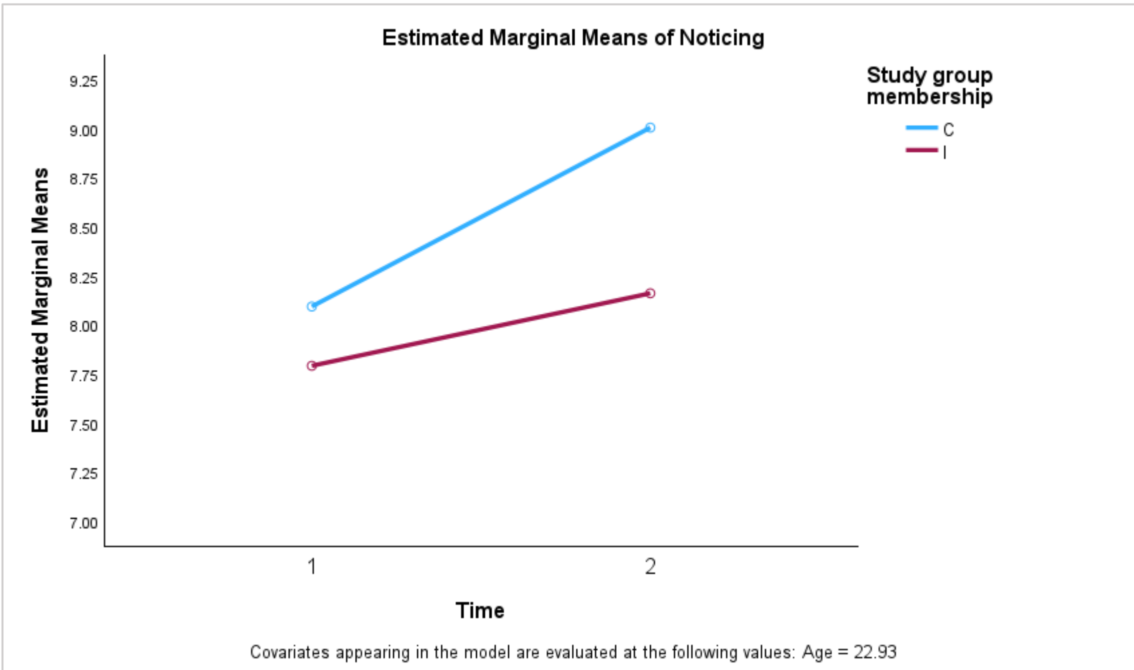
Source	*V*	*F*	*df*	*Error df*	*p*	η^2
Within						
Time	.87	3.00	4	81	.02*	.13
Time*Group	.97	.68	4	81	.61	.03
Time*HCExp	.98	.32	4	81	.86	.02
Time*VTExp	.96	.94	4	81	.45	.04
Time*Age	.89	2.59	4	81	.04*	.11
Between			4	81		
Intercept	.27	54.60	4	81	<.001***	.73
Group	.86	3.31	4	81	.01*	.14
HCExp	.99	.18	4	81	.95	.01
VTExp	.98	.36	4	81	.84	.02
Age	.95	1.17	4	81	.33	.06

Note. $N = 89$. HCExp = Previous healthcare experience; VTExp = Previous virtual technology experience.

$^*p < .05$, $^{***}p < .001$.

Figure 5

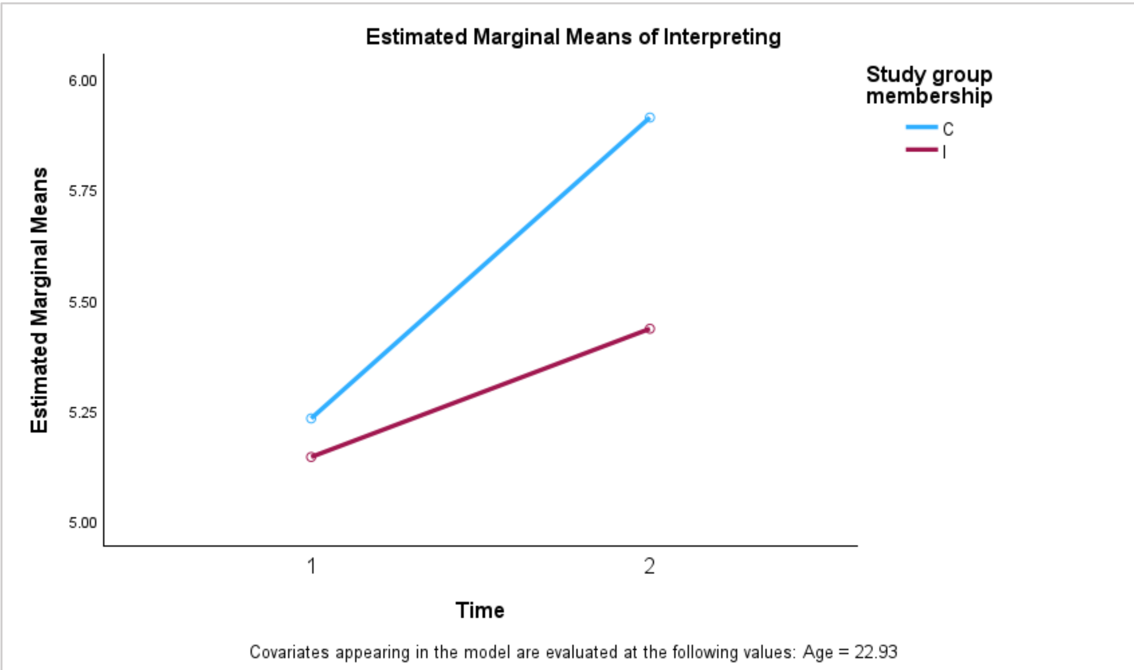
Plot of Estimated Marginal Means Comparing the Means at T1 (Pretest) and T2 (Posttest) by Study Group for Self-Perceived CJ Noticing Subscale Score



Note. *N* = 89 (*n* = 46 for the HFMS (C-control) group and *n* = 43 for the VPS (I-intervention) group).

Figure 6

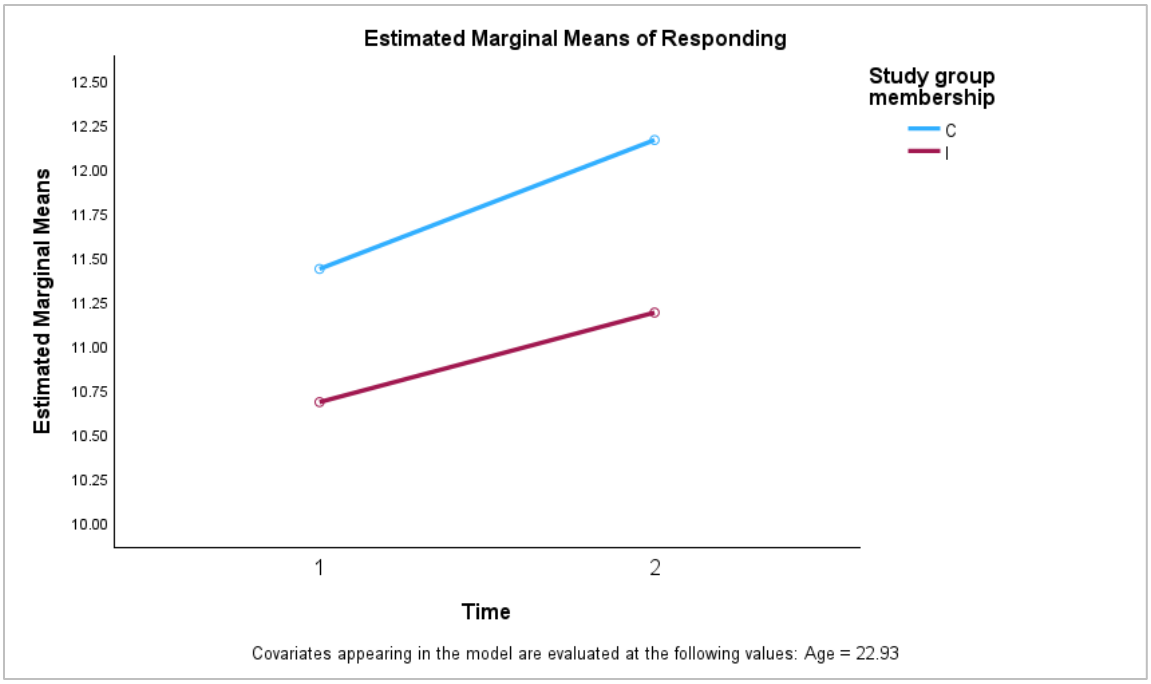
Plot of Estimated Marginal Means Comparing the Means at T1 (Pretest) and T2 (Posttest) by Study Group for Self-Perceived CJ Interpreting Subscale Score



Note. N = 89 (n = 46 for the HFMS (C-control) group and n = 43 for the VPS (I-intervention) group).

Figure 7

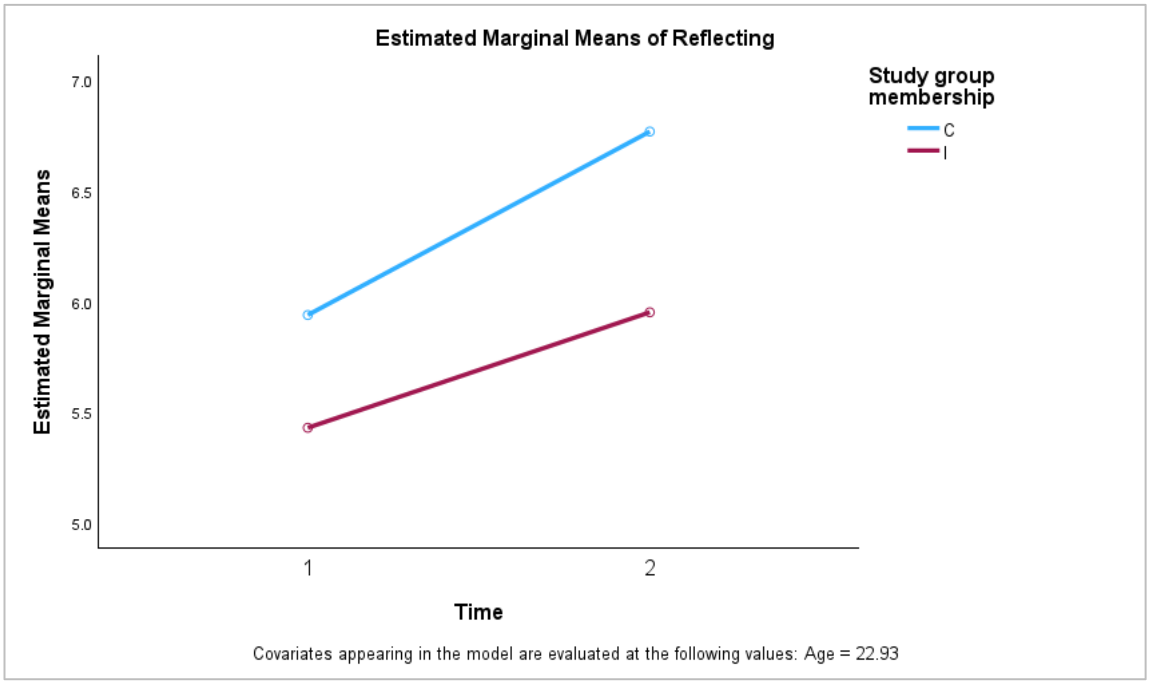
Plot of Estimated Marginal Means Comparing the Means at T1 (Pretest) and T2 (Posttest) by Study Group for Self-Perceived CJ Responding Subscale Score



Note. N = 89 (*n* = 46 for the HFMS (C-control) group and *n* = 43 for the VPS (I-intervention) group).

Figure 8

Plot of Estimated Marginal Means Comparing the Means at T1 (Pretest) and T2 (Posttest) by Study Group for Self-Perceived CJ Reflecting Subscale Score



Note. N = 89 (n = 46 for the HFMS (C-control) group and n = 43 for the VPS (I-intervention) group).

H2a-Group Difference in the Change of Self-Perceived CJ Total Scale Score from T1 (Pretest) to Endpoint

Results from the mixed ANCOVA showed a significant main effect of Time (F(1, 85) = 5.94, $p < .05$, $\eta^2 = .07$) from T1 (pretest) to Endpoint (T2 for the HFMS group and T3 for the VPS group; see Figure 9). Although a significant interaction effect of Time by study group was not found (Table 11), a significant interaction effect of Time by previous VT experience (F(1, 85) = 5.49, $p < .05$, $\eta^2 = .06$) was found with participants who did not have previous VT experience showing a greater increase in the self-perceived CJ total scale score from T1 (pretest) to Endpoint (T2 for the HFMS group and T3 for the VPS group) compared to participants who had previous VT experience.

Table 11

Mixed ANCOVA Comparing the Means Between T1 (Pretest) and Endpoint by Study Group for Self-Perceived CJ Total Scale Score

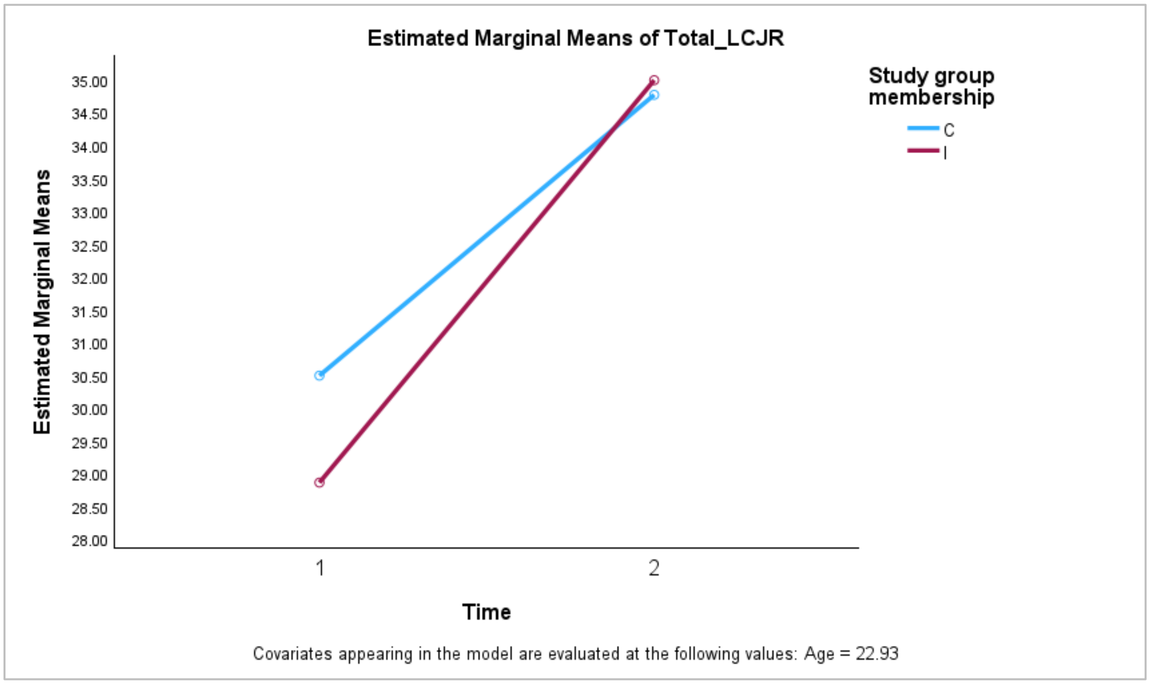
Source	*SS*	*df*	*MS*	*F*	η^2
Within					
Time	75.77	1	75.77	5.94*	.07
Time*Group	31.43	1	31.43	2.47	.03
Time*HCExp	11.46	1	11.46	.90	.01
Time*VTExp	70.03	1	70.03	5.49*	.06
Time*Age	8.88	1	8.88	.70	.01
Error (Time)	1083.69	85	12.75		
Between					
Intercept	4103.97	1	4103.97	148.65***	.64
Group	18.10	1	18.10	.66	.01
HCExp	1.49	1	1.49	.05	.00
VTExp	.61	1	.61	.02	.00
Age	72.84	1	72.84	2.64	.03
Error	2346.70	85	27.61		

Note. $N = 90$. HCExp = Previous work/volunteer healthcare experience; VTExp = Previous virtual technology experience.

*$p < .05$, ***$p < .001$.

Figure 9

Plot of Estimated Marginal Means Comparing the Means Between T1 (Pretest) and Endpoint by Study Group for Self-Perceived CJ Total Scale Score



Note. N = 90. (n = 47 for the HFMS (C-control) group and n = 43 for the VPS (I-intervention) group).

H2b-Group Difference in the Change of Self-Perceived CJ Subscale Scores from T1 (Pretest) to Endpoint

Using Pillai's trace, the results from the mixed MANCOVA did not show a significant Time effect from T1 (pretest) to Endpoint (T2 for the HFMS group and T3 for the VPS group) for the self-perceived CJ subscale scores (noticing, interpreting, responding, and reflecting; see Table 12) or significant interaction effects (see Table 12). Figures 10 through 13 are based on the results of the four mixed ANCOVAs for each self-perceived CJ subscale score and demonstrate the patterns over time between the study groups conducted following the MANCOVA results. Findings did, however, show a significant main effect of the study group for the self-perceived CJ reflecting subscale score ($F(1, 84) = 3.98$, $p < .05$, $\eta^2 = .05$) with the HFMS (control) group scoring higher on average than the VPS (intervention) group. A significant main effect of Age ($V = .87$, $F(4, 81) = 2.96$, $p < .05$, $\eta^2 = .13$) between the groups was also observed for the self-perceived CJ responding ($F(1, 84) = 5.35$, $p < .05$, $\eta^2 = .06$) and reflecting ($F(1, 84) = 4.68$, $p < .05$, $\eta^2 = .05$) subscale scores with younger students scoring higher on average than older students in the self-perceived CJ responding and reflecting subscales.

Table 12

Mixed MANCOVA Comparing the Means Between T1 (Pretest) and Endpoint by Study Group for Self-Perceived CJ Subscale Scores

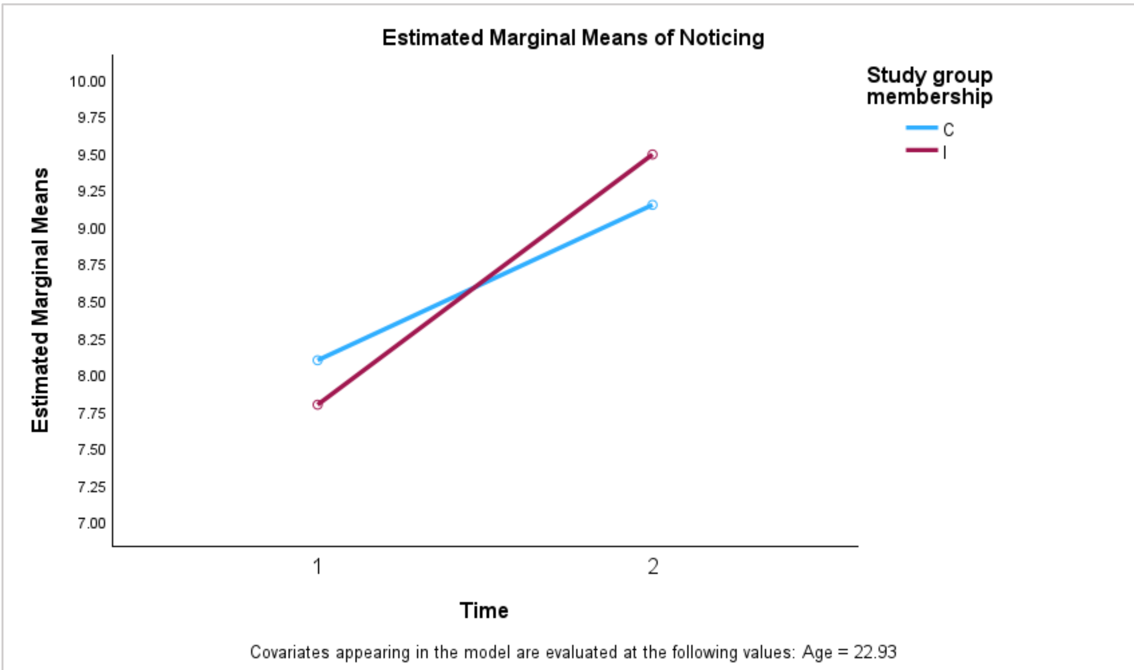
Source	*V*	*F*	*df*	*Error df*	*p*	η^2
Within						
Time	.94	1.39	4	81	.24	.06
Time*Group	.97	.62	4	81	.65	.03
Time*HCExp	.95	1.10	4	81	.36	.05
Time*VTExp	.94	1.31	4	81	.27	.06
Time*Age	.98	.32	4	81	.86	.02
Between						
Intercept	.32	42.44	4	81	<.001***	.68
Group	.89	2.58	4	81	.04*	.11
HCExp	.93	1.64	4	81	.17	.08
VTExp	.97	.59	4	81	.67	.03
Age	.87	2.96	4	81	.03*	.13

Note. $N = 89$. HCExp = Previous healthcare experience; VTExp = Previous virtual technology experience.

*$p < .05$, ***$p < .001$.

Figure 10

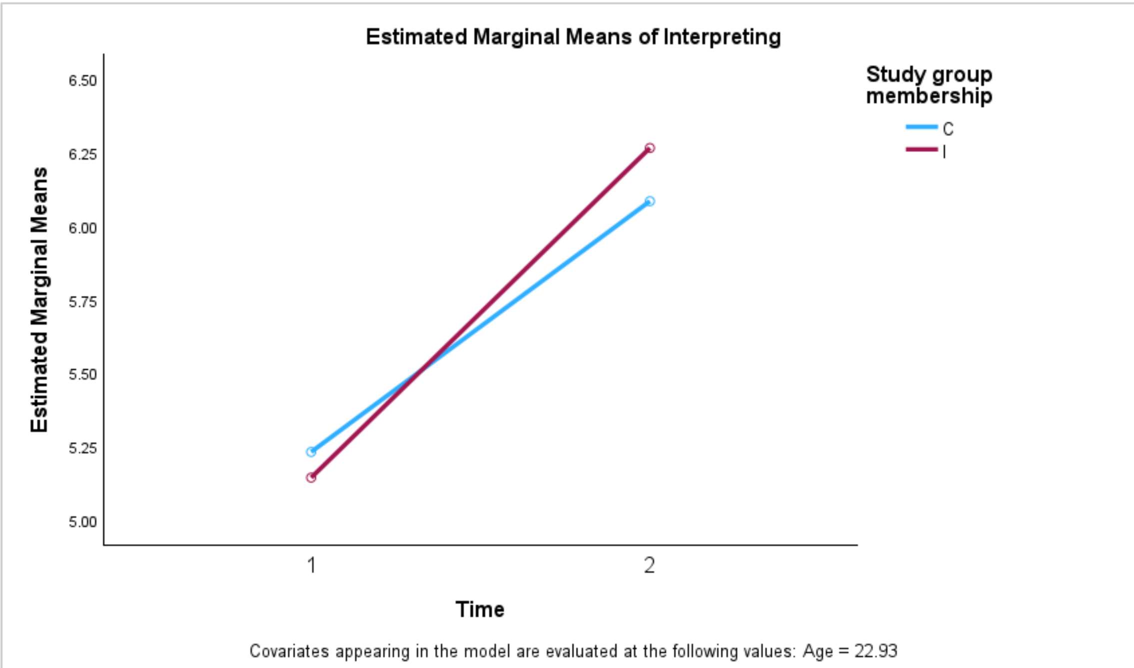
Plot of Estimated Marginal Means Comparing the Means Between T1 (Pretest) and Endpoint by Study Group for Self-Perceived CJ Noticing Subscale Score



Note. *N* = 89. (*n* = 46 for the HFMS (C-control) group and *n* = 43 for the VPS (I-intervention) group).

Figure 11

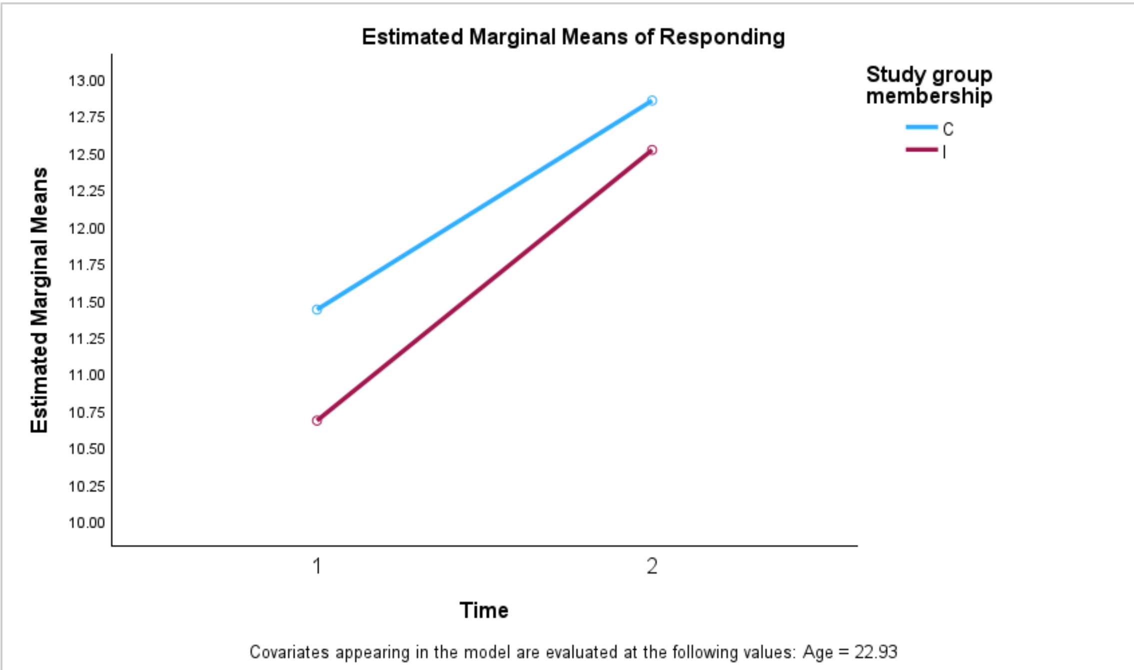
Plot of Estimated Marginal Means Comparing the Means Between T1 (Pretest) and Endpoint by Study Group for Self-Perceived CJ Interpreting Subscale Score



Note. N = 89. (*n* = 46 for the HFMS (C-control) group and *n* = 43 for the VPS (I-intervention) group).

Figure 12

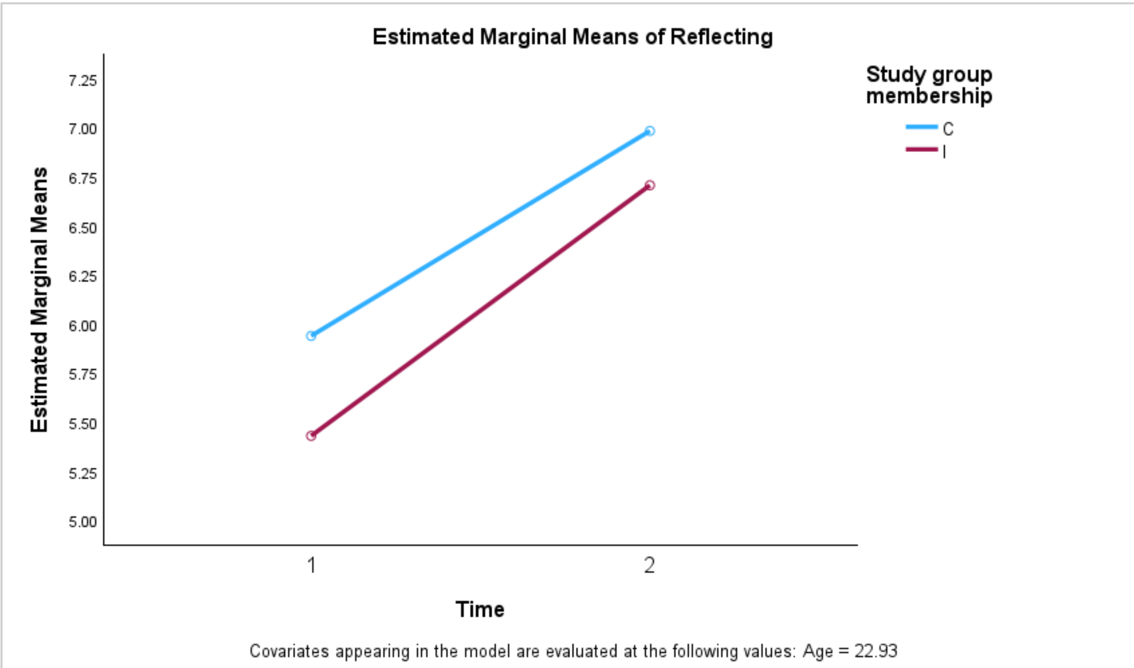
Plot of Estimated Marginal Means Comparing the Means Between T1 (Pretest) and Endpoint by Study Group for Self-Perceived CJ Responding Subscale Score



Note. N = 89. (*n* = 46 for the HFMS (C-control) group and *n* = 43 for the VPS (I-intervention) group).

Figure 13

Plot of Estimated Marginal Means Comparing the Means Between T1 (Pretest) and Endpoint by Study Group for Self-Perceived CJ Reflecting Subscale Score



Note. N = 89. (*n* = 46 for the HFMS (C-control) group and *n* = 43 for the VPS (I-intervention) group).

Chapter Summary

Results of this study showed high Pearson bivariate correlations between the self-perceived CJ total scale and subscale scores and each of the subscale scores for both study groups. The 11-item Lasater Clinical Judgment Rubric showed good internal consistency reliability, and all items contribute to the rubric's overall reliability. The findings of the confirmatory factor analysis showed high inter-factor correlations, and the redundancy between the factors showed a single-factor model that best represents the rubric. The results support the construct validity of the rubric to measure clinical judgment among the participants of this study. The findings for the research questions showed that overall, the educational approach delivered for each study group promoted an increase in the self-perceived CJ total scale and subscale scores. However, significant differences were not found in the magnitude of change by the study group for the self-perceived CJ total scale and subscale scores. In conclusion, the novel approach did not produce statistically significant differences across time within and between the study groups in the self-perceived CJ total scale and subscale scores. However, findings showed increases over time for the self-perceived CJ total scale and subscale scores for both study groups, indicating both groups benefited from simulation approaches and both modalities were similarly effective in promoting clinical judgment.

Chapter 5: Discussion

This chapter discusses the interpretation of the findings and explains the significance of the results related to prelicensure nursing students' clinical judgment. The implications for the two educational approaches delivered in this study are explored, including the study's strengths and limitations. Recommendations for future research are also offered.

This study examined VPS's effectiveness as a novel teaching strategy to improve prelicensure nursing students' clinical judgment. Since COVID-19, the use of VPS has increased among nursing programs (Shea & Rovera, 2021). However, more conclusive findings are needed to determine if VPS promotes CJ among prelicensure nursing students. The study also assessed the psychometric characteristics of the Lasater Clinical Judgment Rubric.

Descriptive statistics found the Age variable statistically significant, and further analyses using a median split were conducted to identify the median age. Results identified the median age of the study sample to be 21.5. Participants above the median age were considered 'older,' and students below or equal to the median age were considered 'younger.'

The reliability findings for the Lasater Clinical Judgment Rubric (LCJR) showed high internal consistencies; however, the internal consistencies for each of the four subscales (noticing, interpreting, responding, reflecting) were lower compared to previous studies (Gubrud-Howe, 2008; Jensen, 2013). The confirmatory factor analysis (CFA), which tested the construct validity of the LCJR showed factors grouped together rather than into four separate factors. The redundancy between the factors was substantiated by the CFA performed by Adamson (2011), which found that "mathematically, the items on the Lasater Clinical Judgment Rubric all represent one component or factor" (p. 93). These findings were consistent with the strong Pearson correlations between the self-perceived CJ total scale and subscale scores and the high internal consistency reliability (Cronbach's alpha) for the total scale score. Therefore, the rubric did not differentiate between four factors; instead, the correlations among the items were due to a single common factor (UCLA, 2021) representing one latent variable (DeVellis & Thorpe, 2021).

Research Question 1a

The first research question examined the interaction effect of Time by study group from T1 (pretest) to T2 (after each group received their assigned intervention) for the self-perceived CJ total scale score. The results did not support the hypothesis, indicating that both groups showed a similar increase over time in the self-perceived CJ total scale score, even though the delivery of the simulation modalities and debriefing sessions differed. The VPS group received three VPS scenarios, and previous research has shown that multiple scenarios greater than 30 minutes per scenario effectively promote clinical reasoning (Sim et al., 2022). VPS as a primer, when combined with HFMS, has also been shown to improve critical thinking, problem-solving, and clinical performance abilities (Kim et al., 2019). Theoretically, completing each scenario's pre-simulation and post-simulation quizzes should have improved clinical judgment.

Previous studies examining CJ with VPS have been either mixed or inconclusive. Findings from an integrative state-of-the-science review comparing high-fidelity and virtual simulation were inconclusive about which modality had a greater effect on clinical judgment (Martin & Tyndall, 2022). However, a quasi-experimental study comparing high-fidelity simulation, virtual simulation, and case studies found that virtual simulation induced a higher level of CJ than high-fidelity simulation among NGRNs (Luo et al., 2021). Moreover, Fogg et al. (2020) showed significant improvements in LCJR after completing virtual simulation sessions. However, perceived increases in clinical judgment may have been due to scenario mastery and concomitant didactic and direct care clinical experiences.

One possible contributor to help explain the findings may be related to not having set scoring benchmarks for the VPS components. Participants were assigned three VPS scenarios and a pre-and post-simulation quiz for each scenario. Yet, participants were not required to meet a benchmark for either of the quizzes or submit the guided reflection questions that accompanied each VPS scenario. Setting scoring benchmarks for the quizzes and the VPS scenarios may have improved clinical judgment.

A significant interaction effect of Time by Age showed that younger students had a greater increase over time on average than older students in the self-perceived CJ total scale score and benefited more from HFMS or VPS. This finding demonstrated that younger students self-perceived a higher level of clinical judgment than older students. A cross-sectional research study examined the factors associated with developing clinical reasoning competency among undergraduate nursing students. Findings showed that students under 21 years had better clinical reasoning competency and problem-solving ability than older students (Hong et al., 2021). In this study, younger students may have self-perceived higher clinical judgment skills than older students. Still, they may have lacked self-awareness or a realistic view of their understanding and knowledge of the scenario content. Students' learning may be affected by "illusions of fluency" or misjudging the depth of knowledge (Desai et al., 2018). The assumption of understanding may give the illusion that having familiarity with content means knowing the content (Center for the Advancement of Teaching, 2020). However, further analyses are needed to identify the relationship between age and self-perceived CJ total scale score. There were significant main effects among the covariates Time and Study Group. For the main effect of time, participants improved their self-perceived CJ total scale score from T1 to T2 between the study groups. The main effect of the study group showed the HFMS group scored higher on average than the VPS group on the self-perceived CJ total scale score.

Research Question 1b

The second research question examined the interaction effect of Time by study group from T1 (pretest) to T2 (after each group received their assigned intervention) for the self-perceived CJ subscale scores. Results for this hypothesis did not show a significant Time-by-study group interaction effect on the self-perceived CJ subscale scores. The hypothesis was not supported. However, the findings showed that both groups showed a similar increase over time in the self-perceived CJ subscale scores (noticing, interpreting, responding, reflecting). Although both groups showed a similar increase in the self-perceived CJ subscale scores, the finding was unexpected. A systematic review and meta-analysis of virtual simulation found this modality effective in fostering clinical reasoning skills when multiple scenarios lasting more than 30 minutes focused on patient management (Sim et al., 2022). Fogg et al. (2020) also found significant improvements in clinical judgment after participants completed virtual simulation sessions, but findings may have been confounded by scenario repeatability and concurrent clinical experiences.

Results, however, showed a significant interaction effect of Time by Age, indicating that younger students had a greater increase on average than older students in the self-perceived CJ subscale scores and benefited more from their assigned intervention, HFMS or VPS. The univariate analyses identified that younger students had a greater increase in the self-perceived CJ responding and reflecting subscale scores from the pretest to after each group received their assigned intervention.

The responding phase is the nurses' decision to take action or not to take action (Tanner, 2006). The responding subscale from the LCJR measures participants' confidence and mastery in nursing skills, ability to communicate and offer reassurance to patients and families, and tailor intervention responses (Lasater, 2007). Hong et al. (2021) postulated that younger (less than 21) students displayed better clinical reasoning competency and problem-solving ability than older students. In this study, younger students self-perceived a higher ability to make decisions overall than older students. Further analyses are needed to identify the significance of age in the self-perceived CJ subscale scores.

The reflecting phase includes reflection-in-action and reflection-on-action. The nurse reflects-in-action by examining the patient's response to the intervention and adjusting based on follow-up assessment (Tanner, 2006). Reflection-on-action is the nurse's overall reflection of the patient care experience (Tanner, 2006). Self-assessment contributes to clinical knowledge development and the capacity for exercising clinical judgment in future patient situations (Tanner, 2006). The reflecting subscales measure participants' ability to evaluate and self-analyze clinical performance and their commitment to ongoing improvement by identifying strengths and weaknesses (Lasater, 2007). High-fidelity mannequin simulation has been found to significantly affect the reflecting phase (Martin & Tyndall, 2022). However, little is known about the impact of self-debriefings by virtual simulation platforms. MacKenna et al. (2021) explored students' self-debriefing after completing virtual simulation scenarios and found that students had varying levels of reflective thinking. The level of reflection varied with each question, and further research is needed to evaluate the effect of reflecting on virtual platforms (MacKenna et al., 2021).

The findings for the main effect showed that the HFMS group scored higher than the VPS group in the self-perceived noticing, responding, and reflecting subscales. It is unclear why the HFMS group did not also score higher in the self-perceived CJ interpreting subscale. The interpreting phase is the nurse's ability to analyze patient findings and reach an interpretation of the situation based on the data collected (Tanner, 2006). The HFMS session may have validated students' ability to notice, respond, and reflect but not interpret.

Research Question 2a

The third research question examined the interaction effect of Time by study group from T1 (pretest) to Endpoint (T2 for the HFMS group; T3 for the VPS group) for the self-perceived CJ total scale score. The findings did not show a significant Time by Group interaction effect for the self-perceived CJ total scale score, and the hypothesis was not supported. However, results indicated both groups had similar increases in the self-perceived CJ total scale score. The VPS group had their self-perceived CJ evaluated after receiving both VPS and HFMS modalities. The purpose of the VPS intervention at T2 was to examine if VPS administered before HFMS would improve students’ clinical judgment skills. Findings showed that VPS as a primer did not increase the self-perceived CJ total scale compared to HFMS alone. Exposure to a primer activity has been shown to help the students recognize and recall information for later use (Addison, 2022). Addison (2022) postulated that “priming prepares students for upcoming information” and serves as a foundation for building new knowledge and improving comprehension (Addison, 2022). Kim et al. (2019) compared virtual simulation to blended simulation (virtual- and high-fidelity simulation) and found significant improvements in critical thinking and problem-solving skills with blended simulation compared to virtual simulation alone (Kim et al., 2019). A systematic review and meta-analysis of virtual patients' effectiveness in comparing blended learning with traditional education found improvement in clinical reasoning and communication skills compared to traditional educational strategies (Kononowicz et al., 2019). The combination of computer-based simulation with HFMS has significantly improved critical thinking, problem-solving processes, and clinical performance more than virtual simulation alone, demonstrating the synergistic effect of the two simulation modalities (Kim et al., 2019). However, data has found that 78% of Americans are familiar with virtual reality, and its use is expected to grow in the 18-34 age group (Lindner, 2023). If students have virtual technology experience, a computer-based simulation program may not engage the student enough to serve as a primer before the delivery of HFMS.

The analysis of this research question also identified a significant interaction effect for Time by Previous virtual technology experience and a main effect for the variable Time. The findings for the interaction effect showed that students who did not have previous VT experience had a greater increase in the self-perceived CJ total scale score with either HFMS or VPS plus HFMS compared to participants with previous VT experience. Virtual technology creates an immersive virtual reality generated by haptic devices that allow touch, feeling, and manipulation. The feedback from haptics offers an immersive experience that makes the virtual environment feel ‘real’ (Ashtari, 2022). A systematic review of 15 studies found that immersive virtual reality can increase self-confidence, self-efficacy, and self-assessed competency (Liu et al., 2023). Research has also shown that virtual technology can improve cognitive functions, help focus attention, exercise memory, and improve problem-solving and decision-making processes (Sokolowska, 2023). A research study comparing the learning effect between immersive virtual reality and computerized virtual simulation found that an immersive reality program “generates a higher level of presence” believed to enhance learners’ engagement with content (Bray et al., 2023, p. 7). The non-immersive VPS scenarios delivered in this study may not have engaged the participants and thus affected their self-perceived clinical judgment. The main effect of Time showed that participants in both the HFMS and VPS groups improved their self-perceived CJ total scale score over time.

Research Question 2b

The fourth research question examined the interaction effect of Time by study group from T1 (pretest) to Endpoint (T2 for the HFMS group; T3 for the VPS group) for the self-perceived CJ subscale scores. The interaction effect was not significant, and the hypothesis was not supported, indicating that both groups showed a similar increase in the self-perceived CJ subscale scores (noticing, interpreting, responding, reflecting). The purpose of the VPS group receiving two interventions (VPS at T2 and HFMS at T3) was to examine the effects of VPS as a priming learning activity. However, the finding was similar to the results identified for the self-perceived CJ total scale score in research question 2a.

The analysis for this research question also identified two main effects. The univariate analyses examining the main effect of the study group variable found that the HFMS group scored higher in the self-perceived CJ reflecting subscale than the VPS group. This finding was similar to research question 1b. The second main effect for Age showed that younger students, on average, scored higher in the self-perceived CJ responding and reflecting subscales than older students. Descriptive statistics found that the HFMS group was, on average, younger than the VPS group, and the findings may have been confounded by age.

Implications for Nursing Education

The findings from this study showed that self-perceived clinical judgment total scale and subscale scores improved over time. Students learned from their simulation experiences and benefited from HFMS, VPS, and combined simulation modalities. These findings have important implications for prelicensure nursing programs. Both study groups learned from their simulation experiences, and the HFMS and VPS simulation modalities were similarly effective in increasing students' self-perceived CJ total scale and subscale scores.

The study examined the impact of adding VPS as a primer to HFMS on clinical judgment skills. Adding VPS as a primer did not demonstrate statistically significant group differences compared to HFMS alone. Yet, the findings showed that the blended approach was similarly effective as HFMS alone in increasing self-perceived CJ total scale score and subscale scores. These findings are important because students in this study completed the virtual scenarios independently without an instructor, indicating that both mannequin and virtual simulation modalities fostered clinical judgment skills. Using VPS alone can support students' decision-making skills with fewer resources and lower costs. For this study, the resources needed for students to complete the VPS scenarios included their computer devices and Wi-Fi connectivity. A cost-analysis examining the monetary terms and utility of both mannequin and virtual simulation found that the overall cost/utility ratio for mannequin-based simulation was approximately $37 per participant compared to $11 for the virtual simulation platform (Haerling, 2018). The calculated cost per participant considered faculty and staff time to prepare and run the simulation and the equipment and ownership costs for each modality (Haerling, 2018).

High-fidelity mannequin simulations are delivered to a few students in multiple groups. HFMS requires physical space compared to VPS, which can be delivered simultaneously to larger groups of students without needing a classroom. Virtual platforms would decrease the need for faculty and staff and address the classroom space issues associated with delivering mannequin simulations (Haerling, 2018). Virtual patient simulation requires fewer resources than high-fidelity mannequin simulation, and this study's findings offer nursing programs a more accessible and affordable simulation option.

A component of high-fidelity mannequin simulation is the instructor-led debriefing that accompanies scenarios upon their conclusion. Debriefings encourage the exploration of knowledge, identification of knowledge gaps, assessment of errors, and reflection (AL Sabei & Lasater, 2016). This metacognitive process supports cognitive, affective, and psychomotor learning (AL Sabei & Lasater, 2016). Adding instructor-led debriefing may improve virtual simulation and enhance clinical judgment skills among prelicensure nursing students. The simulation standards of best practice for simulation set by the International Nursing Association for Clinical Simulation and Learning (Decker et al., 2021) include a prebriefing to prepare the learner for the simulation content and a debriefing to encourage reflection, exploration of knowledge, and transfer to an actual patient care setting (Decker et al., 2021). A review of 23 studies examining the use of VPS to assess clinical competence found the need to include interaction, reflection, and debriefing to enhance learning (Coyne et al., 2021). The role of the facilitator is to assist students in the reflective process and help them reexamine the clinical encounters to foster clinical reasoning and judgment skills (Dreifuerst, 2009). Using VPS with instructor-led prebriefing and debriefing may induce a reflective process needed to gain a sense of salience and enhance clinical judgment (Gantt et al., 2018; Lapum et al., 2019).

Virtual patient simulation supports students' learning, and the accessibility afforded by this modality is an essential aspect of this learning approach. Students, independently of a nursing instructor, completed patient case scenarios and learned from their experience. This educational approach has the potential to expand nursing schools' simulation programs, and the findings from this study showed that virtual simulation promotes clinical judgment in prelicensure nursing students.

Strengths and Limitations

Strengths

One of the study's strengths was the sample size, which increased its statistical power. The recruitment of two study groups across two academic semesters helped minimize the potential sharing of the experience by the participants. The collaboration with the faculty and their support in counting the novel intervention as an equivalent activity to standard coursework supported the recruitment and sample size of the study. The study protocol was also standardized to ensure the recruitment and collection of all data were consistent across both study groups. The study limited possible confounding variables related to concurrent didactic and clinical experiences by delivering the study in the first three weeks of the semester.

Limitations

The study had some limitations. The sociodemographic survey asked about participants' current educational level. The setting for the study was a bachelor's nursing program, and the question asking participants to select their current educational level may have led them to inadvertently choose 'bachelor's degree' to identify the program they were enrolled in rather than a degree they had previously obtained. Although the question was clarified for the VPS group before and during the survey administration, this study could not investigate the effect of this variable.

Participants in the VPS group were assigned three virtual simulations that were accessed and completed remotely. Participants completed the three virtual simulations at their leisure using their personal computers. Although the remote completion of the virtual simulations increased the external validity and generalizability of the findings to the population, there were variations in the completion of the pre-simulation and post-simulation quizzes. Some students completed the quizzes once, and others repeated the quizzes to obtain higher scores, although a benchmark score was not established for this study. The mannequin simulations and debriefings were not standardized, and there were variations in the delivery of the HFMS and debriefing sessions based on instructor preferences and experience.

Previous studies have found higher performance scores with VPS after students completed a third virtual simulation scenario, indicating improved performance with repetitive practice (Sapiano et al., 2018). However, the VPS scenarios were not assigned in a specific order, and the varied levels of complexity may have affected students' self-perceived scoring. Participants were also not asked to rate their level of comfort and experience navigating the virtual simulation platform before starting the simulation. Their expertise and comfort level may have affected students' overall experience and self-assessment of clinical judgment skills. Qualitative research has found that virtual simulation may cause frustration among learners due to the navigation system (Foronda et al., 2018). Students who feel frustrated by the system will focus on being able to navigate the VPS scenario rather than focusing on the patient case scenario (Foronda et al., 2018). Another limitation of the study was participants' scoring of their self-perceived clinical judgment. Self-perception may have influenced the scoring of the total scale and subscale scores, and further research is needed to identify the relationship between self-perception and self-scoring. In addition, Age and study group membership were confounded to a certain degree, and it was impossible to separate the study groups by age.

Recommendations

One recommendation for further research is to focus on the elements offered by the virtual simulation platform. Increasing the rigor of the VPS program by identifying and setting scoring benchmarks for the virtual scenarios and the pre-and post-test quizzes is needed to understand the effectiveness of these elements. Setting benchmarks would also improve students' understanding and competency of scenario content. Increasing the rigor of VPS may be necessary to meet the objectives of the simulation and be effective in fostering clinical judgment. Another recommendation is to examine the relationship between students' VPS scores and self-perceived clinical judgment scores. Identifying a possible correlation between the VPS scores and the self-perceived clinical judgment would help determine if a benchmark score would promote clinical judgment.

Future studies should also focus on the self-guided reflection questions offered by the virtual simulation platform. There is a lack of evidence demonstrating if self-guided reflection questions are valuable in fostering students' reflective process. A recommendation is to require students to submit the assignment and have nursing instructors provide feedback. Nursing instructors could assess students' thinking processes and address potential knowledge gaps. Evaluating students' responses would also provide insight into the effectiveness of the debriefing tool. Simulation debriefing increases clinical judgment (AL Sabei & Lasater, 2017). Yet, a standardized approach for debriefing practices is lacking and varies across nursing instructors. Debriefings allow students to reexamine their performance, explore feelings, and assess errors, but students need higher-order thinking questions to promote more meaningful learning experiences.

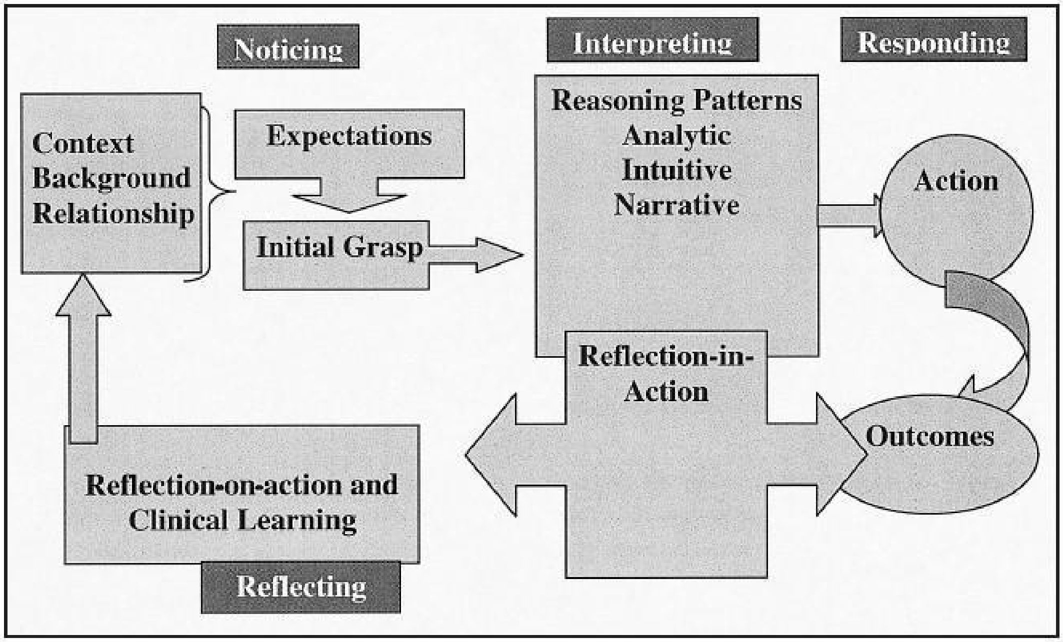
Finally, future studies should also investigate VPS in conjunction with an online or in-person instructor-led debriefing session to examine the impact on students' clinical judgment. Virtual patient simulation allows students to use critical thinking and clinical reasoning to identify the 'next steps.' However, clinical judgment may not be achieved without a debriefing component that helps students identify knowledge gaps (Gantt et al., 2018; Lapum et al., 2019). Therefore, future studies should also investigate VPS in conjunction with an instructor-led debriefing session and examine if this added component improves clinical judgment.

Chapter Summary

The study aimed to examine the effects of HFMS and VPS interventions on the self-perceived clinical judgment total scale and subscales scores. Although the findings showed that VPS combined with HFMS did not significantly increase the self-perceived clinical judgment measured by the Lasater Clinical Judgment Rubric, virtual patient simulation and high-fidelity mannequin simulation were similarly effective in fostering clinical judgment, and both promoted participants' learning. High-fidelity mannequin simulation has been a cornerstone of nursing education and is effective for developing critical thinking (Hanshaw & Dickerson, 2020; Lee & Oh, 2015; Shin et al., 2015) and clinical judgment (Hanshaw & Dickerson, 2020; Klenke-Borgmann, 2020; Lee & Oh, 2015). Nursing students are novices and need help recognizing the priorities and demands embedded in clinical situations to gain a sense of salience (Benner et al., 2010). Debriefings offer a mechanism to unfold patient care experiences, engage in higher-order thinking, and link knowledge with practice (AL Sabei & Lasater, 2016). Self-debriefings offered by virtual simulation platforms are self-paced, but learners may have unanswered questions and a lack of understanding for improving future performances (Lupum et al., 2018). Debriefings are a critical learning component in simulation, and future research should focus on incorporating high-quality debriefing with virtual simulation to evaluate its effectiveness as a teaching and learning modality.

Appendix A

Tanner Clinical Judgment Model



Note: Reproduction from *Thinking Like a Nurse: A Research-Based Model of Clinical Judgment in Nursing*, by C. Tanner, 2006, Journal of Nursing Education, 45(6), 204-211. (https://doi.org/10.3928/01484834-20060601-04). Copyright 2006 by Christine Tanner, Ph.D., RN. In the public domain.

Appendix B

Lasater Clinical Judgment Rubric

Lasater Clinical Judgment Rubric

Dimension	Exemplary	Accomplished	Developing	Beginning
Effective noticing involves:				
Focused observation	Focuses observation appropriately; regularly observes and monitors a wide variety of objective and subjective data to uncover any useful information	Regularly observes and monitors a variety of data, including both subjective and objective; most useful information is noticed; may miss the most subtle signs	Attempts to monitor a variety of subjective and objective data but is overwhelmed by the array of data; focuses on the most obvious data, missing some important information	Confused by the clinical situation and the amount and kind of data; observation is not organized and important data are missed, and/or assessment errors are made
Recognizing deviations from expected patterns	Recognizes subtle patterns and deviations from expected patterns in data and uses these to guide the assessment	Recognizes most obvious patterns and deviations in data and uses these to continually assess	Identifies obvious patterns and deviations, missing some important information; unsure how to continue the assessment	Focuses on one thing at a time and misses most patterns and deviations from expectations; misses opportunities to refine the assessment
Information seeking	Assertively seeks information to plan intervention: carefully collects useful subjective data from observing and interacting with the patient and family	Actively seeks subjective information about the patient's situation from the patient and family to support planning interventions; occasionally does not pursue important leads	Makes limited efforts to seek additional information from the patient and family; often seems not to know what information to seek and/or pursues unrelated information	Is ineffective in seeking information; relies mostly on objective data; has difficulty interacting with the patient and family and fails to collect important subjective data
Effective interpreting involves:				
Prioritizing data	Focuses on the most relevant and important data useful for explaining the patient's condition	Generally focuses on the most important data and seeks further relevant information but also may try to attend to less pertinent data	Makes an effort to prioritize data and focus on the most important, but also attends to less relevant or useful data	Has difficulty focusing and appears not to know which data are most important to the diagnosis; attempts to attend to all available data
Making sense of data	Even when facing complex, conflicting, or confusing data, is able to (a) note and make sense of patterns in the patient's data, (b) compare these with known patterns (from the nursing knowledge base, research, personal experience, and intuition), and (c) develop plans for interventions that can be justified in terms of their likelihood of success	In most situations, interprets the patient's data patterns and compares with known patterns to develop an intervention plan and accompanying rationale; the exceptions are rare or in complicated cases where it is appropriate to seek the guidance of a specialist or a more experienced nurse	In simple, common, or familiar situations, is able to compare the patient's data patterns with those known and to develop or explain intervention plans; has difficulty, however, with even moderately difficult data or situations that are within the expectations of students; inappropriately requires advice or assistance	Even in simple, common, or familiar situations, has difficulty interpreting or making sense of data; has trouble distinguishing among competing explanations and appropriate interventions, requiring assistance both in diagnosing the problem and developing an intervention
Effective responding involves:				
Calm, confident manner	Assumes responsibility; delegates team assignments; assesses patients and reassures them and their families	Generally displays leadership and confidence and is able to control or calm most situations; may show stress in particularly difficult or complex situations	Is tentative in the leader role; reassures patients and families in routine and relatively simple situations, but becomes stressed and disorganized easily	Except in simple and routine situations, is stressed and disorganized, lacks control, makes patients and families anxious or less able to cooperate

TABLE 2 (Continued)

Lasater Clinical Judgment Rubric

Dimension	Exemplary	Accomplished	Developing	Beginning
Clear communication	Communicates effectively; explains interventions; calms and reassures patients and families; directs and involves team members, explaining and giving directions; checks for understanding	Generally communicates well; explains carefully to patients; gives clear directions to team; could be more effective in establishing rapport	Shows some communication ability (e.g., giving directions); communication with patients, families, and team members is only partly successful; displays caring but not competence	Has difficulty communicating; explanations are confusing; directions are unclear or contradictory; patients and families are made confused or anxious and are not reassured
Well-planned intervention/flexibility	Interventions are tailored for the individual patient; monitors patient progress closely and is able to adjust treatment as indicated by patient response	Develops interventions on the basis of relevant patient data; monitors progress regularly but does not expect to have to change treatments	Develops interventions on the basis of the most obvious data; monitors progress but is unable to make adjustments as indicated by the patient's response	Focuses on developing a single intervention, addressing a likely solution, but it may be vague, confusing, and/or incomplete; some monitoring may occur
Being skillful	Shows mastery of necessary nursing skills	Displays proficiency in the use of most nursing skills; could improve speed or accuracy	Is hesitant or ineffective in using nursing skills	Is unable to select and/or perform nursing skills
Effective reflecting involves:				
Evaluation/self-analysis	Independently evaluates and analyzes personal clinical performance, noting decision points, elaborating alternatives, and accurately evaluating choices against alternatives	Evaluates and analyzes personal clinical performance with minimal prompting, primarily about major events or decisions; key decision points are identified, and alternatives are considered	Even when prompted, briefly verbalizes the most obvious evaluations; has difficulty imagining alternative choices; is self-protective in evaluating personal choices	Even prompted evaluations are brief, cursory, and not used to improve performance; justifies personal decisions and choices without evaluating them
Commitment to improvement	Demonstrates commitment to ongoing improvement; reflects on and critically evaluates nursing experiences; accurately identifies strengths and weaknesses and develops specific plans to eliminate weaknesses	Demonstrates a desire to improve nursing performance; reflects on and evaluates experiences; identifies strengths and weaknesses; could be more systematic in evaluating weaknesses	Demonstrates awareness of the need for ongoing improvement and makes some effort to learn from experience and improve performance but tends to state the obvious and needs external evaluation	Appears uninterested in improving performance or is unable to do so; rarely reflects; is uncritical of himself or herself or overly critical (given level of development); is unable to see flaws or need for improvement

Appendix C

UNLV

INFORMED CONSENT

School of Nursing

Title of Study: Effectiveness of a Virtual Simulation Program as a Novel Approach to Improve Clinical Judgment in Prelicensure Nursing Students
Investigator(s):
Student Investigator (SI) Monica Millard MSN RN
Principal Investigator (PI) Du Feng, Ph.D.

For questions or concerns about the study, you may contact Monica Millard at 805-403-0514 or millam1@unlv.nevada.edu.

For questions regarding the rights of research subjects or any complaints or comments regarding the manner in which the study is being conducted, contact **the UNLV Office of Research Integrity – Human Subjects at 702-895-2794 or via email at IRB@unlv.edu.**

It is unknown as to the level of risk of transmission of COVID-19 if you decide to participate in this research study. The research activities will utilize accepted guidance standards for mitigating the risks of COVID-19 transmission: however, the chance of transmission cannot be eliminated.

PURPOSE OF THE STUDY
You are invited to participate in a research study to evaluate the effectiveness of virtual patient simulation compared to high-fidelity mannequin simulation for obtaining clinical judgment among third-year bachelor prelicensure nursing students.

PARTICIPANTS
You are being asked to participate in the study because you are 18 or older, enrolled in the third year of the bachelor's nursing program, and registered in the Nursing Care of Older Adults course.

PROCEDURES
You will take online and pencil/paper measurements to measure clinical judgment before and after completing simulation activities. The student investigator will present a pre-recorded video showing and discussing the measurement with the participants. The study will take place in the course classroom, the UNLV Shadow Lane Campus Clinical Simulation Center, and remotely via personal computers. You will be asked not to disclose anything about the study to any participant enrolled in the nursing program.

BENEFITS OF PARTICIPATION
Your participation may benefit nursing educators and future students by better understanding the effect of a high-fidelity mannequin and virtual patient simulation on clinical judgment development. Learning from the simulation sessions includes free access to new virtual patient

simulation scenarios by vSim® for Nursing by Laerdal, improved performance in critical thinking, clinical reasoning, and clinical judgment, fostering success for passing the nursing licensure exam (NCLEX), and enrichment of learning experiences.

RISKS OF PARTICIPATION

There are risks involved in all research studies. The anticipated risk for participating in the activities of this study is minimal and no greater than the normal risk for simulation training in this educational program. If you feel uncomfortable answering the survey and measurements, you may skip answering the items or discontinue the forms.

COST /COMPENSATION

There will be no financial cost to you to participate in this study. The study will take approximately 42 to 66 minutes of your time and will take place over three weeks. Upon completion of each wave of posttest data, each participant will receive a lunch box valued at $8. After completing the final posttest measurement, you will receive a $10 UNLV Bookstore gift card, or through the UNLV Research Participant Incentive Payment System, you'll receive the gift card. The UNLV Research Participant Incentive Payment System may ask you to provide your name, gender, email, mailing address, and date of birth for compensation purposes. These identifiers will not be linked to the research study data. Participation in this study will also provide you with 30-day free access to 20 virtual simulation scenarios provided by vSim® for Nursing by Laerdal that you can complete at your leisure.

CONFIDENTIALITY

Your contact information will be kept confidential. No reference will be made to written materials that could link you to this study. Your contact information collected during this study will be stored using encrypted computer files, and documents will be held in a locked cabinet in the student investigator's office. All records will be kept for a minimum of three years after the completion of the study and then destroyed. The students' data, including outcome measures, will be kept confidential and not shared with course instructors other than the investigators. Email addresses used for the study will be discarded immediately after collecting the required data.

VOLUNTARY PARTICIPATION

Participants in the summer cohort who consent to participate in the study will complete a simulation activity required for the course. Responses generated from the simulation activity will be collected for analysis. Participants in the fall cohort who consent to participate in the study will complete a simulation activity and either a virtual activity or a novel intervention as standard coursework. The novel intervention will be offered as an equivalent activity instead of a class-assigned virtual clinical activity. Responses generated from the simulation activity and novel intervention will be collected for analysis. Participation in this study is voluntary, and withdrawal from the study will not affect your course grade or relations with UNLV. You are encouraged to ask questions about this study at any time.

PARTICIPANT CONSENT

I have read the above information and agree to participate in this study. I have been able to ask questions about the research study. I am at least 18 years of age. A copy of this form has been given to me.

Signature of Participant _________________________________ Date: ________________

Participant Name (Please Print) ___________________________ Assigned Number: ________

Appendix D

UNLV | SCHOOL OF NURSING

I am interested in participating in the research study examining the effects of high-fidelity mannequin simulation and virtual patient simulation on clinical judgment. I approve of the student investigator, Monica Millard, sending emails as a reminder to complete the posttest measurement and provide instructions for accessing the virtual patient simulations.

____

PRINT NAME

____

SIGNATURE

____

SCHOOL EMAIL ADDRESS

Appendix E

Sociodemographic Survey Scantron

Assigned ID #		
⓪	⓪	⓪
①	①	①
②	②	②
③	③	③
④	④	④
⑤	⑤	⑤
⑥	⑥	⑥
⑦	⑦	⑦
⑧	⑧	⑧
⑨	⑨	⑨

Fill in and write in the best response for each question. Thank you.

1. What is your gender? Male Ⓜ Female Ⓕ Prefer not to say Ⓟ

2. What is your age in years? *(fill one bubble/row per digit of age)*
   ⓪ ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨
   ⓪ ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨

3. What is your race? (mark all that apply)
   - ☐ American Indian/Alaskan Native
   - ☐ Asian
   - ☐ Black/African American
   - ☐ Native Hawaiian/Other Pacific Islander
   - ☐ White
   - ☐ Prefer not to say

4. What is your ethnicity?
   - ◯ Hispanic/Latinx
   - ◯ Not Hispanic/Latinx

5. What is your current educational level?
   - ◯ Associate degree
   - ◯ Bachelor's degree

6. Do you have previous work or volunteer healthcare experience? Yes Ⓨ No Ⓝ

   a. If 'yes,' what is your work or volunteer healthcare experience?
   - ☐ Caregiver
   - ☐ Emergency Medical Technician
   - ☐ Home Health Aide
   - ☐ Hospital Transporter
   - ☐ Medical Assistant
   - ☐ Monitor Technician
   - ☐ Nursing Assistant
   - ☐ Therapy Aide
   - ☐ Phlebotomist
   - ☐ Other (please specify) ____

   b. If 'yes' to question 6a, how long have you been working/volunteering in healthcare? Describe in years and months below: *(fill one bubble/row per digit of years worked/volunteered)*

   Years: ⓪ ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨
   ⓪ ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨

   Months: ⓪ ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪

7. Do you have experience with virtual patient simulation (i.e., interacting with a computer monitor, keyboard, touchscreen, and computer-generated human-like characters known as avatars)? Yes Ⓨ No Ⓝ

8. Do you have experience with virtual technology (i.e., sensory output devices, head-mounted devices, or haptic devices that allow touch, feel, or manipulation)? Yes Ⓨ No Ⓝ

Appendix F

Lasater Clinical Judgment Rubric – Pretest

Assigned ID Number __________

Pretest Measurement

The Lasater Clinical Judgment Rubric was created by Dr. Kathie Lasater to measure the development of clinical judgment.

- You will be using this rubric to self-assess your clinical judgment based on 4 domains. Each domain has between 2 and 4 subscales: *Noticing* has 3 subscales, *Interpreting* has 2 subscales, *Responding* has 4 subscales, and *Reflecting* for 2 subscales.
- Each subscale can be rated using one of the 4 rating levels: *Exemplary, Accomplished, Developing, and Beginning.*
- Before you begin rating yourself in each subscale, retrospectively reflect on the most recent simulation experiences and choose the descriptors that best describe you in each subscale, all things considered. Select one and only one descriptor.
- Please use a pencil so that you can erase the circle if you make a mistake.
- Self-assessment using this rubric should take no longer than 10 minutes. Please ask the researcher if you have any questions.
- Do not write your name on the form. Your responses will not be shared with your nursing faculty.

Lasater Clinical Judgment Rubric

Dimension	Exemplary	Accomplished	Developing	Beginning
Effective noticing involves:				
Focused observation	Focuses observation appropriately; regularly observes and monitors a wide variety of objective and subjective data to uncover any useful information	Regularly observes and monitors a variety of data, including both subjective and objective; most useful information is noticed, may miss the most subtle signs	Attempts to monitor a variety of subjective and objective data but is overwhelmed by the array of data; focuses on the most obvious data, missing some important information	Confused by the clinical situation and the amount and kind of data; observation is not organized and important data are missed, and/or assessment errors are made
Recognizing deviations from expected patterns	Recognizes subtle patterns and deviations from expected patterns in data and uses these to guide the assessment	Recognizes most obvious patterns and deviations in data and uses these to continually assess	Identifies obvious patterns and deviations, missing some important information; unsure how to continue the assessment	Focuses on one thing at a time and misses most patterns and deviations from expectations; misses opportunities to refine the assessment
Information seeking	Assertively seeks information to plan intervention: carefully collects useful subjective data from observing and interacting with the patient and family	Actively seeks subjective information about the patient's situation from the patient and family to support planning interventions; occasionally does not pursue important leads	Makes limited efforts to seek additional information from the patient and family; often seems not to know what information to seek and/or pursues unrelated information	Is ineffective in seeking information; relies mostly on objective data; has difficulty interacting with the patient and family and fails to collect important subjective data
Effective interpreting involves:				
Prioritizing data	Focuses on the most relevant and important data useful for explaining the patient's condition	Generally focuses on the most important data and seeks further relevant information but also may try to attend to less pertinent data	Makes an effort to prioritize data and focus on the most important, but also attends to less relevant or useful data	Has difficulty focusing and appears not to know which data are most important to the diagnosis; attempts to attend to all available data

Making sense of data	Even when facing complex, conflicting, or confusing data, is able to (a) note and make sense of patterns in the patient's data, (b) compare these with known patterns (from the nursing knowledge base, research, personal experience, and intuition), and (c) develop plans for interventions that can be justified in terms of their likelihood of success	In most situations, interprets the patient's data patterns and compares with known patterns to develop an intervention plan and accompanying rationale; the exceptions are rare or in complicated cases where it is appropriate to seek the guidance of a specialist or a more experienced nurse	In simple, common, or familiar situations, is able to compare the patient's data patterns with those known and to develop or explain intervention plans; has difficulty, however, with even moderately difficult data or situations that are within the expectations of students; inappropriately requires advice or assistance	Even in simple, common, or familiar situations, has difficulty interpreting or making sense of data; has trouble distinguishing among competing explanations and appropriate interventions, requiring assistance both in diagnosing the problem and developing an intervention
Effective responding involves:				
Calm, confident manner	Assumes responsibility; delegates team assignments; assesses patients and reassures them and their families	Generally displays leadership and confidence and is able to control or calm most situations; may show stress in particularly difficult or complex situations	Is tentative in the leader role; reassures patients and families in routine and relatively simple situations, but becomes stressed and disorganized easily	Except in simple and routine situations, is stressed and disorganized, lacks control, makes patients and families anxious or less able to cooperate
Clear communication	Communicates effectively; explains interventions; calms and reassures patients and families; directs and involves team members, explaining and giving directions; checks for understanding	Generally communicates well; explains carefully to patients; gives clear directions to team; could be more effective in establishing rapport	Shows some communication ability (e.g., giving directions); communication with patients, families, and team members is only partly successful; displays caring but not competence	Has difficulty communicating; explanations are confusing; directions are unclear or contradictory; patients and families are made confused or anxious and are not reassured
Well-planned intervention/flexibility	Interventions are tailored for the individual patient; monitors patient progress closely and is able to adjust treatment as indicated by patient response	Develops interventions on the basis of relevant patient data; monitors progress regularly but does not expect to have to change treatments	Develops interventions on the basis of the most obvious data; monitors progress but is unable to make adjustments as indicated by the patient's response	Focuses on developing a single intervention, addressing a likely solution, but it may be vague, confusing, and/or incomplete; some monitoring may occur
Being skillful	Shows mastery of necessary nursing skills	Displays proficiency in the use of most nursing skills; could improve speed or accuracy	Is hesitant or ineffective in using nursing skills	Is unable to select and/or perform nursing skills
Effective reflecting involves:				
Evaluation/self-analysis	Independently evaluates and analyzes personal clinical performance, noting decision points, elaborating alternatives, and accurately evaluating choices against alternatives	Evaluates and analyzes personal clinical performance with minimal prompting, primarily about major events or decisions; key decision points are identified, and alternatives are considered	Even when prompted, briefly verbalizes the most obvious evaluations; has difficulty imagining alternative choices; is self-protective in evaluating personal choices	Even prompted evaluations are brief, cursory, and not used to improve performance; justifies personal decisions and choices without evaluating them
Commitment to improvement	Demonstrates commitment to ongoing improvement; reflects on and critically evaluates nursing experiences; accurately identifies strengths and weaknesses and develops specific plans to eliminate weaknesses	Demonstrates a desire to improve nursing performance; reflects on and evaluates experiences; identifies strengths and weaknesses; could be more systematic in evaluating weaknesses	Demonstrates awareness of the need for ongoing improvement and makes some effort to learn from experience and improve performance but tends to state the obvious and needs external evaluation	Appears uninterested in improving performance or is unable to do so; rarely reflects; is uncritical of himself or herself or overly critical (given level of development); is unable to see flaws or need for improvement

Appendix G

Instructions for Accessing vSim® for Nursing by Laerdal Online

1. Website: thepoint.lww.com

2. Enter your first 12-digit access code

3. Enter your UNLV school email address

4. Password: select “No, I am new.”

5. Select Your Role: select “I’m a student.”

6. Register:

   - Enter your first name and last name
   - Confirm your UNLV school email address
   - Enter and confirm your new password
   - School Institution: University of Nevada, Las Vegas
   - School Address: 4505 S. Maryland Pkwy, Las Vegas, NV, 89154

7. Agree to Terms: select “I accept” for both Terms and Conditions and Privacy Policy.

8. Access Confirmation: select ‘Continue.’

9. Go to the top of the screen: click on ‘Add a new title to My Content.’

10. Enter your second 12-digit access code.

11. Click on My Content at the top of the screen. You will see the *vSim for Nursing Medical-Surgical* and *vSim for Nursing Advanced Medical-Surgical* programs.

    - Click “Launch” to view the assigned virtual patient scenarios in each program.

12. Enter Class Code: **B333A6F5** (Medical-Surgical) **771B182A** (Advanced Medical-Surgical)

    - Click ‘Search’ and ‘Join the Class’

13. In each vSim program, click on ‘Assignments’.

    - View the NextGen vSim Video Tutorial parts 1 through 14. These are very short videos, totaling 14 minutes. The video has been assigned in each program, but you only need to watch the video tutorial once
    - Once you finish watching the video tutorial, click on the ‘X’ on the top left side of the screen.
    - Complete the assigned virtual patient scenarios: **Skyler Hansen** from the Medical-Surgical program and **Valerie Cucina** and **William Edwards** from the Advanced Medical-Surgical program.

14. Once all three scenarios are complete, use the QR code or the link https://unlv.co1.qualtrics.com/jfe/form/SV_3IWrtTvVvK5BqSy to complete the posttest measurement. Enter your Identification Number provided to you in your Participation Folder. If you cannot recall or find your identification number, please email me at millam1@unlv.nevada.edu and your identification number will be emailed to you.

Appendix H

Lasater Clinical Judgment Rubric – Posttest

Lasater Clinical Judgment Rubric - Posttest

Assigned ID Number: _______________

Posttest Measurement

Considering the feedback received after the three scenarios, select one and only descriptor in each subscale that best describes you.

The posttest can also be completed online using the QR code or this link https://unlv.co1.qualtrics.com/jfe/form/SV_3IWrtTvVvK5BqSy

Lasater Clinical Judgment Rubric

Dimension	Exemplary	Accomplished	Developing	Beginning
Effective noticing involves:				
Focused observation	Focuses observation appropriately; regularly observes and monitors a wide variety of objective and subjective data to uncover any useful information	Regularly observes and monitors a variety of data, including both subjective and objective; most useful information is noticed, may miss the most subtle signs	Attempts to monitor a variety of subjective and objective data but is overwhelmed by the array of data; focuses on the most obvious data, missing some important information	Confused by the clinical situation and the amount and kind of data; observation is not organized and important data are missed, and/or assessment errors are made
Recognizing deviations from expected patterns	Recognizes subtle patterns and deviations from expected patterns in data and uses these to guide the assessment	Recognizes most obvious patterns and deviations in data and uses these to continually assess	Identifies obvious patterns and deviations, missing some important information; unsure how to continue the assessment	Focuses on one thing at a time and misses most patterns and deviations from expectations; misses opportunities to refine the assessment
Information seeking	Assertively seeks information to plan intervention: carefully collects useful subjective data from observing and interacting with the patient and family	Actively seeks subjective information about the patient's situation from the patient and family to support planning interventions; occasionally does not pursue important leads	Makes limited efforts to seek additional information from the patient and family; often seems not to know what information to seek and/or pursues unrelated information	Is ineffective in seeking information; relies mostly on objective data; has difficulty interacting with the patient and family and fails to collect important subjective data
Effective interpreting involves:				
Prioritizing data	Focuses on the most relevant and important data useful for explaining the patient's condition	Generally focuses on the most important data and seeks further relevant information but also may try to attend to less pertinent data	Makes an effort to prioritize data and focus on the most important, but also attends to less relevant or useful data	Has difficulty focusing and appears not to know which data are most important to the diagnosis; attempts to attend to all available data

Making sense of data	Even when facing complex, conflicting, or confusing data, is able to (a) note and make sense of patterns in the patient's data, (b) compare these with known patterns (from the nursing knowledge base, research, personal experience, and intuition), and (c) develop plans for interventions that can be justified in terms of their likelihood of success	In most situations, interprets the patient's data patterns and compares with known patterns to develop an intervention plan and accompanying rationale; the exceptions are rare or in complicated cases where it is appropriate to seek the guidance of a specialist or a more experienced nurse	In simple, common, or familiar situations, is able to compare the patient's data patterns with those known and to develop or explain intervention plans; has difficulty, however, with even moderately difficult data or situations that are within the expectations of students; inappropriately requires advice or assistance	Even in simple, common, or familiar situations, has difficulty interpreting or making sense of data; has trouble distinguishing among competing explanations and appropriate interventions, requiring assistance both in diagnosing the problem and developing an intervention
Effective responding involves:				
Calm, confident manner	Assumes responsibility; delegates team assignments; assesses patients and reassures them and their families	Generally displays leadership and confidence and is able to control or calm most situations; may show stress in particularly difficult or complex situations	Is tentative in the leader role; reassures patients and families in routine and relatively simple situations, but becomes stressed and disorganized easily	Except in simple and routine situations, is stressed and disorganized, lacks control, makes patients and families anxious or less able to cooperate
Clear communication	Communicates effectively; explains interventions; calms and reassures patients and families; directs and involves team members, explaining and giving directions; checks for understanding	Generally communicates well; explains carefully to patients; gives clear directions to team; could be more effective in establishing rapport	Shows some communication ability (e.g., giving directions); communication with patients, families, and team members is only partly successful; displays caring but not competence	Has difficulty communicating; explanations are confusing; directions are unclear or contradictory; patients and families are made confused or anxious and are not reassured
Well-planned intervention/flexibility	Interventions are tailored for the individual patient; monitors patient progress closely and is able to adjust treatment as indicated by patient response	Develops interventions on the basis of relevant patient data; monitors progress regularly but does not expect to have to change treatments	Develops interventions on the basis of the most obvious data; monitors progress but is unable to make adjustments as indicated by the patient's response	Focuses on developing a single intervention, addressing a likely solution, but it may be vague, confusing, and/or incomplete; some monitoring may occur
Being skillful	Shows mastery of necessary nursing skills	Displays proficiency in the use of most nursing skills; could improve speed or accuracy	Is hesitant or ineffective in using nursing skills	Is unable to select and/or perform nursing skills
Effective reflecting involves:				
Evaluation/self-analysis	Independently evaluates and analyzes personal clinical performance, noting decision points, elaborating alternatives, and accurately evaluating choices against alternatives	Evaluates and analyzes personal clinical performance with minimal prompting, primarily about major events or decisions; key decision points are identified, and alternatives are considered	Even when prompted, briefly verbalizes the most obvious evaluations; has difficulty imagining alternative choices; is self-protective in evaluating personal choices	Even prompted evaluations are brief, cursory, and not used to improve performance; justifies personal decisions and choices without evaluating them
Commitment to improvement	Demonstrates commitment to ongoing improvement; reflects on and critically evaluates nursing experiences; accurately identifies strengths and weaknesses and develops specific plans to eliminate weaknesses	Demonstrates a desire to improve nursing performance; reflects on and evaluates experiences; identifies strengths and weaknesses; could be more systematic in evaluating weaknesses	Demonstrates awareness of the need for ongoing improvement and makes some effort to learn from experience and improve performance but tends to state the obvious and needs external evaluation	Appears uninterested in improving performance or is unable to do so; rarely reflects; is uncritical of himself or herself or overly critical (given level of development); is unable to see flaws or need for improvement

Appendix I

Lasater Clinical Judgment Rubric Posttest Online Option via Qualtrics

https://unlv.co1.qualtrics.com/jfe/form/SV_3IWrtTvVvK5BqSy

UNLV

Please enter your identification number:

→

UNLV

Post-test Measurement
Consider the feedback you received after the three scenarios. Select one and only descriptor in each subdomain that best describes you. After you have completed the survey, click on the arrow located on the bottom right corner to submit the survey. Thank you.

Effective Noticing involves:

Focused observation

Dimension	Exemplary	Accomplished	Developing	Beginning
Focused observation	Focuses observation appropriately; regularly observes and monitors a wide variety of objective and subjective data to uncover any useful information	Regularly observes and monitors a variety of data, including both subjective and objective; most useful information is noticed: may miss the most subtle signs	Attempts to monitor a variety of subjective and objective data but is overwhelmed by the array of data; focuses on the most obvious data, missing some important information	Confused by the clinical situation and the amount and kind of data; observation is not organized and important data are missed, and/or assessment errors are made

	Exemplary	Accomplished	Developing	Beginning
Focused Observation	○	○	○	○

Recognizing deviations from expected patterns

Dimensions	Exemplary	Accomplished	Developing	Beginning
Recognizing deviations from expected patterns	Recognizes subtle patterns and deviations from expected patterns in data and uses these to guide the assessment	Recognizes most obvious patterns and deviations in data and uses these to continually assess	Identifies obvious patterns and deviations missing some important information; unsure how to continue the assessment	Focuses on one thing at a time and misses most patterns and deviations from expectations; misses opportunities to refine the assessment

	Exemplary	Accomplished	Developing	Beginning
Recognizing deviations from expected patterns	○	○	○	○

Appendix J

UNLV

ORI-HS, Exempt Review Exempt Notice

DATE: May 11, 2023

TO: Du Feng
FROM: Office of Research Integrity - Human Subjects

PROTOCOL TITLE: UNLV-2023-114 Effectiveness of a Virtual Simulation Program as a Novel Approach to Improve Clinical Judgment in Prelicensure Nursing Students
SUBMISSION TYPE: Initial

ACTION: Exempt
REVIEW DATE: May 11, 2023
REVIEW TYPE: EXEMPT
REVIEW CATEGORY: Category 1. Research, conducted in established or commonly accepted educational settings, that specifically involves normal educational practices that are not likely to adversely impact students' opportunity to learn required educational content or the assessment of educators who provide instruction. This includes most research on regular and special education instructional strategies, and research on the effectiveness of or the comparison among instructional techniques, curricula, or classroom management methods.

This memorandum is notification that the protocol referenced above has been reviewed as indicated in Federal regulatory statutes 45 CFR 46 and deemed exempt under Category 1 as noted in Review Category .

PLEASE NOTE:
Upon final determination of exempt status, the research team is responsible for conducting the research as stated in the exempt application reviewed by the ORI - HS, which shall include using the most recently submitted Informed Consent/Assent and recruitment materials.

If your project involves paying research participants, it is recommended to contact HSComp@unlv.edu to ensure compliance with the Policy for Incentives for Human Research Subjects.

Any changes to the application may cause this study to require a different level of review.

Should there be any change to the study, it will be necessary to submit a **Modification** request for review. No changes may be made to the existing study until modifications have been approved/acknowledged.

All **unanticipated problems** involving risk to subjects or others, and/or **serious and unexpected adverse events** must be reported promptly to this office.

Any **non-compliance** issues or **complaints** regarding this protocol must be reported promptly to this office.

Please remember that all approvals regarding this research must be sought prior to initiation of this study (e.g., IBC, COi, Export Control, OSP, Radiation Safety, Clinical Trials Office, etc.).

If you have questions, please contact the Office of Research Integrity - Human Subjects at IRB@unlv.edu or call 702-895-2794. Please include your study title and study ID in all correspondence.

Office of Research Integrity - Human Subjects
4505 Maryland Parkway. Box 451047. Las Vegas, Nevada 89154-1047
(702) 895-2794
IRB@unlv.edu

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Curriculum Vitae

MONICA P. MILLARD

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EDUCATION

Doctor of Philosophy in Nursing **2020-present**
University of Nevada, Las Vegas

Master of Science in Nursing Education **April 2013**
Walden University, Minnesota

Associate Degree in Nursing **May 2000**
Santa Barbara City College

Bachelor of Science, Biopsychology **June 1997**
University of California, Santa Barbara

LICENSE AND CERTIFICATIONS

California Registered Nurse **2000-present**
Basic Life Support **2000-present**

TEACHING

Division Chair for Nursing and Allied Health **2018-present**

- New four-year term started Fall of 2020
- Interim position from 2018-2020
- Elected to a new four-year term beginning Fall 2020
- Represent and advocate for eight health-care-related programs
- Collaborate with Nursing and Allied Health Directors
- Collaborate with the Dean to oversee five Allied Health programs

Full-Time Nursing Faculty **2013-present**

- Develop, implement, evaluate, and revise course and program curriculum
- Teach courses related to diseases, chronic conditions, and pharmacology
- Teach in skills and simulation lab
- Lead instructor for first-semester students
- Orient and mentor new Tenure-track and Part-time nursing faculty

Part-Time Nursing Faculty **2007-2013**

- Clinical instruction for first-year nursing students
- Taught in a simulation lab
- Taught courses for incoming nursing students
- Produced videos for simulation
- Mentored new part-time clinical instructors

WORK EXPERIENCE

Per Diem Nurse, Sierra Vista Regional Medical Center, San Luis Obispo 2013-2020

- Acute care experience caring for geriatric, adult, and pediatric patients in Medical/Surgical, Stepdown, Day-Stay, Pediatric, and Mother/Baby units

Part-time Staff Nurse, Sierra Vista Regional Medical Center, San Luis Obispo 2008-2013

- Acute care experience caring for geriatric, adult, and pediatric patients on
- Medical/Surgical, Stepdown, Day-Stay, Pediatric, and Mother/Baby units

Full-time Staff Nurse, Sierra Vista Regional Medical Center, San Luis Obispo 2003 – 2008

- Acute care experience caring for geriatric, adult, and pediatric patients on
- Medical/Surgical, Stepdown, Day-Stay, Pediatric, and Mother/Baby units

Full-time Staff Nurse, Sierra Vista Regional Medical Center, San Luis Obispo 2001 – 2003

- Acute care experience caring for adult and geriatric patients in a Medical/Surgical department

Full-time Staff Nurse, Santa Barbara Cottage Hospital, Santa Barbara 2000

- Acute care experience caring for adult and geriatric patients in the Oncology unit

COLLEGE SERVICE

Promise Day Outreach 2023

- High-school student outreach of nursing and allied health programs

Subcommittee Taskforce – Administrative Policy Faculty Hiring Practices 2020/2023

- Subcommittee was formed to revise, improve, and include diversity, equity, and inclusion practices

Subcommittee Taskforce - Faculty Prioritization, Cuesta College 2019

- Subcommittee was formed to discuss, revise, and formulate new guidelines for the upcoming Faculty Prioritization Process

Cuesta College Federation of Teachers, Cuesta College 2018-present

- Representative for the Nursing and Allied Health division

Division Chair Committee, Cuesta College 2018-present

- Represent and voice issues affecting the division

Foundation Board of Directors, Cuesta College 2016-2018

- Connects private and corporate philanthropy with opportunities to support Cuesta College and its students

Academic Senate, Cuesta College 2015-2018

- Representative for the Nursing and Allied Health division and participated in discussions related to recommendations regarding academic and professional matters

CONFERENCE PRESENTATIONS

PROMISE DAY, CUESTA COLLEGE, SAN LUIS OBISPO **2019/2018**

- Workshop to discuss Nursing and Allied Health programs to students from all county high schools

EDUCATE WORKSHOPS, CUESTA COLLEGE, SAN LUIS OBISPO **2017/2018**

- Nursing and Allied Health programs presented to Latino high school students
-

"ETHICS IN THE NEWS", CUESTA COLLEGE, SAN LUIS OBISPO **2017**

- Presented in conjunction with the college's Book of the Year: The Immortal Life of Henrietta Lacks
- Presentation in collaboration with six other nursing faculty
- Lecture presented on mandatory vaccinations

CAREER FAIR, SAN LUIS OBISPO HIGH SCHOOL, SAN LUIS OBISPO **2015/2016**

- Workshop to present Nursing and Allied Health careers to high school students

HONORS AND AWARDS

PhD Dissertation Project and Tish Smyer Nursing Scholarship, University of Nevada, Las Vegas **2023**

- Awarded in support of a dissertation research project

Peter and M'May Diffley Award for Faculty Excellence, Cuesta College **2020**

- Distinguished performance and excellence in service

Erny Edelson RN Endowed Memorial Scholarship, Santa Barbara City College **1999**

- Awarded to high achieving students either entering or continuing in the Associate Degree of Nursing Program who have an interest in or dedication to community service

Eve Miller, Gladys Smits, Florence Tisdell, and Ida Meir Memorial Scholarship, Santa Barbara City College **1999**

- Awarded to outstanding nursing students who have financial need and have a minimum GPA of 3.5

PROFESSIONAL ORGANIZATIONS

The Honor Society of Phi Kappa Phi **2022**
National League of Nursing **2022**
Sigma Theta Tau International Honor Society of Nursing **2021**
Latina Leadership Network, Cuesta College **2013-2020**

COMMUNITY SERVICE

Medical Reserve Corps – Santa Barbara County **2021**

- Assisted with screening and administered COVID-19 vaccines

Central Coast Rescue Mission **2020**

- Served food and meals to community members

Foodbank of Santa Barbara County, Santa Maria **2017-present**

- Warehouse assistance packing bags of food for delivery
- Picnic in the Park program serving meals to school-aged children

REFERENCES

Dr. Jason Curtis, Assistant Superintendent/Vice-President of Academic Affairs
Cuesta College, San Luis Obispo
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Dr. Oscar Ramos, Dean of Instruction, Health & Wellness, Skilled Trades and Technology
Cuesta College, San Luis Obispo
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