Virtual Reality Simulation's Influence on Nursing Students' Anxiety and Communication Skills with Anxious Patients

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Dedication

I dedicate my dissertation to my husband, Michael, who has provided unconditional love and support throughout my journey to a Ph.D. I also want to thank my parents, Todd and Mel, and my sister, Taren, who have always pushed me to strive for the best in my career and exceed my educational goals. Lastly, my children, Sean and Reese, deserve special recognition as they were patient with me and understood when I needed quiet time to complete my school work. In my most doubted and trying times, my husband and family endured with me and cheered me onward.

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Abstract

The incidence of medical-surgical patients with a secondary anxiety diagnosis is increasing, and nurses' feelings of inadequacy in communicating with anxious patients have hindered the therapeutic nurse-patient relationship, negatively impacting patient outcomes. Simulation methods such as high fidelity simulation and standardized patients have decreased nursing students' anxiety levels in caring for anxious patients. However, they face maintenance costs, availability, and consistency barriers. Full immersion virtual reality simulation has demonstrated success in nonhealthcare and medical education but is limited in nursing education. Nursing students from an associate and bachelor's degree nursing program participated in a full immersion virtual reality simulation anxious patient scenario twice. Their anxiety levels were assessed at three points in time: before the simulation experience (week 3), after session I (weeks 4-7), and after session II (weeks 8-11). In addition, participants' communication skills were evaluated during each session using the simulation's analytics dashboard, which issued a numeric score based on their communication performance. Study results found a statistically significant decrease in students' anxiety levels over time, from the pretest to posttest II. However, participants' communication scores did not display a statistically significant increase from session I to session II. Implications of these findings are discussed relative to increasing research of full immersion virtual reality simulation in nursing education and the use of an analytics dashboard to objectively evaluate communication skills.

Keywords: virtual reality simulation, anxious patients, communication

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Chapter I: Statement of the Problem

The incidence of mental illness is staggering, with approximately 46% of the United States population experiencing some form of mental health disorder (Alexander et al., 2016). Anxiety disorders are among the most prevalent and disabling mental health disorders, as evidenced by higher rates of cardiovascular and respiratory diseases, diabetes mellitus, infections, and certain types of cancers compared to those without mental illness (Alexander et al., 2016; Antai-Otong, 2016). The link between mental and physical health is prominent as patients with mental illness have higher rates of physical illness, adverse events, and suboptimal outcomes during their acute care stays (Brunero et al., 2017). From a nursing standpoint, the increasing number of patients admitted to the medical-surgical units with underlying anxiety has dramatically increased the complexity of patient care (Avery et al., 2020).

Effective communication skills are vital to nursing care standards and necessary for successful nurse licensure (National League for Nurses, 2020; QSEN Institute, 2020). These skills contribute to positive patient outcomes and are critical for patients suffering from anxiety. Unfortunately, undergraduate nursing education does not adequately prepare nursing students to effectively communicate with anxious patients (Avery et al., 2020; Giandinoto et al., 2018). Students' ill-preparedness in communicating with patients suffering from anxiety causes self-fear and avoidance of that population, thus inhibiting a therapeutic nurse-patient relationship (Liu, 2021; Martin & Chanda, 2016). An insufficient nurse-patient relationship leads to unsatisfactory patient care experiences and poor outcomes (Giandinoto & Edward, 2015; Zolnierek, 2014). In response to students' lack of skill in communicating with anxious patients, nurse researchers have studied how various simulation modalities may improve students' communication competence.

Simulation has gained widespread attention for immersing students in realistic patient care scenarios and teaching through experience (Pottle, 2019; Yu & Mann, 2021). This learning modality allows students to practice communication skills with patients experiencing anxiety in a safe, low-stakes atmosphere that promotes learning and self-reflection. Simulation is valuable because it upholds a level of standardization that the real-life clinical setting cannot produce. Simulation can include low and high fidelity mannequins, standardized patients, computer-based virtual worlds, and full immersion virtual reality simulation (VRS). Simulation using high fidelity mannequins has reduced anxiety in nursing students before communicating with patients experiencing anxiety; however, realism is lacking because the mannequins cannot display nonverbal communication cues (Szpak & Kameg, 2013; Kameg et al., 2014). Standardized patients have also improved nursing students' communication skills and decreased their anxiety, but recruiting them can be time-consuming and expensive. They have also shown to lack consistency when functioning within large-scale simulations (Sarikoc et al., 2017).

Full immersion VRS uses a headset and haptic hand controls to place participants in realistic patient care scenarios, motivating them to engage with the virtual patients and environment. Its flexibility allows students to practice skills independently at a convenient time and reduces the need for facilitator presence (Pottle, 2019). Other healthcare and non-healthcare disciplines have generated positive outcomes when using full immersion VRS in their training; however, its existence in nursing education is limited (Foronda et al., 2013; Smith & Hamilton, 2015). Given the success of full immersion VRS in other disciplines, inquiries about its potential uses in nursing education have been raised.

Problem Statement

Nurses are the primary providers of patient care and spend most of their time communicating with patients. However, most nurses feel unprepared to successfully care for patients experiencing anxiety because they lack the necessary communication skills (Avery et al., 2020). Successfully managing patients suffering from anxiety requires effective communication and the ability to build a positive nurse-patient relationship (Martin & Chanda, 2016). Often, nursing students lack the communication skills to care for anxious patients making them especially fearful of this population (Martin & Chanda, 2016). Extensive communication practice is essential for students to develop the required skills to communicate with patients with anxiety.

Various simulation methods enhance students' technical and non-technical skills, including communication skills (Bruce et al., 2019). Studies have shown that high fidelity mannequins significantly decrease students' anxiety in communicating with anxious patients; however, the mannequins lack realism (Kameg et al., 2014). Realism is the ability to place the learner in a suspension of disbelief by creating a simulation environment that mimics the learner's actual work environment (Lopreiato et al., 2016). In simulation, realism is conveyed through the environment and the patients or avatars (MacLean et al., 2019). Standardized patients can simulate complex behaviors related to mood and affect, generating more authentic scenarios (Bartlett & Butson, 2015; Quail et al., 2016). Unfortunately, they are challenging to locate, costly, and may lack consistency among the different students within the same scenario (Martin & Chanda, 2016; Quail et al., 2016).

On the other hand, full immersion VRS immerses the learner in a scenario and gives them that sense of presence, of 'being there' to promote skill development (Makowski et al., 2017;

Slater, 2018). This simulation utilizes visual, auditory, and tactile senses to transport the learner to a realistic, three-dimensional, interactive environment through a headset and haptic hand controls. The participant can navigate the virtual environment, interact with avatars, and manipulate virtual objects. Full immersion VRS allows for standardized repetition that can be completed independently and more efficiently with less need for additional lab resources or personnel (Chang & Weiner, 2016; Yu & Mann, 2021). It appeals to the newest generation of nursing students as they prefer technology and experiential learning concepts (Chicca & Shellenbarger, 2018; Loveland, 2017). Full immersion VRS scenarios encompass a wide range of patient care environments, from infants to geriatrics, medsurg to critical care, and specialty nursing scenarios. They meet the competencies outlined by the Quality and Safety Education in Nursing (QSEN) and the National League for Nurses (NLN). Full immersion VRS has become integral in training and testing in the military, oil and gas industry, construction, medical education, and surgical training; however, research on its influence on nursing education is minimal (Ammanuel et al., 2019; Iserson, 2018). Research on the influence of full immersion VRS on nursing students' communication skills and anxiety levels when communicating with a patient experiencing anxiety does not exist, indicating a research gap.

Purpose of the Study

The purpose of this quasi-experimental study is to determine full immersion VRS's influence on nursing students' anxiety levels and communication skills when caring for anxious patients.

Research Questions and Hypotheses

The following research questions will be addressed:

1. Does exposure to full immersion VRS influence nursing students' anxiety levels over time: pre VRS exposure (week 3), VRS 1 (week 4-7), VRS 2 (week 8-11)?

   Ho: There will be no significant difference in students' anxiety levels over time.

2. Does the use of full immersion VRS improve students' communication scores?

   Ho: The mean difference in students' communication scores will be less than or equal to zero.

Philosophical Background

This study emanates from a postpositivist worldview, an extension of positivism but with the understanding that the researcher's knowledge and values influence what is observed (Creswell & Creswell, 2018). Through the scientific method, postpositivists use a deductive approach to interpret empirical evidence and disprove hypotheses. Reality can be discovered using objective observation, measurement, and interpretation; however, that reality remains imperfect given bias that can never be fully controlled (Kelly et al., 2018). While this study employs the scientific method through a quasi-experimental design, it cannot claim to be free of bias. Researcher bias will be reduced as much as possible, assumptions and limitations will be disclosed, and the study's results will be open for peer review upon publication.

Theoretical Framework

The NLN Jeffries simulation theory serves to identify the foundational principles for simulation-based education (Cowperthwait, 2020). Before its development, no theoretical framework for simulation existed, which identified a knowledge gap in constructing and evaluating simulation in nursing education (Jeffries, 2016). The theory's framework originated from the literature supporting simulation-based learning, which proved that simulation effectively achieves the Quality and Safety Education for Nurses (QSEN) standards (Jeffries, 2016). The simulation principles and quality measures outlined by the International Nursing Association for Clinical Simulation and Learning (INACSL) guided the simulation theory. Moreover, collaboration among INACSL, NLN, and other key simulation stakeholders has driven the simulation theory's development and refinement (Jeffries, 2016).

The theory’s model was developed from an extensive literature review that provided a list of simulation design characteristics with which all simulation scenarios should follow. Jeffries’ simulation model contains six core elements: context, background, design, simulation experience, educational strategies, and outcomes (Jeffries, 2016). This study meets the six core elements in the following ways. The full immersion VRS anxious patient scenario is designed for instruction and learning, setting the simulation’s context. The scenario’s student learning objectives and goals set the background. The simulation’s design characteristics include its content, complexity, level of fidelity, and the facilitator’s role in the simulation. The scenario provides appropriate content related to the communication and care of anxious patients. The complexity level is designed for nursing students inexperienced in communicating with anxious patients, and the fidelity level is high given that the scenario is delivered through full immersion VRS. No human facilitator is needed in this simulation experience as the avatar responds to the participants’ communication choices through a complex algorithm system. The simulation's context, background, and design impact the overall simulation experience. The interactions between the participant and the avatar followed by a performance analytics summary contribute to the simulation's educational strategies. The final core element, simulation outcomes, is broken into participant, patient, and system outcomes. This study will focus on participant outcomes with the goal of contributing to nursing education system outcomes on graduate nurse communication skills and anxiety levels.

Assumptions and Limitations

The first assumption is that students who volunteer to participate in the study will be engaged in the simulation scenario and earn communication scores representing that engagement. The second assumption is that they will provide honest responses in the state anxiety inventory. The third assumption is that the nursing education faculty will be receptive to the study and encourage their students to participate.

There are several limitations to this study. The first limitation is using a convenience sample from one nursing school, affecting the study's generalizability. Although the sample will be from one school, the participants represent a diverse population from two nursing programs: associate degree registered nurse and bachelor's degree registered nurse. The second limitation is the participants' level of engagement. They may not take the simulation scenario and the anxiety inventories seriously since the study is not attached to any course grade. The third limitation is the nursing education faculty's support for the study. The faculty may lack interest in the study, and their perceptions may resonate with the participants, potentially impacting the study's results. The fourth limitation is participants' anxiety about entering a new simulation format, as most have never participated in full immersion VRS. Participants’ anxiety related to a new type of simulation is uncontrollable. The fifth limitation is using the same anxious patient scenario for both simulation sessions because the software does not provide two different anxious patient scenarios. Zulkosky et al., 2021 encourage the opportunity to repeat simulation scenarios based on students’ improvement in clinical knowledge, performance, and self-confidence when repeating simulation scenarios. As a result of repeating the same scenario, the participants may feel more at ease during their second attempt, impacting their anxiety scores. The sixth limitation relates to the current confines of artificial intelligence in virtual reality simulation. Participants will not communicate verbally with the avatar; rather, they will communicate by choosing the most appropriate option from a set of multiple statements. Selecting from a set of statements contains some probability of randomly guessing the correct communication option and increases the probability of choosing the correct statement during the second simulation experience.

Significance of the Study

Given the prevalence of anxiety sufferers and the strong link between mental health and physical health, many patients admitted to the medical-surgical units will have a physical and secondary mental health diagnosis (Ohrnberger et al., 2017). Effective communication builds therapeutic nurse-patient relationships, promotes the successful nurse management of anxious patients, and improves patient outcomes (Martin & Chanda, 2016).

Unfortunately, nurses feel ill-prepared to communicate with anxious patients citing a lack of experience and training during their nursing education (Avery et al., 2020). Nursing students are fearful and apprehensive in communicating with patients suffering from anxiety because they lack the necessary communication experience and skills (Avery et al., 2020; Martin & Chanda, 2016). Nursing students will enter the nursing profession as novice nurses, but the role expectations continually rise, demanding that graduates "hit the ground running;" therefore, nursing students will be expected to effectively communicate with anxious patients (Bruce et al., 2019; Hayden et al., 2014). However, their fear of communicating with anxious patients impedes the nurse-patient relationship, negatively impacting patient outcomes (Giandinoto et al., 2018; Martin & Chanda, 2016).

Definition of Terms

Throughout this research, terms that will consistently appear are *anxiety*, *effective communication, full immersion VRS,* and *nursing students*. Precise definitions of these terms provide the reader with an appropriate context and clarity to the study.

Anxiety

Theoretical definition. According to the American Psychological Association (2020), anxiety is an "emotion characterized by tension, worried thoughts, and physical changes" (para. 1). Those with an anxiety disorder have "recurring intrusive thoughts or concerns" and often avoid social situations due to excessive worry (American Psychological Association, 2020, para. 2). People suffering from anxiety may also possess physical symptoms such as "sweating, trembling, dizziness, or rapid heartbeat" (American Psychological Association, 2020, para. 2). According to Merriam-Webster's dictionary (2020), anxiety is defined as an "apprehensive uneasiness or nervousness usually over an impending or anticipated ill" (para. 1). From a medical standpoint, Merriam-Webster (2020) defined anxiety as:

> an abnormal and overwhelming sense of apprehension and fear often marked by physical signs (tension, sweating, and increased pulse rate), by doubt concerning the reality and nature of the threat, and by self-doubt about one's capacity to cope with it (para. 2).

Operational definition. Anxiety presence and severity can be measured using self-reporting questionnaires, typically in Likert scale format, that provides an overall score. The higher the value along the questionnaire's score spectrum, the higher the participant's anxiety level. In this study, Spielberger's (2015) short form state anxiety inventory (SAI) will measure the nursing students' anxiety levels. It is a shortened form of the 1983 edition of the Spielberger State-Trait Anxiety Inventory (STAI) measuring state anxiety and composed of 10 items assessed on a 4-point scale. State anxiety is characterized by "subjective feelings of apprehension, nervousness, and worry" (Spielberger et al., 2015, p. 1). Although the short form SAI has been reduced from the original 20 item inventory, research has demonstrated high reliability and validity ratings (Abed et al., 2011; Kruyen et al., 2013; Marteau & Bekker, 1992; Spielberger, 2015).

Effective Communication

Theoretical definition. Effective communication is clear, informative, and interactive communication between a healthcare provider and patient (Abdolrahimi et al., 2017). Communication is a complex skill that requires much practice and experience to develop competence. Effective communication is essential in building a positive nurse-patient relationship, and promoting positive patient outcomes (Giandinoto & Edward, 2015).

Operational definition. Communication is measured using a variety of standardized scales or through observation and evaluation. Nursing students' communication skills will be evaluated through the full immersion VRS scenario's analytics software. The analytics feature documents every action and comment the participant makes, compares those actions to best practice measures, and provides a numeric score (Oxford Medical Simulation, 2020). Students will be given choices when communicating with the avatar; correct decisions improve their communication score while poor choices decrease the score. Individual participants can compare communication scores between scenario one and scenario two and against the class average. Communication analytics scores will be recorded after each scenario attempt, and those results will be examined to determine if there are significant differences between the communication scores.

Full immersion virtual reality simulation

Theoretical definition. Virtual reality simulation is defined according to its immersion level on inclusiveness, vividness, and motion capture. Full immersion VRS is considered high-level immersion because it stimulates auditory and visual senses and proprioception, which places the participant in the correct spatial orientation within the simulation scenario (Kardong-Edgren et al., 2019). The participant wears a head-mounted device that provides a 360-degree graphic projection of the scene in high visual and color resolution. The simulated environment displays immense detail and accuracy in mimicking the real environment it is portraying. Sensors placed in the perimeters of the virtual reality simulation laboratory communicate with the headset and hand controls. The sensors capture the body's movements, allowing the participant to physically navigate the virtual world and manipulate virtual objects (Kardong-Edgren et al., 2019). According to the healthcare simulation dictionary, virtual reality simulation is described as "a variety of immersive, highly visual, 3D characteristics to replicate real-life situations and/or healthcare procedures" and incorporates features such as "speech and voice recognition, motion sensors, or haptic devices" (Lopreiato et al., 2016, p. 40).

Operational definition. The software system monitors the operation of the 3D headset and hand controls. If the headset or a hand control is off, loses battery power, or has a communication issue, the scenario will pause, and an error message will appear. All error messages must be resolved before the scenario can continue. The headset's proper fitting will be determined with a snug fit to the face and head and a clear view of the virtual environment with all head movements. The researcher will be present to troubleshoot any error messages so the student can focus on the simulation's content.

Nursing students

Theoretical definition. *Nursing students* are defined as students who do not yet possess a registered nurse license.

Operational definition. Nursing students enrolled in an accredited nursing educational program. All are working to satisfy degree requirements to graduate from the respective nursing program and college to have their name released to sit for the National Council Licensure Examination RN.

Chapter Summary

The purpose of the study is to explore the influence of full immersion VRS on nursing students' communication skills and anxiety levels when caring for anxious patients. The problem and significance highlight the prevalence of medical-surgical patients with a secondary diagnosis of anxiety and that most nurses or nursing students are not equipped to communicate with this patient population. Given nurses' unpreparedness in communicating with anxious patients, a need for increased training and experiences in nursing education has been identified. Simulation has been impactful in better preparing nursing students for complex patients; however, some barriers to those methods have been identified. Full immersion VRS was introduced with research demonstrating its success in other disciplines, but its influence in nursing education is minimal, identifying a research gap.

The postpositivist worldview will guide the study by using a scientific, quantitative approach, understanding that no results can be purely objective as nursing is value-laden. The NLN Jeffries' simulation theory underpins the research study as the anxious patient scenario aligns with the model's six core elements. Assumptions and limitations have been disclosed to provide the reader with a context of the study's results. Definitions of the most common terms have been provided to ensure a clear understanding of the research variables. The information from this chapter presents the necessary background to chapter II, the literature review.

Chapter II: Review of the Literature

The chapter will provide a comprehensive review of literature about full immersion VRS's influence on nursing students' communication skills and anxiety levels when caring for patients experiencing anxiety. The literature review will include a review of the following themes: anxiety disorders, nurse preparation, common simulation modalities, and full immersion VRS in non-healthcare and healthcare disciplines. Finally, a discussion about the use of full immersion VRS in nursing education and its influence on mental health nursing education will be presented.

Literature Search

The literature search was completed during the past six months in 2020 and remains ongoing as new research emerges. The Cumulative Index to Nursing and Allied Health Literature (CINAHL), PubMed, and PsychInfo (ProQuest) databases were used for the healthcare-related research. The American Chemical Society, Arts & Humanities database, ASME Digital Library, BioMed Central, and the JSTOR database were used in the literature search for full immersion VRS in non-healthcare disciplines. Those databases encompass various non-healthcare topics in chemistry, biology, art, engineering, technology, and social science. Google Scholar and the PQDT Open database were sporadically accessed throughout the literature search to capture relevant dissertations and articles from databases outside the realm of the university's library. Additional articles were retrieved from the reference lists of related articles, and new simulation study updates were attained through membership with the International Association for Clinical Simulation and Learning (INACSL).

In searching for anxiety disorder prevalence and caring for patients with anxiety in medical-surgical settings, the following terms were used: *anxiety* AND *medical-surgical*. The

CINAHL search yielded 170 peer-reviewed articles with a ten-year limit and 91 with a five-year limit. In PubMed, the same search terms produced 1,813 results. Despite multiple attempts to add keywords and include the Boolean phrase *NOT*, the search continued to yield hundreds of results, so the top 40 most relevant results were reviewed. The following key terms were used in the CINAHL search for simulation in nursing education: *simulation* AND *nursing education,* which returned 93 studies from academic journals within the last five years. PubMed yielded 234 articles published in 2019 and 2020. To further narrow the simulation search, *high fidelity simulation* replaced the keyword *simulation,* producing 239 results in CINAHL and 45 in PubMed. When replaced with *standardized patient simulation*, the search yielded 72 results in CINAHL and 43 in PubMed.

In the literature search for full immersion VRS in non-healthcare disciplines, the key words *virtual reality simulation* AND *virtual reality* OR *full immersion virtual reality simulation* were initially used. However, the search yielded too many results, so the keyword search was reduced to *full immersion virtual reality simulation*. The American Chemical Society produced 315 articles, 17 published within the last year. This database did not allow for a date range to be placed, so the longest timeframe, 'within the previous year,' was chosen. The Arts & Humanities database yielded 208 results with 46 peer-reviewed articles within the last five years. ASME Digital Library returned 103 results with the same limiters placed. BioMed Central produced 52 results with no options for limits to be placed. The JSTOR database yielded 69 peer-reviewed studies within the last five years. Most of the studies yielded from the databases were not directly relevant to full immersion virtual reality simulation.

The literature search on full immersion VRS in nursing education included the following key terms: *virtual reality simulation* AND *virtual reality* AND *nursing* AND *nursing student*

AND *nursing education.* Those terms produced 16 peer-reviewed articles in CINAHL within the last ten years. That same search produced seven results in PubMed. When searching for literature on full immersion VRS in other healthcare disciplines, individual searches were conducted with the following terms to replace those associated with nursing: *radiography* AND *radiography student*; *physical therapy* AND *physical therapy student*; *occupational therapy* AND *occupational therapy student*; and lastly, *paramedic*. When additional terms were added to the keyword *paramedic,* such as *paramedic student* AND *emergency medical technician* AND *EMT*, no results were yielded, so those terms were eliminated. CINAHL and PubMed produced one result in radiography, but the article from each search was different. In physical therapy, CINAHL produced four results while PubMed yielded zero results. CINAHL produced four results in occupational therapy, and PubMed returned one study, but no articles were relevant to full immersion VRS. In the search for articles on full immersion VRS with paramedic programs, CINAHL yielded five articles, while PubMed found no results.

Anxiety Disorders

According to the Anxiety & Depression Association of America (ADAA), anxiety disorders affect 40 million United States adults, or approximately 18% of the population, each year (Anxiety & Depression Association of America, 2021). The National Institute of Mental Health (NIMH) estimates that 31% of U.S. adults experience an anxiety disorder in their lifetime (National Institute of Mental Health, 2017). As eluded in the data, anxiety disorders are the most common of mental health disorders. Unfortunately, many anxiety sufferers go without diagnosis or appropriate treatment due to a perceived negative societal stigma, personal embarrassment, and normalization of symptoms (Wei et al., 2015; Wei et al., 2016; Sari & Yuliastuti, 2018). Normalizing anxiety symptoms provides a false comfort to sufferers because they attribute their symptoms as ordinary responses to typical life stressors, which creates a barrier to seeking help, further contributing to an underrepresentation of anxiety disorder prevalence (Paulus et al., 2015).

Anxiety disorders contribute to the burden of disability, costing the United States billions of dollars annually (Paulus et al., 2015). A burden of disability is measured in units called disability-adjusted life years (DALYs), which represent the years lost to illness, disability, or premature death (US Burden of Disease Collaborators, 2013). Anxiety disorders are ranked third among mental health disorders that cause the most DALYs, demonstrating the negative impact on individuals, loved ones, and the community (US Burden of Disease Collaborators, 2013).

Individuals that do not receive treatment for their anxiety disorder face social isolation, employment loss, and barriers to accessing medical care (Wei et al., 2016). Those who attempt to seek treatment for their symptoms often perceive their encounters with healthcare providers to be unsupportive or dismissive (Brunero et al., 2018). Negative encounters with healthcare providers may contribute to anxiety sufferers avoiding care and perceived noncompliance with their treatment regimen. Anxiety symptoms that are unaddressed or untreated lead to poor outcomes as patients experiencing anxiety cannot comprehend, process, and remember newly given information, no matter their intelligence level (Price, 2017). The inability to understand and apply newly learned health information is another reason for patient noncompliance regarding treatment plans (Toronto & Weatherford, 2016).

Nurses' Preparedness in Caring for Patients with Anxiety

Patients admitted for medical care will be assigned to an appropriate medical-surgical unit regardless of an anxiety disorder history. Caring for patients with anxiety requires a unique set of knowledge and skills. Most medical-surgical nurses do not feel adequately equipped to provide the type of care that meets these patients' needs (Avery et al., 2020). A lack of undergraduate nursing education, professional development, and guidance on meeting anxiety patients' needs have contributed to nurses' feelings of unpreparedness (Avery et al., 2020; Giandinoto & Edward, 2015). Nurses that do not possess the knowledge to care for patients with anxiety are at risk for developing a negative stigma as they often misunderstand their behaviors, inappropriately labeling them as 'difficult' (Alexander et al., 2016; Avery et al., 2020; Brunero et al., 2017; Giandinoto & Edward, 2015; Zolnierek, 2014). A lack of knowledge and understanding of patients with anxiety impedes the therapeutic nurse-patient relationship and potentiates adverse patient outcomes.

Nursing education programs do not adequately prepare students to care for patients with mental health disorders, such as anxiety, outside of the mental healthcare setting (Avery et al., 2020; Kameg et al., 2013). Students lack experience in caring for patients with anxiety because those skills are not introduced until their mental health course, which occurs late in nursing curricula. Additionally, mental health rotations are only one semester in length, which is not adequate for students to develop and practice effective communication skills. Since students will encounter patients with anxiety well before their mental health rotation, building communication exercises early and throughout nursing curricula is vital (Kameg et al., 2013). The more communication practice nursing students have with anxious patients, the less anxiety they will experience during those encounters.

Simulation

Simulation reinvents real-world scenarios in a controlled environment that is safe for learning and reflection, significantly strengthening students' nursing skills and promoting smoother transitions to clinical practice (Beroz, 2017). Nursing graduates that enter their careers ready for practice positively impact patient outcomes (Bruce et al., 2019). Simulation implements "learning through experience," which has been pivotal in engaging the learner and effectively teaching nursing students communication, critical thinking, and team collaboration skills (Aebersold, 2018; NLN, 2015). Students recognize that simulation is a valuable learning tool to help develop their nursing skills, increase their comfort level in clinical practice, and assist in knowledge retention (Shearer, 2016). Simulation's efficacy has been so profound in nursing education that the National Council of State Boards of Nursing (NCSBN) has allowed controlled simulation experiences to substitute up to 50% of traditional clinical experiences (Hayden et al., 2014; Sullivan et al., 2019).

Low and High Fidelity Simulation

Low fidelity mannequins provide students the opportunity to practice a multitude of physical skills such as care with activities of daily living, sterile technique, medication administration, and patient safety practices (Aebersold, 2018). Although used heavily in nursing education, low fidelity mannequins cannot impress realism into the simulation scenarios as they remain motionless and without any physiological sounds. When used in communication simulation scenarios, they require a faculty member or student to complete the speaking parts, impacting the simulation's level of immersion, dramatically decreasing its realism.

High fidelity mannequins produce a level of interaction with students as they mimic physiological responses such as vital sign changes; cardiac, respiratory, and bowel sounds; pupillary responses, and pulses. These technological attributes offer students the opportunity to practice without risking patient safety. High fidelity mannequins can say a limited number of words and phrases for the students to respond to; however, the simulation facilitators must also ad-lib phrases to create a more realistic nurse-patient dialogue. The facilitator's increased participation in the scenario may also result in unintentional variations between the simulation sessions, impacting consistency (Chang & Weiner, 2016). Although high fidelity mannequins have enhanced students' learning and skill performance, they are costly to purchase and maintain (Haerling, 2018). High fidelity simulation has been called labor intensive because of limited access to established scenarios, especially ones specific to mental health nursing, forcing faculty to develop their own scenarios (Shin et al., 2019). Additionally, faculty may not be adequately trained to operate a high fidelity mannequin or have access to lab personnel for assistance during the simulation. This lack of formal training and support staff is challenging to faculty as they must assume the role of mannequin operator and scenario facilitator simultaneously.

Despite the challenges with realism, some research has found that high fidelity simulation, coupled with verbal cues from simulation facilitators, enhances students' communication skills (Brown, 2015). High fidelity simulation has significantly improved nursing students' self-efficacy and decreased their anxiety when communicating with patients with anxiety (Szpak & Kameg, 2013). Increased self-efficacy improves students’ ability to establish the nurse-patient relationship as they are less anxious and can better focus on their communication skills.

Standardized Patient Simulation

Standardized patients have been instrumental in providing authentic experiences in communicating with patients under distress, experiencing anxiety, and suffering from other mental health disorders (Bartlett & Butson, 2015; Kameg et al., 2014). Standardized patients have improved students' self-confidence in communicating with patients with mental health disorders (de Presno et al., 2021; Doolen et al., 2014; Martin & Chanda, 2016). Students felt that their experiences with standardized patients could decrease their anxiety when communicating with patients on mental health units (Brown, 2015). Martin and Chanda (2016) reported that students' communication skills significantly improved between pre and posttest scores after interacting with standardized patients.

Standardized patients must be highly skilled to appropriately mimic an anxious state; however, those who possess that capability are difficult to locate, schedule, and remain costly (Martin & Chanda, 2016; Quail et al., 2016). When conducting mass scale simulations, even the most skilled standardized patients lack consistency among one another, mainly when depicting a patient suffering from a mental health disorder as students' responses vary greatly (Martin & Chanda, 2016; Quail et al., 2016). Standardized patient simulations effectively promote experiential learning but may not reach that coveted benchmark level of consistency, impacting students' experiences and communication skills.

Computer-Based Virtual Reality Simulation

Computer-based virtual reality simulation is another standardized approach for teaching students using avatars and virtual environments. Students participate in virtual scenarios through a desktop or laptop computer, using a keyboard and mouse to manipulate the environment and interact with the avatars (Cant et al., 2019). The avatars will respond according to the phrases and actions the user chooses. Computer-based virtual reality simulation allows students to experience various simulation scenarios regardless of their physical location. Virtual gaming simulation (VGS) is an emerging term within computer-based virtual reality simulation that uses a web-based, interactive environment to place students in a clinical scenario using a gaming platform (Verkuyl et al., 2017). Students in VGS will have to choose the most appropriate responses and actions to move forward in the game and earn points throughout. The points may be linked to a specific grade within the assigned nursing course.

Research has found that computer-based virtual reality simulation has increased nursing students' clinical skills, teamwork, clinical reasoning, and general nursing knowledge compared to traditional education modalities (MacRae et al., 2021). It has also enhanced students' cultural competence, improved their perceived clinical judgment abilities, and instilled in them more optimistic beliefs about the long-term outcomes of those who have a mental illness (Chae et al., 2021; Fogg et al., 2020; Liu, 2021). However, research on the effect of computer-based virtual reality simulation on students' communication skills with anxious patients was not found.

Although computer-based virtual simulation provides active learning, its format of looking into a computer screen decreases its level of immersion, reducing its realism and causing disengagement with the virtual world (Kidd et al., 2012). A high level of immersion makes the participant believe that the scenario is genuine, promoting an emotional buy-in and reacting as if that virtual simulation were a real-life scenario (Muckler, 2017). A lack of immersion and emotional buy-in may negatively impact student learning.

Full Immersion VRS

Full immersion VRS is the newest, innovative form of simulation that immerses the learner in a patient care scenario using virtual reality. The participant wears a headset for a 360-degree view of the simulation environment and holds hand controls to manipulate objects within the virtual world (Slater & Sanchez-Vives, 2016). Full immersion VRS provides physical fidelity, which is the simulator's ability to replicate reality by portraying a genuine environment and authentic-looking patients (Muckler, 2017). High physical fidelity promotes suspension of disbelief, the belief that the virtual world you see is real. Suspension of disbelief ignites the same emotional responses in participants as if they were experiencing the situation in real life and is vital in maximizing learning and retention (de Gelder et al., 2018; Muckler, 2017; Vottero, 2014). The realism portrayed in full immersion VRS produces a unique learning experience that can be implemented in education and professional development in various disciplines.

Full Immersion VRS in Non-Healthcare Disciplines

Research on full immersion VRS in non-healthcare disciplines continues to develop as the call for well-trained operators in every industry intensifies (Lele, 2013). The presence of full immersion VRS has been documented in multiple disciplines such as computer and gaming science, engineering, chemical sciences, construction, pharmaceuticals, military training, and oil and gas industry maintenance. Computer science has produced substantial research on the technological components of full immersion VRS, especially related to improving haptic devices and headsets, providing increased immersion levels to enhance the suspension of disbelief, and decrease cybersickness (Freina & Ott, 2015). Immersive technology has become a part of everyday life through digital media entertainment theatres and smart consumer devices (Boas, 2013). Gaming through cybersports such as eSports has rapidly grown into a billion-dollar industry, with market projections exceeding $1.6 billion by 2021 (Pei, 2019). As technology continues to be an integral part of modern society, future professionals will expect virtual reality simulation in their education and training, making its implementation across multiple professions essential.

Full immersion VRS has been an effective teaching modality, time and cost-saver in the construction field with visualizing structures, assessing engineering designs, implementing safety models, and conducting professional training (Ahmed, 2019). Pharmaceutical companies incorporate full immersion VRS to view molecules in an entirely new way and gain a deeper understanding of their structures (Norrby et al., 2015). Full immersion VRS is paramount to military training by mimicking flight, ground, and water rescues, training in firearm use and safety, and defense tactic scenarios (Boas, 2013). Full immersion VRS in the oil and gas industry has been implemented in education and professional training to maintain and repair oil and gas rigs (Kassem et al., 2017). This training method generates more proficient operators, reduces critical errors, increases quality and efficiency, and most importantly, improves worker safety (Boas, 2013). Virtual reality simulation can replicate dangerous environments, allowing participants to learn in those situations without the actual danger (Freina & Ott, 2015; Kassam et al., 2017).

Promising research from many disciplines outside of the healthcare realm demonstrates the effect that full immersion VRS can have on improving learning, enhancing collaboration, reducing time, costs, and maximizing consumer safety. As immersive VRS technologies continue to emerge, more research on their use and benefits will be anticipated.

Full Immersion VRS in Healthcare Disciplines

Full immersion VRS is progressively emerging in other healthcare fields and is currently most prevalent in graduate medical and surgical education. Other healthcare disciplines such as radiography, physical therapy, occupational therapy, and paramedic training have been included in the literature search. Multiple clinical studies measure the influence of full immersion VRS on the knowledge, skills, and satisfaction of medical students, residents, and physicians across several specialties. Common findings concluded that virtual reality simulation produced equal knowledge and skills compared to traditional methods, and participants indicated satisfaction in using this modality for their learning (Jwayyed et al., 2011; Sakakushev et al., 2017).

Opportunities for surgical training in live operating rooms have decreased; however, virtual reality simulation has filled that gap by providing immersive, realistic, and engaging scenarios for medical students to practice without the risk of patient harm (Sugand et al., 2015).

Full immersion VRS has been successful in orthopedic and otolaryngology surgery training as residents exhibited improved performance, increased confidence, and demonstrated knowledge and skill transfer to the live operating rooms (Locketz et al., 2017; Sugand et al., 2015). VRS technology uses internal scanning tools to mimic patients' exact features to assist surgeons in practicing highly technical and complex procedures and solve potentially unforeseen issues before operating on live patients (Izard et al., 2017).

Although limited in the emergency department, full immersion VRS has produced the same results as traditional methods when teaching medical students team leadership and advanced trauma life support skills (McGrath et al., 2018). Full immersion VRS has also improved pediatric residents' communication skills, especially when speaking to parents about the benefits of vaccinating their children against influenza (Real et al., 2017). Despite the amount of current research on the influence of full immersion VRS in medical and surgical education, more studies assessing its success in knowledge and skill gain against traditional learning methods are needed.

The presence of full immersion VRS and subsequent research among other healthcare disciplines is severely limited. Despite the lack of research, one radiography study found that students' who practiced hand positioning skills in full immersion VRS perceived this learning method as equally effective as the traditional role-play simulation (Sapkaroski et al., 2020). The critical difference between the two simulation modalities was that students could repeatedly and independently practice their skills in full immersion VRS (Sapkaroski et al., 2020). This research supports the need for an increased presence of full immersion VRS and more research to assess its effect on radiography education. One study in physical therapy found that immersive VRS improved students' interprofessional communication and patient advocacy skills (Taylor et al., 2017). A small percentage of occupational therapy programs have used computer-based virtual gaming simulation to help with skills and concept integration; however, no studies on full immersion virtual reality simulation were found (Bethea et al., 2014). Preliminary research on the influence of full immersion VRS on rehabilitation for neurological and mental health disorders have been explored. However, ethical concerns related to its potential adverse effects have caused delays in research and application to clinical practice (Kellmeyer, 2018).

Paramedic programs have utilized a wide range of simulation resources, including virtual reality simulation, but most of those simulations were computer-based virtual reality or mixed reality (Cowling & Birt, 2018; McKenna et al., 2015). The limited research assessing the effect of full immersion VRS in paramedic education found the scenarios authentic and more collaborative than paper and pencil case studies (Vaughan et al., 2020). One study also found that immersive VRS was useful in testing various emergency response triage models because the same disaster scenario could be repeated for an objective evaluation of each model (Jain et al., 2016).

Although there is emerging research using full immersion VRS in various healthcare disciplines, the quantity of studies is severely limited, lacks adequate sample sizes, and has not been repeated with other student populations. Substantially more research providing conclusive data on the influence of full immersion VRS is warranted.

Full Immersion VRS in Nursing Education

Full immersion VRS in nursing education is an emerging concept with limited research on its presence and effect on student learning. According to the available research, full immersion VRS has generally provided participants with an authentic, immersive experience and earned positive feedback (Butt et al., 2018; Samosorn et al., 2020; Shin et al., 2019; Smith et al., 2018; Ulrich et al., 2014; Vottero, 2014). Full immersion VRS successfully created a realistic medication dispensary area, with common interruptions that nurses face, to improve nursing students' medication administration skills (Vottero, 2014). Students scored the simulation as realistic, technically correct, and immersive (Vottero, 2014). Samosorn et al. (2020) found that full immersion VRS was effective in teaching nursing faculty and students patient airway maintenance skills such as respiratory assessment, airway patency maneuvers, and oxygen delivery devices. Both students and faculty scored the simulation as having a high presence, meaning they experienced a high level of immersion (Samosorn et al., 2020).

A study comparing full immersion VRS with traditional methods in teaching nursing students operating room fire safety knowledge and skills found both methods were equally effective (Rossler et al., 2019). These findings support its use in hospitals to teach and reinforce operating room fire safety to all nursing and operating room staff. Research using full immersion VRS to practice urinary catheter insertion skills displays mixed results. In one study, nursing students found the simulation engaging and enjoyable and demonstrated identical catheter insertion skill competence compared to the traditional skill practice group (Butt et al., 2018). Another study using faculty and nursing professionals across multiple sites found full immersion VRS challenging and engaging; however, technical issues were frustrating, and participants did not enjoy learning catheter insertion in a virtual environment (Breitkreuz et al., 2021).

Compared to computer-based virtual reality and traditional teaching methods, full immersion VRS generated statistically significant knowledge gains regarding healthcare disaster procedures (Smith et al., 2018). These results imply that virtual reality simulation modalities produce disaster knowledge and procedural skill gain equivalent to current traditional approaches; however, knowledge retention after six-months lacked among all the teaching modalities (Smith et al., 2018). The lack of knowledge retention indicates the need for repetition, no matter the simulation format. An earlier qualitative study on nursing students' disaster skills found that it was fun, safe, and engaging as participants could envision the necessary physical steps after completing the simulation experience (Ulrich et al., 2014). Even though knowledge gain or retention was not assessed, the students' feedback guides nursing education programs in developing more engaging and effective learning strategies. Full immersion VRS is comparable to high fidelity and standardized patient simulation in opioid overdose and naloxone training. No significant differences in opioid overdose knowledge or attitudes were found (Giordano et al., 2020).

Some studies on full immersion VRS found mixed results while others produced statistically significant results; however, most contained small sample sizes, signifying the need for more research. Despite the need for more research, many studies have demonstrated favorable results on full immersion VRS's ability to produce equitable skills against conventional methods with increased student satisfaction, further supporting its use in nursing education (Rourke, 2020).

Simulating Patients Experiencing Anxiety

Caring for patients with anxiety requires experience and strong communication skills. Simulation can provide students with the experiences and tools needed to effectively communicate with patients experiencing anxiety (Williams et al., 2017). Unfortunately, simulations designed for the care of patients with anxiety is limited; therefore, its effect on student learning and comfort is unknown (Lamont & Brunero, 2013; Martin & Chanda, 2016; Szpak & Kameg, 2013; Williams et al., 2017). Despite the research gap, it has become more evident that simulation-based education promotes knowledge and skill acquisition and positive attitudes (Aebersold, 2018; Brown, 2015).

Caring for patients experiencing anxiety requires a unique set of therapeutic communication skills, and students lack the confidence and competence to care for anxious patients. This lack of confidence and competence causes anxiety in students, further affecting their ability to perform in the clinical setting, adversely impacting patient outcomes (Brown, 2015). The most effective way to prepare students for anxious patients is through simulation experiences to improve assessment skills, problem recognition, prioritization, and effective communication (Kavanagh & Szweda, 2017).

Chapter Summary

The literature review covered research on the increased prevalence of people suffering from anxiety disorders and highlighted the consequences of medical-surgical nurses' inadequacies in communicating with anxious patients. The review also showed that nursing students are not well equipped to communicate with patients experiencing anxiety. Simulation using high fidelity mannequins and standardized patients reduced nursing students' anxiety when caring for anxious patients, but they face multiple limitations in sustainability, cost, and realism. Full immersion VRS has provided effective, efficient, and safe professional training and learning in many healthcare and non-healthcare disciplines. However, minimal literature exists on its presence and influence on nursing education. To date, no studies have investigated its ability to improve nursing students' communication skills with anxious patients.

Chapter III: Methodology

This chapter will describe the study design, recruitment processes, data collection procedures, and statistical analyses. A quasi-experimental study design was used to assess the effects of full immersion VRS on nursing students' anxiety levels and communication skills when caring for anxious patients. First, the independent variable (full immersion VRS) and the dependent variables (participants' anxiety levels and communication skills) will be defined. Next, the sample, setting, and participant recruitment process will be explained. Use of the short form state anxiety inventory (SAI) and the VRS simulation performance analytics dashboard to measure the dependent variables will be described. Finally, a detailed description of the data collection process, support for the statistical analyses, and ethical considerations will be provided.

Research Design

This quasi-experimental study determined if full immersion VRS influenced nursing students' anxiety levels and communication skills when caring for anxious patients. A quasi-experimental research design resembles experimental research in that it seeks to establish a causal relationship but without the ability to randomize the sample (Gray et al., 2017). This type of research design is most often conducted in field studies where random assignment is not possible. In this study, nursing students were the focus population, and randomization did not occur.

Independent and Dependent Variables

The independent variable was identified as exposure to the full immersion VRS anxiety patient scenario. According to Lopreiato et al. (2016), full immersion VRS is the use of "a variety of immersive, highly visual, 3D characteristics to replicate real-life situations" (p. 40).

The independent variable was applied twice during the study through participant exposure to the same full immersion VRS anxious patient scenario that simulated an encounter with an anxious patient. The first dependent variable, nursing students' anxiety level, is defined as a state of "an overwhelming sense of apprehension and fear," displaying “self-doubt about one's capacity to cope" ("Anxiety," 2020, para. 2). The short form SAI assessed the students' anxiety levels. The second dependent variable, nursing students' communication skills, is defined as the transparent exchange of information between people through verbal language, writing, or other mediums (Sibiya, 2018). The performance analytics dashboard within the full immersion VRS measured the participants’ communication skills by providing a numeric communication score with each scenario experience.

Oxford Medical Simulation (OMS) VRS

Full immersion VRS by Oxford Medical Simulation was used to determine if it has any influence on nursing participants’ anxiety levels and communication skills when caring for an anxious patient. The OMS virtual reality platform provides a large variety of peer-reviewed, full immersion scenarios that engage participants, assess performance, and allow for repeated, deliberate practice (Oxford Medical Simulation, 2020). The scenarios average 20-minutes in length to allow learners the opportunity to practice critical thinking skills and provide adequate patient care (Schleicher, 2020). They encompass high physical and conceptual fidelity by replicating an actual patient care setting furnished with the same features such as medical equipment, supplies, and a realistic-looking and sounding avatar. The headset provides the participant with a 360-degree view of the environment, further increasing its perception of realism. The scenarios are standardized, allowing participants to independently practice and experience the same scenario with little variation. The scenarios align with Jeffries’ simulation theory and follow INACSL's standard criteria on measurable objectives, structured prebrief, presence of fidelity, a participant-centered approach, and an evaluation framework (INACSL Standards Committee et al., 2021).

The anxious patient scenario was explicitly designed for participants to practice their communication skills with a patient experiencing acute anxiety symptoms. The scenario's overall goal was for participants to employ effective communication techniques and implement appropriate nursing skills to provide adequate patient care. Skills included establishing a physical and psychiatric history, identifying anxiety triggers, performing a physical assessment, effectively communicating with the patient, and maintaining patient safety and comfort (Oxford Medical Simulation, 2021).

Sample

A convenience sample of nursing students was recruited from two accredited registered nursing education programs in northcentral Pennsylvania. Only those currently enrolled were asked to volunteer for the study. There were no exclusion criteria for the eligible participants. Participants who could not adhere to the required timeframes to complete the simulation sessions I and II would be dismissed from the study.

The sample size was determined by the type of statistical testing used to analyze the data. Pending the data met all assumptions, participants' anxiety levels would be analyzed using a one-way repeated measures ANOVA and their communication scores examined with a one-tailed paired t-test. According to the G-Power analysis, a within factors, one-way repeated measures ANOVA design required a sample size of 28 participants given the following parameters: one group, three measures, a medium effect size (0.25), 80% power, and an alpha value of 0.05. In addition, both the correlation among repeated measures and nonsphericity remained set at the G-Power tool's standard values of 0.5 and 1, respectively. The required sample size for a one-tailed, paired t-test with a medium effect size (0.5), 80% power, and an alpha value of 0.05 was 27 participants. Given the total population of approximately 200 students, the necessary sample size to meet statistical power was a realistic and achievable goal.

Setting

The study was conducted at a college in northcentral Pennsylvania equipped with the necessary simulation software and hardware to accommodate full immersion VRS. The college contains a virtual reality simulation room that houses two simulation laptops, and their instructional technology department maintains the simulation hardware and software programs to maintain proficiency during use.

Recruitment Procedures

At the beginning of the semester, the researcher collaborated with faculty to generate interest in the study and sent all potential participants a recruitment email (Appendix A). The email outlined the study's purpose; listed the risks, benefits, time commitments, and provided a table outlining the data collection process. The study's approval by the Human Subjects Institutional Review Board (IRB) for the Pennsylvania College of Technology and Wilkes University was disclosed (Appendix F). Lastly, participants were informed that a $10 gift card would be provided to everyone who completed the study in its entirety. Email correspondence between the researcher, participants, and assisting staff occurred through their college-issued secure email server.

Participants interested in the study were asked to email the researcher stating their willingness to participate. The researcher individually responded to the participant's email, including notification of IRB approval, a blank informed consent form (Appendix B), and instructions about the informed consent signature process. Informed consent signatures were obtained through Ever Sign, a cloud-based e-signature service (Appendix C). Once the participant's electronic signature was obtained, Ever Sign sent both the participant and the researcher a finalized copy of the signed consent.

Data Collection

Data collection occurred immediately after the recruitment procedure and during the full immersion VRS anxious patient sessions I and II. The full immersion VRS anxious patient session I occurred during weeks four through seven of the semester, and session II occurred during weeks eight through 11. All participant data was collected via computer and consisted of: 1) a simple demographic data collection form, 2) the short form SAI (pretest, posttest I, and posttest II), and 3) the simulation's performance analytics communication scores (VRS 1 and VRS 2).

Demographic Data & Short Form SAI Pretest

After the researcher received signed informed consent, an email was sent to the participants containing instructions for the next steps (Table 1). Participants were instructed to visit the nursing education office within one week from the email date and begin step one by drawing a random identification number. The random identification number assured anonymity and would be used for each data collection method. The nursing education office staff witnessed the random number drawing and documented the participant's identification number, name, and college email in a password-protected excel database accessible only to the office staff. If the participant forgot their identification number at any time during data collection, they visited the nursing education office, and the office staff provided it. After drawing a random number, the participant was directed to the adjacent office room with a data collection laptop to log in using their student credentials and access their college email. They received an email from the office staff containing a link to the demographic data form and the short form SAI pretest. The participant completed step two by accessing and completing the demographic data form followed by the short form SAI pretest (Table 1). All participants were instructed to complete the short form SAI pretest under the context of being assigned to care for a patient experiencing anxiety. Once completed, the participant logged out of the computer and visited the office staff to schedule a 25-minute appointment for VRS patient session I. The office assistants were given date parameters to ensure participants' appointments remained within the appropriate timeframes.

Table 1

Steps for Data Collection Procedure

Steps	Procedures
1	Informed consent, ID number
2	Demographic data form, SAI pretest
3	VRS orientation (OMS video & PowerPoint)
4	VRS session I
5	SAI posttest I, schedule VRS session II
6	VRS session II, SAI posttest II, receive gift card

Full Immersion VRS Anxious Patient Session I

The researcher sent an email reminder before the participants' scheduled appointment. Next, the researcher met the participant at the college's virtual reality classroom for the full immersion VRS anxious patient session I on their scheduled date and time and confirmed their appointment. The researcher ensured that informed consent had been signed and the demographic data form and short form SAI pretest were completed. The participant completed step three by viewing the VRS orientation materials, consisting of a 35-second video and a 10-slide Microsoft PowerPoint presentation created by OMS (Table 1). The orientation introduced the participant to the OMS full immersion VRS equipment, scenarios, and performance analytics dashboard. While the participant completed the orientation, the researcher inputted their identification number and college email into the OMS simulation system. The simulation system required this data so participants' performance scores could be collected and tracked; however, their email remained hidden to maintain anonymity.

VRS session I (step four) was conducted immediately following the participant's OMS orientation (Table 1). The participant was directed to the simulation's equipment docking area located next to the data collection laptop and donned the headset and hand controls with the researcher's assistance. At this time, they were offered the opportunity to take a minute and acclimate to the equipment in an unrelated demonstration scenario. After the participant expressed comfort with the simulation equipment, they were instructed to log into the simulation system using their identification number to begin the scenario. The participant completed the anxious patient scenario independently while the researcher waited in an adjacent anteroom. The expected time to complete the full immersion VRS anxious patient scenario was 15 to 20 minutes. Participants that finished the scenario in a shorter timeframe still had their data included in the study. When finished with the scenario, the participant verbally called for the researcher, who guided them to the performance analytics dashboard within the simulation. During this time, the participant and researcher reviewed the first communication score and immediate feedback about how well they did during the session.

During the final step of session I, the participant removed the headset, docked the hand controls, and returned to the data collection laptop. The researcher emailed the participant the link to the short form SAI posttest I. The participant re-accessed their email, completed the short form SAI posttest I under the same conditions as the pretest, and logged out of the computer.

Lastly, the participant and researcher scheduled an appointment for the full immersion VRS anxious patient session II using Microsoft Outlook. The participant exited the virtual reality classroom as their full immersion VRS anxious patient session I was complete.

Full Immersion VRS Anxious Patient Session II

The researcher sent an email reminder before the participants' second scheduled appointment. Upon arrival to the virtual simulation classroom, the researcher confirmed the participant's appointment date and time, directed them to the simulation laptop, and assisted them with donning the headset and hand controls. They logged into the same anxious patient scenario from VRS session I, and followed the same procedure to complete the VRS session II (Table 1). The researcher and participant reviewed the second communication score, and the participant removed the headset, docked the hand controls, and reported to the data collection laptop. The researcher and participant followed the same procedure to complete the short form SAI posttest II. The participant logged out of the computer, received their $10 gift card, and exited the virtual reality classroom since VRS session II was complete. All participants were emailed their anxiety and communication scores from both sessions once the study was finished.

Instrumentation

Demographics Data Form

The demographics data form (Appendix D) was developed, scored, and managed through Mind Garden's Transform System™, an independent publisher of psychological assessments. Their databases were secure and password protected. The demographic data form included age, ethnicity, nursing education program, nursing education level, participants' experience communicating with anxious patients, and their experience with full immersion VRS. The participants' VRS experience was rated on a 4-point Likert scale ranging from no experience (1 point) to experienced (4), with higher scores indicating more experience with VRS use. A definition was provided for each experience rating to ensure that all participants fully understood their choice. For example, 'minimal experience' was defined as communicating with an anxious patient or using full immersion VRS one to two times. The 'experienced' rating was defined as communicating with an anxious patient or using full immersion VRS five or more times. The demographic data form took approximately two minutes to complete and provided descriptive data about the study participants. All frequency data was collected via Mind Garden's Transform System™, and all the results were summarized and provided to the researcher at the conclusion of the study.

Short Form SAI

Participants' anxiety levels were measured using Spielberger's (2015) short form SAI, a shortened subscale of Spielberger's 40-item State-Trait Anxiety Inventory for Adults™. The short form SAI is copyrighted through Mind Garden's Transform System™; therefore, the researcher had to purchase the rights to use the inventory for the study. Mind Garden's Transform System™ scored each participant's submissions and managed the results in the same format as the demographic data form.

Spielberger's 20-item SAI is the most widely used measure of state anxiety in college and high school students, working adults, and military recruits in research and clinical practice (Kruyen et al., 2013; Marteau & Bekker, 1992; Seok et al., 2015). However, its length may be too demanding for participants, leading to diminished response rates and item omissions. Since the participants took the state anxiety inventory three times, the 10-item short form SAI was the best choice to maximize response rates and minimize item omissions, maintaining high reliability and validity (Spielberger, 2015). In addition, the approximate time to complete the short form SAI was three to five minutes.

The anxiety-absent items are sensitive to low stressors, while the anxiety-present items are sensitive to high stressors. Spielberger's short form SAI used the following item numbers: 3, 7, 9, 12, 13, and 17 (anxiety present) and 1, 5, 15, 19 (anxiety absent). The copyright policy for Spielberger's SAI prohibits item reproduction in published work, only allowing item numbers. Therefore, to maintain the integrity of the SAI, only four sample items that the publishing company chose were permitted for display in the dissertation (Appendix E).

The short form SAI was measured on a 4-point scale ranging from 1 (i.e., not at all) to 4 (i.e., very much so) for the anxiety present items, and 4 (i.e., not at all) to 1 (i.e., very much so) for the anxiety absent items. From a psychometric perspective, the minimum number of response categories for items with a Likert-scale format should be at least four, as anything less has been shown to dramatically decrease the survey's reliability and validity (Lee & Paek, 2014). The short form SAI scores range from a minimum of 10, or no anxiety, to a maximum of 40, or high anxiety (Spielberer, 2015). The mean anxiety score norms from the short form SAI for working adults are as follows: 18.61 (± 5.95) for ages 18 to 22, 18.66 (±6.17) for ages 23 to 32, and 17.53 (±5.65) for those 33 years and older (Spielberger, 2015). This data was used to compare the study participants' anxiety scores.

Validity and Reliability

Spielberger's SAI has an extensive history of reliability coefficients greater than 0.90; however, test-retest correlations remain low as expected due to the influence of situational factors (Marteau & Bekker, 1992; Spielberger et al., 2015). Test-retest correlations vary greatly because anxiety states are transient; therefore, the alpha coefficient data is more meaningful

(Spielberger, 2015). When comparing the original to the short form SAI using college students, a 0.95 correlation was found, indicating a strong relationship between both inventories (Spielberger, 2015). The high reliability of the original and short-form SAIs has led to their use in nursing education research studies (Kameg et al., 2014; Marteau & Bekker, 1992; Szpak & Kameg, 2013).

OMS Communication Performance Analytics Dashboard

The OMS full immersion VRS software's performance analytics dashboard measured participants' communication skills. The dashboard analyzed, scored, and graphed the participants' performances on technical skills, communication, teamwork, timing and provided an overall average (Oxford Medical Simulation, 2020). Participants received percentage scores on each category listed above, ranging from 0 to 100, with 75% indicating a passing score. For the purposes of this study, only the communication scores were used for data analysis. The researcher exported the communication scores for each participant from every simulation session (VRS I and VRS 2) and imported the data into an updated SPSS data analysis program.

The performance analytics dashboard did not provide reliability and validity scores; however, the objective and standardized algorithms used to evaluate participants' behaviors throughout the simulation were valuable to guide learning and accurately assess performance (Oxford Medical Simulation, 2020). The performance analytics component was critical as it identified participants' strengths and weaknesses and encouraged self-reflection. It has been supported by many medical schools and nursing education programs and demonstrated effectiveness in medical, military, and nursing research (Oxford Medical Simulation, 2020).

Data Analysis

Mind Garden's Transform System™ automatically scored and collated each participant's demographic data form, SAI pretest, posttest I, and posttest II results, while the simulation's software collected and collated each participant's communication scores. The data was stored in a secure, password-protected database within each system. After all collection procedures were complete, the researcher accessed both databases and exported the data into an updated version of SPSS software.

The intent was to use a one-way repeated measures ANOVA for the anxiety scores and a one-tailed paired t-test for the communication scores. However, given that the data collection is from human participants in a natural setting, violations of the assumptions are common (Laerd Statistics, 2016). If violations occur, the following options may be considered: making corrections to the data to decrease or remove the outliers, using the alternative nonparametric statistical tests, or proceeding with the parametric statistical analysis despite the violations (Laerd Statistics, 2016).

One-Way Repeated Measures ANOVA

The one-way repeated measures ANOVA is an extension of a paired t-test in that it seeks to determine if there were significant differences between the means of three or more related levels of a within-subjects factor (Laerd Statistics, 2016). The term *within-subjects factor* indicates the same cases or participants, while *levels* refer to the three different points in time or conditions with which the participants are being measured (Laerd Statistics, 2016).

Several assumptions for a one-way repeated measures ANOVA must be met. First, the design must contain one dependent variable measured at the continuous level and one within-subjects factor containing three or more categorical levels measured on a nominal or ordinal scale (Laerd Statistics, 2016). There should be no significant outliers in any level of the within-subjects factor, and the dependent variable should be approximately normally distributed in each level (Laerd Statistics, 2016). Lastly, the variances of the differences between all levels of the within-subjects factor should be equal, indicating sphericity (Laerd Statistics, 2016). The outlier, normality, and sphericity assumptions will be tested using SPSS Statistics. However, if the assumptions for ANOVA are not met, the non-parametric test Friedman test will be used.

Paired t-test

The paired t-test determines if the mean difference between the paired observations is statistically significant (Laerd Statistics, 2016). In this study, the paired t-test analyzed the participants' communication scores, measured after the first and second VRS anxious patient scenario. Given that the hypothesis was directional, a one-tailed paired t-test was most appropriate.

When conducting a paired t-test, four assumptions must be considered. First, the study must contain one dependent variable at the continuous level with an independent variable consisting of two categorical, related groups, or matched pairs (Laerd Statistics, 2016). There should be no significant outliers in the differences between the paired data, and the distribution of the dependent variable's differences between the related groups should be normally distributed (Laerd Statistics, 2016). The outlier and normality assumptions will be tested using SPSS Statistics.

Ethical Considerations

This study adhered to the American Nurse's Association of Ethics for Nurses guidelines for protecting human subjects' rights in research (Gray et al., 2017). The right of self-determination was met since participation was strictly voluntary, and participants may dismiss themselves from the study at any time. The data remained private through a secure computer password data collection and storage process, thus protecting their right to confidentiality and privacy. Participants randomly chose an identification number to protect their anonymity. The participants used their identification numbers for each data collection period to protect their rights and adhere to fair treatment. Full disclosure on the potential harm and benefits of participating in the study was provided. Since full immersion VRS may cause motion sickness, participants had the right to stop the scenario at any time if they felt ill or experienced any discomfort. However, the benefits outweighed the risks since participants experienced full immersion VRS and the opportunity to practice communication with an anxious patient. Furthermore, the knowledge gained from this study may contribute to nursing education by providing participants the opportunity to increase their skills when communicating with anxious patients.

Chapter Summary

A quasi-experimental design with a convenience sample of undergraduate nursing participants was recruited to experience an anxious patient scenario through full immersion VRS at two different time periods. Participants completed the short form SAI three times and earned two communication scores issued by the simulation scenario's performance analytics dashboard. Details on the researcher's approach to gathering data included a step-by-step explanation that can be used in future studies. In addition, the rationale for using the short form SAI and the simulation's performance analytics dashboard was provided. The one-way repeated measures ANOVA and the one-tailed paired t-test have been identified as the most appropriate data analysis techniques. All data was collected and stored through secure databases and analyzed using an up-to-date SPSS program.

Chapter IV: Findings

The data collection process has been completed. This chapter will describe the study’s sample population and the research findings and, lastly, provide a comprehensive analysis of the data related to the research questions. The purpose of this quasi-experimental study was to determine full immersion VRS’s influence on nursing students' anxiety levels and communication skills when caring for anxious patients. The study addressed the following research questions:

1. Did exposure to full immersion VRS influence nursing students’ anxiety levels over time: pre VRS exposure (week 3), VRS 1 (week 4-7), VRS 2 (week 8-11)?
2. Did the use of full immersion VRS improve students’ communication scores?

Description of the Sample

After IRB approval, a convenience sample of 33 undergraduate registered nursing students were recruited from a northcentral Pennsylvania college. Convenience sampling was utilized because access to participants from a nursing program was readily available when the study was conducted. To ensure the participants were well informed about the study, an IRB-approved email was sent to prospective participants, and all questions were answered. They understood that their participation in the study was voluntary and that they could abort the study at any time without repercussion.

The demographic data presented in Table 1 represented the study sample by age, ethnicity, nursing program type, nursing education level, experience in communicating with anxious patients, and lastly, their experience with full immersion virtual reality simulation. Although there was representation within all the age categories, the most common age range was 18 – 25 years. The undergraduate nursing student population at the college lacked diversity. The lack of diversity was apparent in the sample since most of the participants were white, with only a few from the Hispanic or black population. The sample depicted an almost even split between the associate degree and bachelor degree registered nurse programs; however, there were far more participants in the latter half of their nursing education than those in the fundamentals and medsurg 1 level.

Table 1. *Demographic Profile of Study Participants (N = 33)*

Characteristic	Dimension	Frequency	Percentage
Age	18-25 years	18	54.5%
	26-35 years	7	21.2%
	36-45 years	6	18.2%
	46+ years	2	6.1%
Ethnicity	White	28	84.8%
	Hispanic or Latino	2	6.1%
	Black or African American	3	9.1%
Nursing Program	Associate Degree RN	17	51.5%
	Bachelor Degree RN	16	48.5%
Nursing Education Level	Fundamentals	7	21.2%
	Medsurg 1	4	12.1%
	Medsurg 2	10	30.3%
	Medsurg 3	12	36.4%
Experience Communicating with an Anxious Patient	No Experience	3	9.1%
	Minimal (1-2)	8	24.2%
	Moderate (3-5)	10	30.3%
	Experienced (5+)	12	36.4%
Experience with Full Immersion Virtual Reality Simulation	No Experience	23	69.7%
	Minimal (1-2)	5	15.2%
	Moderate (3-5)	4	12.1%
	Experienced (5+)	1	3.0%

Study Results

All 33 participants completed the study in its entirety, including the demographics data form, the anxiety pretest, anxiety posttest I, anxiety posttest II, VRS I, and VRS II. Each VRS session produced a communication score. The Friedman test assessed the nursing students' anxiety levels at three different times: before VRS, after VRS I, and after VRS II. In addition, a matched pairs design evaluated the nursing students' communication skills at two different times: VRS I and VRS II. The participants' communication skills could only be assessed using the VRS's analytics system; therefore, no pre-VRS communication score existed.

Full Immersion Virtual Reality Simulation Session I and II

The mean time from the first VRS session to the second VRS session was 24.36 days, with a minimum of 21 days and a maximum of 37 days. Participants were not permitted to complete their second VRS session less than 21 days after their first session. As outlined in Table 2, most participants completed their second VRS session within 21 to 28 days, with three participants completing session II on days 31, 35, and 37. The participants with the most prolonged period between the VRS sessions faced quarantine issues related to COVID 19; however, they completed the second session in a reasonable time, so their data remained.

Table 2. *Timeframe Between VRS 1 and VRS 2*

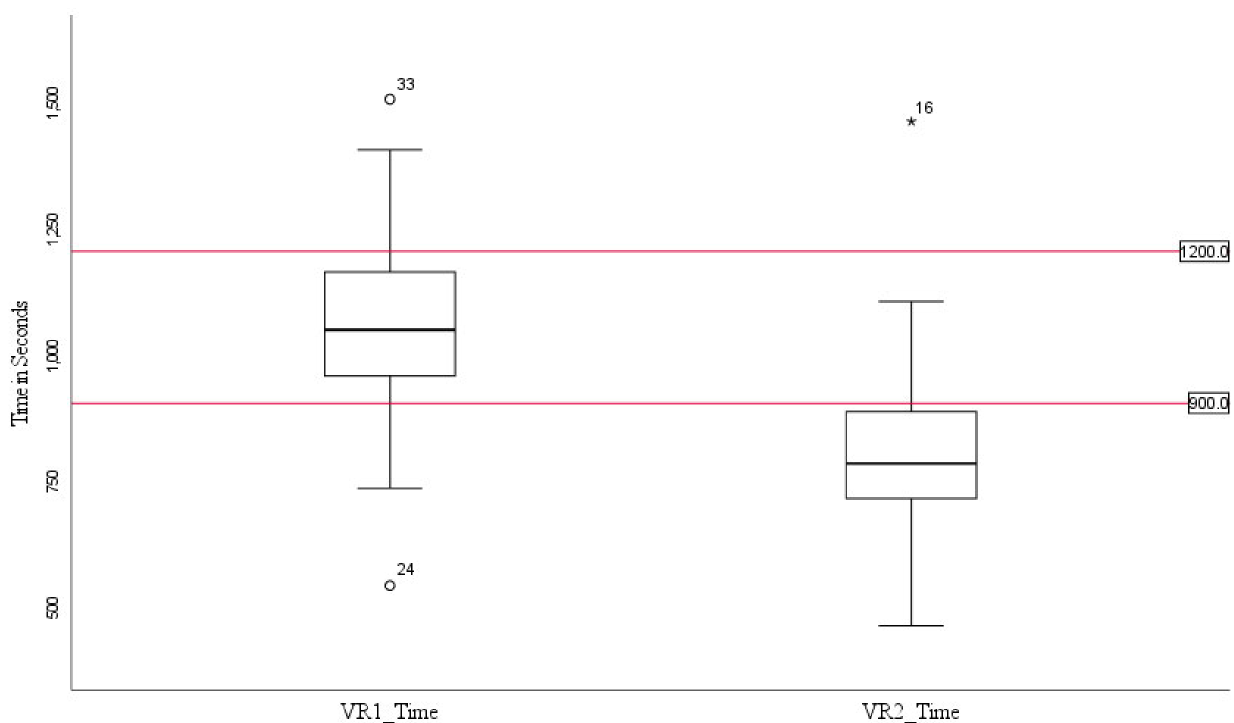
Characteristic	Dimension	Frequency	Percentage
Days Between VRS 1 and VRS 2	21 days	17	51.5%
	23 days	1	3%
	25 days	3	9.1%
	26 days	3	9.1%
	28 days	6	18.2%
	31 days	1	3%
	35 days	1	3%
	37 days	1	3%

Participants completed VRS session I (Figure 1) within a median time of 17 minutes 25 seconds (1, 045 seconds), whereas the shortest time spent in VRS I was 9 minutes (540 seconds) and the longest was 25 minutes (1,500 seconds). VRS session II (Figure 1) was completed within a median time of 13 minutes 1 second (781 seconds); the shortest time at 7 minutes 41 seconds

(461 seconds) and the longest at 24 minutes 16 seconds (1, 456 seconds). The anticipated time to complete the VRS anxious patient scenario was 15 to 20 minutes, as depicted by the red lines in Figure 1. The median time for VRS session I was in the anticipated time range, while the median time for VRS II was below that range. Completing VRS II in less time than VRS I was expected because it was the same anxious patient scenario. Based on their first experience, participants knew what to expect and reacted quicker.

The six participants who surpassed the original 20-minute limit to prevent eye strain were asked if they still wished to proceed and opted to complete the scenario. No participants verbalized illness, nor did any wish to abort the scenario.

Figure 1. *VRS I and VRS II Time*

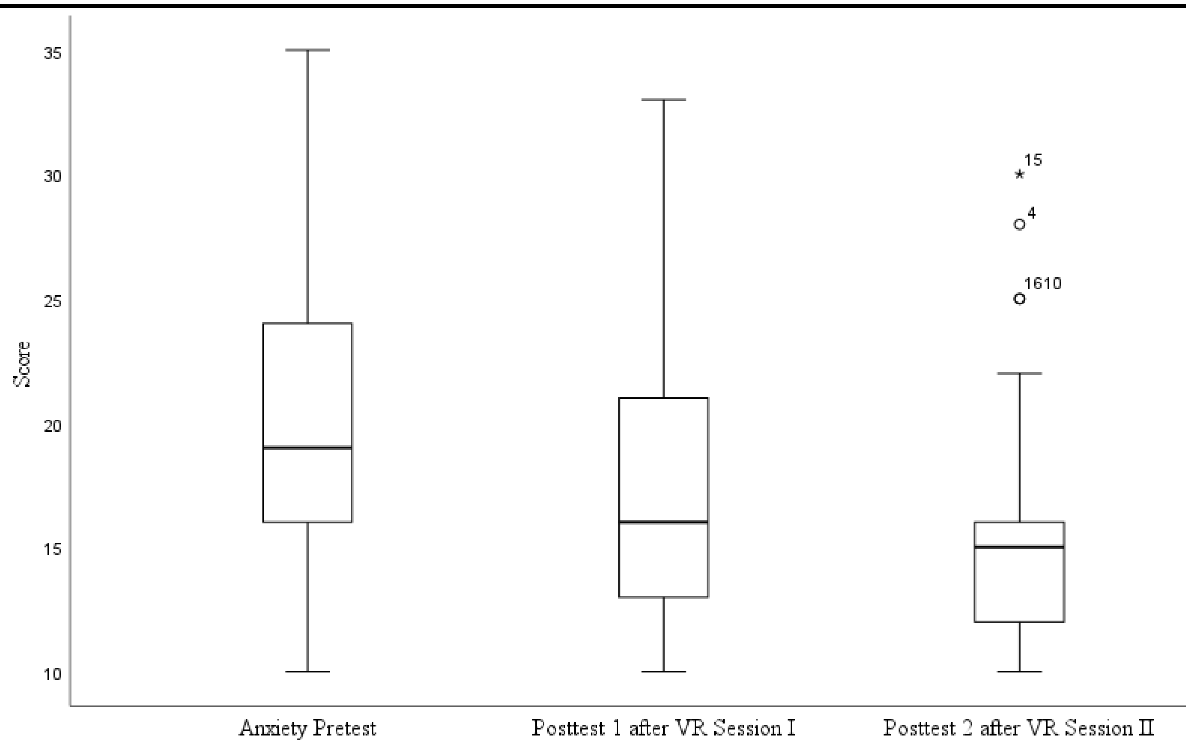


Participants' Anxiety Levels

Participants' mean pretest anxiety levels aligned with the anxiety norms as outlined by Spielberger's SAI among adults (Spielberger, 2015). For example, the 18 – 25 age group participants had a mean pretest anxiety score of 20.83 (Spielberger norm 18.61 ± 5.95). Study participants in the 26 – 35 age category had a mean pretest anxiety score of 18.86 (Spielberger norm 18.66 ± 6.17). Lastly, the 36+ age group participants had a mean pretest anxiety score of 19.25 (Spielberger norm 17.53 ± 5.65) (Spielberger, 2015).

The intent was to complete a one-way repeated measures ANOVA to determine whether there were statistically significant differences in participants' anxiety scores over time (week 3, weeks 4-7, and weeks 8-11). The data met the first two assumptions as their state anxiety levels, measured at three different time points, were an interval level variable. The pretest and posttest I data contained no outliers; however, the box plots identified three outliers and one extreme point within the posttest II data (Figure 2).

Figure 2. *Box Plot Identifying Outliers: Anxiety Levels*



The pretest data were normally distributed based on the Shapiro-Wilk test (Table 3) with a value of .336; however, posttest I and posttest II data were not normally distributed (.004 and

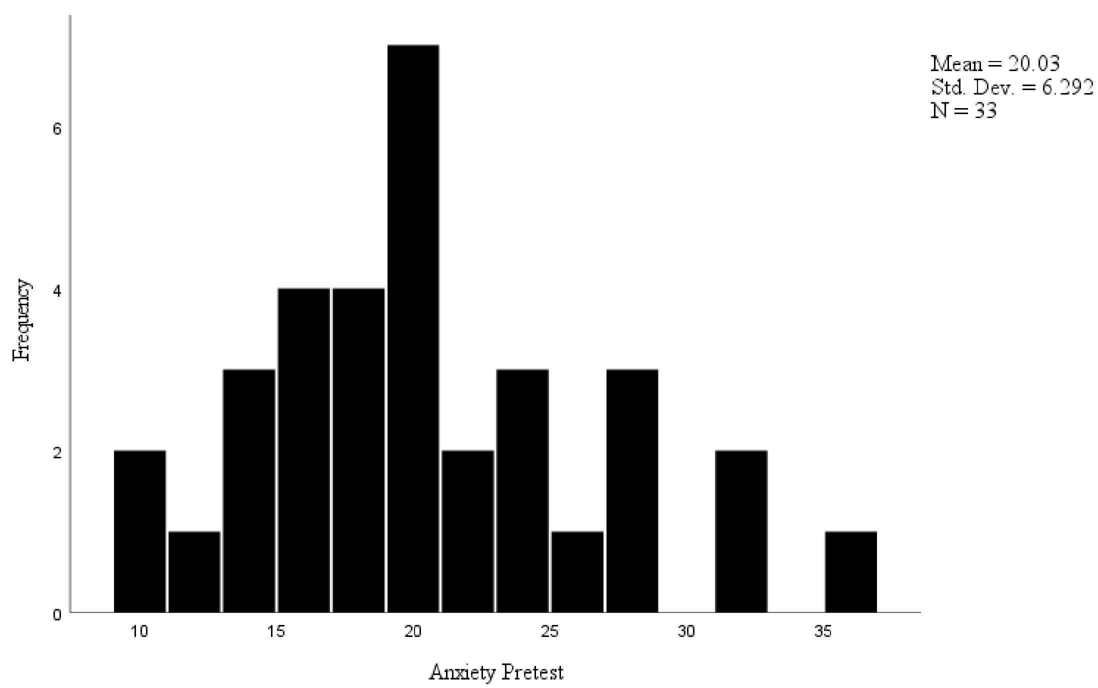
<.001, respectively). The normality of the anxiety scores, illustrating that only the pretest scores were normally distributed, can be found in Figure 3.

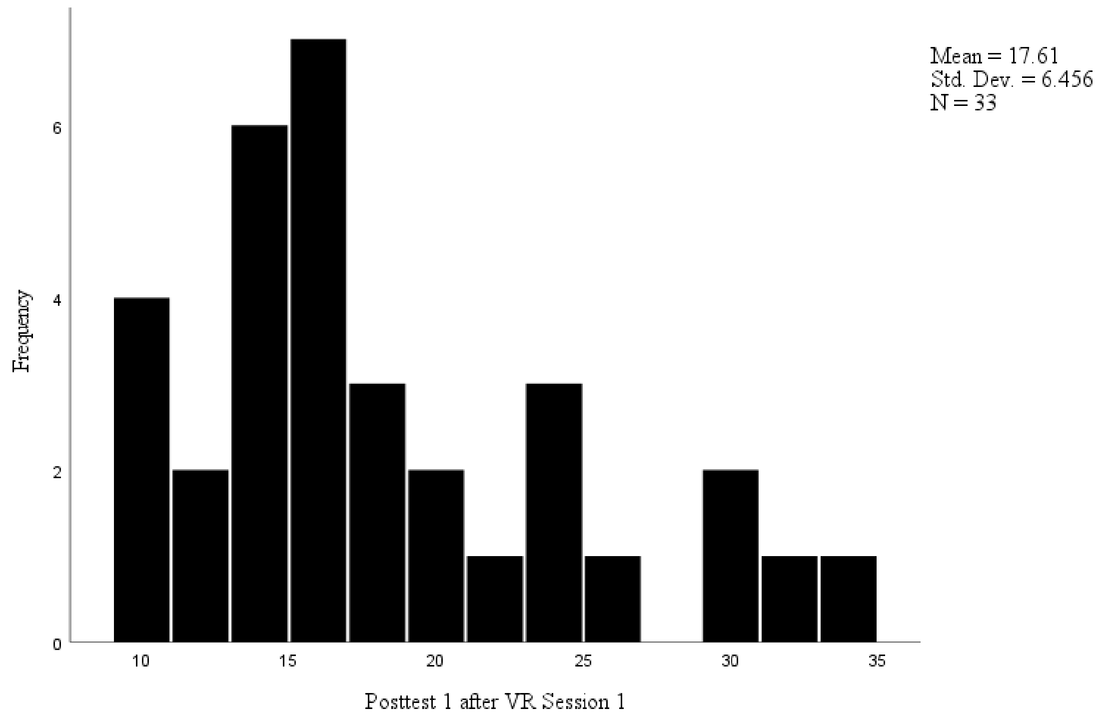
Table 3. *Tests of Normality*

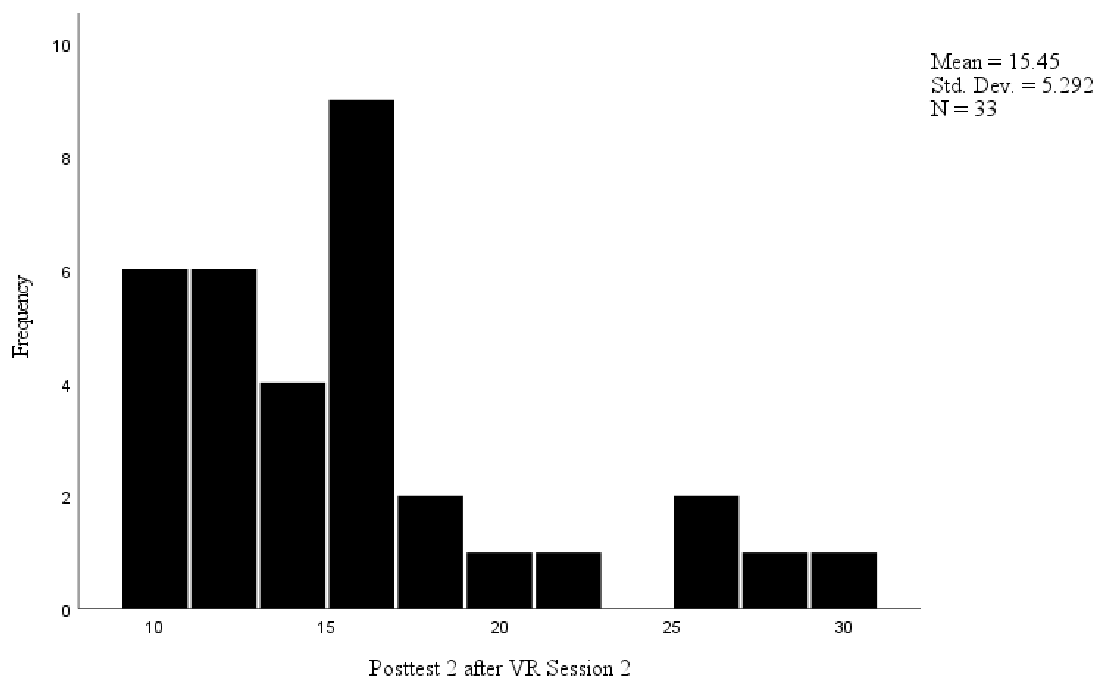
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Pre Intervention Anxiety Score	.138	33	.111	.964	33	.336
Posttest I Anxiety after VR Session I	.174	33	.013	.896	33	.004
Posttest II Anxiety after VR Session II	.217	33	<.001	.852	33	<.001

a. Lilliefors Significance Correction

Figure 3. *Histogram: Pretest, Posttest I, and Posttest II Anxiety Scores*







Given that the data did not meet two assumptions, statistical analysis using the one-way repeated measures ANOVA could not be completed. Instead, the related-sample Friedman one-way analysis of variance by ranks test was completed to determine differences in participants' anxiety scores. The Friedman test is a non-parametric alternative to the one-way repeated measures ANOVA used to determine statistically significant differences between the median values of three or more related groups (Laerd Statistics, 2016). This test is implemented when a repeated measures ANOVA cannot be used due to one or more assumption violations (Kellar & Kelvin, 2013).

Before running a Friedman test, two assumptions must be met. First, the study must contain one dependent, continuous variable (Laerd Statistics, 2016). Second, the independent variable must contain three or more categorical or related groups (Laerd Statistics, 2016). The data met the two assumptions since the participants' state anxiety levels were measured at three different time points.

The Friedman test found that participants' anxiety scores were statistically significantly different at the different time points, $x^2(2) = 21.193$, $p < .001$ (Table 4). Therefore, the null hypothesis was rejected. However, the necessary sample for the Friedman test for 80% power was 36, and this sample size contained 33 participants. Although significance was met, not meeting the required sample size reduced the statistical power.

Table 4. *Friedman's Analysis*

Hypothesis Test Summary

Null Hypothesis	Test	Sig.[a,b]	Decision

1	The distributions of Pre Intervention Anxiety Score, Posttest 1 Anxiety after VR Session 1 and Posttest 2 Anxiety after VR Session 2 are the same.	Related-Samples Friedman's Two-Way Analysis of Variance by Ranks	<.001	Reject the null hypothesis.

a. The significance level is .050.
b. Asymptotic significance is displayed.

Related-Samples Friedman's Two-Way Analysis of Variance by Ranks Summary

Total N	33
Test Statistic	21.193
Degree Of Freedom	2
Asymptotic Sig.(2-sided test)	<.001

Multiple post hoc tests were performed, including Tukey's HSD, the Student–Newman–Keuls (SNK) method, the sign test, and pairwise comparisons with a Bonferroni correction (performed with IBM SPSS Statistics for Windows, Version 28.0). Ultimately, the pairwise comparisons post hoc analysis (Table 5) was chosen as the most conservative method, accounting for type 1 error, which expands with each comparison. Post hoc analysis revealed statistically significant differences (adjusted significance) in the anxiety pretest (Mdn = 19) and posttest II (Mdn = 15) ($p < .000$).

Table 5. *Pairwise Comparisons*

Sample 1-Sample 2	Test Statistic	Std. Error	Std. Test Statistic	Sig.	Adj. Sig.[a]
Posttest 2 Anxiety after VR Session 2-Posttest 1 Anxiety after VR Session 1	.515	.246	2.093	.036	.109

Posttest 2 Anxiety after VR Session 2-Pre Intervention Anxiety Score	1.076	.246	4.370	<.001	.000
Posttest 1 Anxiety after VR Session 1-Pre Intervention Anxiety Score	.561	.246	2.277	.023	.068

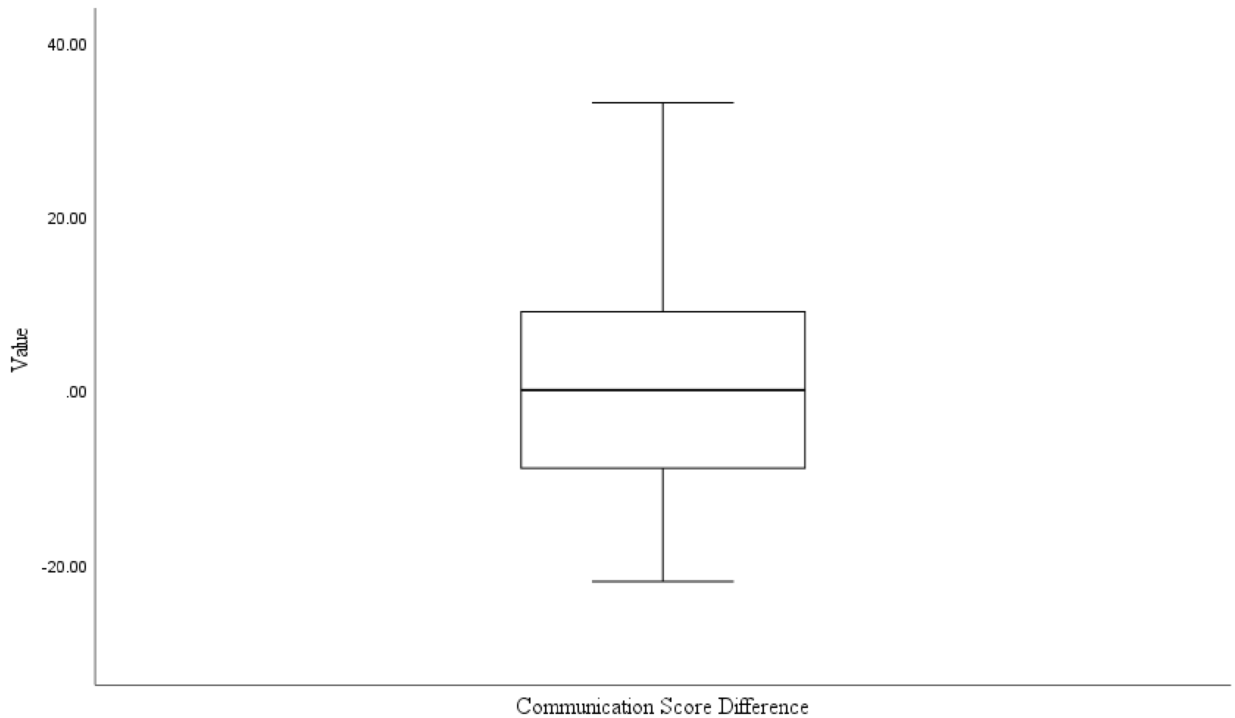
Each row tests the null hypothesis that Sample 1 and Sample 2 distributions were the same.
Asymptotic significances (2-sided tests) have been displayed. The significance level was .050.
a. Significance values have been adjusted by the Bonferroni correction for multiple tests.

The research question asking if exposure to full immersion VRS influenced nursing students' anxiety levels over time has been answered using the Friedman test ($x^2(2)$ = 21.193, p < .001). The second research question sought to determine if the use of full immersion VRS improved students' communication scores through a paired t-test.

Participants' Communication Skills

A one-tailed paired t-test analyzed the participants' communication scores, measured after the first and second VRS anxious patient scenario. The data met the first assumption because the communication scores were measured as one continuous, dependent variable. The second assumption was met since the independent variable consisted of related groups: the participants' VRS I communication scores compared to their VRS II communication scores. Box plot analysis (Figure 4) did not identify any outliers or extreme points; therefore, meeting the third assumption.

Figure 4. *Box Plot Identifying Outliers: Communication Score Differences*



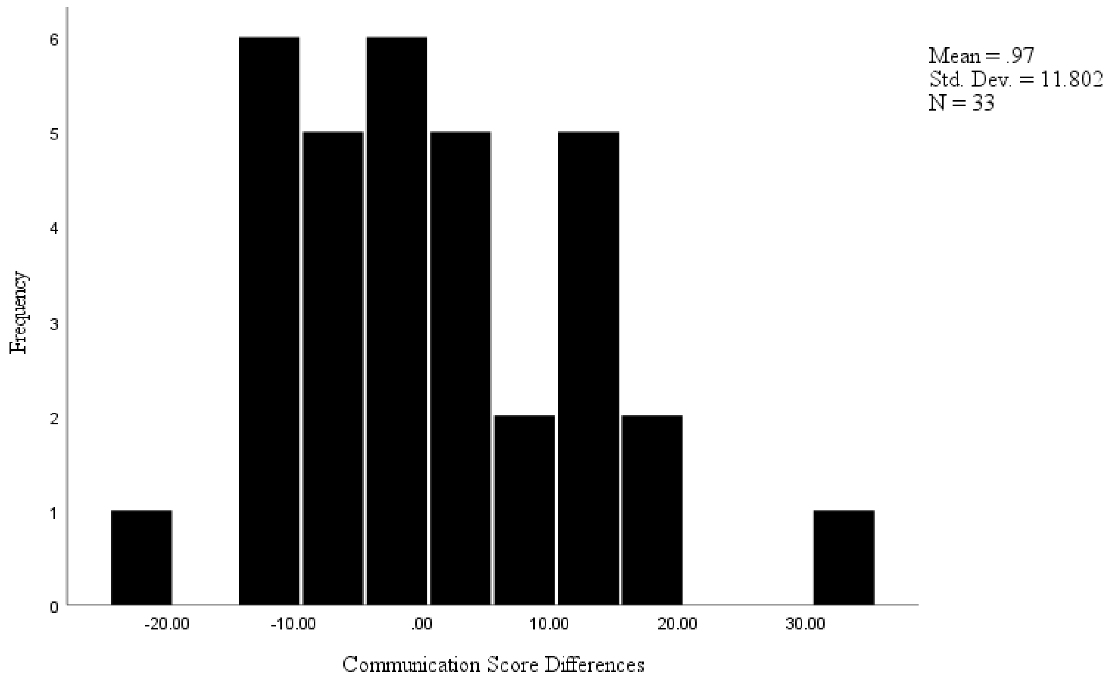
The fourth assumption was met as the Shapiro-Wilk test (Table 6), and histogram data (Figure 5) found that the differences between the VRS I and VRS II communication scores were normally distributed (p = .415).

Table 6. *Tests of Normality*

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
difference	.088	33	.200*	.968	33	.415

*. This is a lower bound of the true significance.
a. Lilliefors Significance Correction

Figure 5. *Histogram: Differences in Communication Scores*



The descriptive data gleaned from the paired t-test (Table 7) found that the mean VRS II communication scores (M = 56.64, SD = 12.03) were greater than the mean VRS I communication scores (M = 55.67, SD = 12.54).

Table 7. *Paired Samples Statistics*

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Comm2 Score	56.64	33	12.033	2.095
	Comm1 Score	55.67	33	12.544	2.184

VRS II demonstrated a mean increase of .970, 95% CI [-3.22, 5.15] in communication scores compared to VRS I (Table 8); however, the mean increase did not meet statistical significance (p = .320). Therefore, the null hypothesis was not rejected.

Table 8. *Paired Samples Test*

	Paired Differences	t	df	Significance

				95% Confidence Interval of the Difference					
	Mean	Std. Deviation	Std. Error Mean	Lower	Upper			One-Sided p	Two-Sided p
Pair 1 Comm2 Score - Comm1_Score	.970	11.802	2.054	-3.215	5.154	.47	32	.320	.640

Chapter Summary

The data findings of the study were presented in response to each research question. Based on failed assumptions, the non-parametric Friedman test was employed to determine significance between the participants' anxiety scores. Statistical significance was found between the anxiety pretest and posttest II scores, rejecting the null hypothesis. However, the sample size required for the Friedman test was not met, reducing the study's statistical power. Participants' communication scores were assessed using the paired t-test as the data met all assumptions. Statistical analysis determined that participants' communication scores from VRS I to VRS II did not improve enough to meet significance; therefore, the null hypothesis could not be rejected.

Chapter V: Conclusion

Anxiety disorders have been the most common mental health disorder, with approximately 40 million United States adults, or 18% of the population, experiencing anxiety (Anxiety & Depression Association of America, 2021). The increased incidence of medical-surgical patients with a secondary anxiety diagnosis and nurses' feelings of inadequacy in communicating with anxious patients has hindered the therapeutic nurse-patient relationship, negatively impacting patient outcomes (Avery et al., 2020; Martin & Chanda, 2016). Nurses' unpreparedness in communicating with anxious patients identified a need for increased communication training in nursing education. Nursing education programs have not sufficiently prepared students to care for patients with anxiety, and that lack of communication experience has contributed to anxiety in students (Avery et al., 2020; Kameg et al., 2013).

The literature established that simulation using high fidelity mannequins and standardized patients reduced nursing students' anxiety when caring for anxious patients, but were limited in sustainability, cost, and realism (Haerling, 2018; Martin & Chanda, 2016; Quail et al., 2016). Additionally, research has shown that full immersion VRS provides effective and safe training in healthcare and non-healthcare disciplines but is severely limited in nursing education. To date, no studies have investigated full immersion VRS's influence on nursing students' anxiety and communication skills when caring for anxious patients.

The purpose of this study was to determine full immersion VRS's influence on nursing students' anxiety levels and communication skills when caring for anxious patients. The quasi-experimental research design utilized a convenience sample of undergraduate nursing students from two accredited registered nursing education programs within the same college. Full immersion VRS was the independent variable, while nursing students' anxiety levels and communication skills were the dependent variables. Spielberger's short form SAI assessed participants' anxiety levels at three intervals: pre-intervention (week 3), immediately after the anxious patient scenario session I (week 4-7), and immediately following the anxious patient scenario session II (week 8-11). In addition, the virtual reality simulation's analytics dashboard evaluated their communication skills at each performance and issued a numeric score. The data identified a statistically significant decrease in nursing students' anxiety levels over time; however, their communication scores did not significantly increase.

Discussion of the Findings

Demographic Data

The sample size from this study mirrored what others used in studies related to full immersion VRS research in nursing education (Butt et al., 2018; Samosorn et al., 2020; Ulrich et al., 2014). However, Giordana et al. (2020) and Smith et al. (2018) recruited larger samples given their access to a more significant population of students from an urban university or across multiple college campuses. Although the sample size for this study was small, it was consistent with the other literature in age and ethnicity (Butt et al., 2018; Giordana et al., 2020; Samosorn et al., 2020; Smith et al., 2018; Ulrich et al., 2014). Unfortunately, our sample did not adequately represent minority students since 34% of minority students were enrolled in entry-level baccalaureate nursing education programs (American Association of Colleges of Nursing, 2019). A larger sample size would have allowed for better stratification of age or race and aligned with statistics that reflect the national nursing student population.

Full Immersion VRS Sessions

The median time participants spent in the virtual reality sessions I and II was supported by others with the time spent in VRS (Giordano et al., 2020; Samosorn et al., 2020; Smith et al., 2018; Ulrich et al., 2014). Participants' time in VRS was important because too much time spent looking through the headset could cause physical symptoms such as dizziness or nausea and contribute to attrition. Cybersickness may negatively impact students' learning abilities, leading to reduced adoption of full immersion VRS in nursing education programs (Samosorn et al., 2020). Consequently, Giordano et al. (2020) required participants to complete a motion sickness screening tool, while Samosorn et al. (2020) utilized a VR sickness questionnaire. The results of the screening tools concluded that all participants experienced little to no cybersickness (Samosorn et al., 2020). Furthermore, none of the identified categories gleaned from the qualitative study by Ulrich et al. (2014) were related to cybersickness, nor was the topic identified as a limitation by Butt et al. (2018) or Smith et al. (2018). It was evident in the literature that cybersickness was not a significant issue.

In contrast to the other studies, this study required participants to complete two sessions of full immersion VRS, with a minimum of three weeks between sessions. Implementing two VRS sessions provided additional experience using immersive simulation and communication with an anxious patient. Furthermore, the performance scores generated from the analytics system allowed for individual and group score comparison.

Anxiety Levels

Our results concluded that full immersion VRS influenced nursing students' anxiety levels, rendering them more comfortable communicating with anxious patients. These findings aligned with Kameg et al. (2014), who used standardized patients and assessed students' anxiety levels with the original Spielberger's State-Trait Anxiety Inventory (STAI) in a pretest-posttest format. Also, Szpak & Kameg (2013) found similar results with high fidelity simulation, indicating a significant reduction in students' anxiety levels through a pretest-posttest design when using Spielberger's STAI. Research using high fidelity simulation and standardized patients with supportive findings from full immersion VRS has demonstrated that it is an integral teaching tool that assists in the reduction of students' anxiety levels.

Communication Skills

Although the participants' communication scores improved slightly from session I to session II, statistical significance was not obtained. Contrary to the findings of this study, Martin & Chandra (2016) concluded that standardized patients significantly improved nursing students' communication skills between pretest and posttest scores. Unfortunately, their measure of communication skills consisted of 10 questions strategically drawn from a mental health textbook question bank and did not contain any reliability or validity data. Real et al. (2017) also found that immersive VRS improved pediatric residents' communication skills. This inference was based on a significant decline in patients' influenza vaccine refusal rates from the intervention group compared to the control group who did not use immersive VRS. Unfortunately, the participants' communication skills were not directly observed when communicating with patients.

Notably, in this study, the participants' mean communication scores were low for both sessions. The decreased communication scores may accurately represent the students' lack of communication skills, emphasizing their need for more communication-based experiences in nursing education. Another cause for the low scores could be related to the VRS systems' analytics dashboard itself, the level of sophistication, and sensitivity to students' communication choices. Unfortunately, the algorithm used to evaluate communication skills was not accessible to the researcher.

Although a significant increase in communication scores was not found, this study was the first to utilize an objective analytics system to assess communication skills instead of subjective human observation, a common skill assessment method in nursing education. In addition, the analytics system provided a way to quantify students' communication skills which could be measured and compared among individuals or as a group. Frequently, communication skills have been evaluated through direct faculty observation, which has been a subjective evaluation method. Additionally, communication skills have been measured through a pretest-posttest design which only assesses a student's knowledge related to communication. To date, an objective measure of communication skills outside of an analytics dashboard has not been perfected or consistently applied to nursing education.

Discussion of Limitations

Although this study supported the use of full immersion VRS to decrease nursing students' anxiety, there remains a paucity of research assessing its overall impact on nursing education. Other limitations included the small sample size, limited ethnic diversity, and the lack of a control group. However, despite the small sample size and lack of ethnic representation, this study implemented the newest, most technological simulation modality, introduced an objective measure of communication skills, and produced meaningful data regarding anxiety levels and communication skills among nursing students.

Participants' anxiety about using a new simulation modality was cited as a limitation; however, it was controlled by providing an orientation to the simulation and offering troubleshooting assistance as needed. In addition, participants were instructed to rate their anxiety under a specific scenario: assignment to an anxious patient for clinical the following day. Another identified limitation was the participants' method of communication with the avatar using drop-down menus over verbal communication. The limitation alluded that participants may have an increased chance of randomly choosing the correct option in their second session. However, the drop-down menu contained a multitude of choices and layers of phrases within those choices, bringing to light a complex communication matrix. This complex system reduced the chances of participants randomly choosing a correct answer.

Since participation in the study was voluntary, no course grades were attached to the students' performance in simulation, which may have increased the risk of students not taking their performance seriously. As a result, some participants may have lacked engagement, especially in their second session as they repeated the same anxious patient scenario. A different anxious patient scenario for session II may have eliminated redundancy and improved engagement. Lastly, contrary to an initially identified limitation, faculty expressed immense interest in this research, and their enthusiasm for the study positively impacted recruitment and retainment.

Implications for Nursing Education

The importance of effective communication in building therapeutic nurse-patient relationships has been established, resulting in the expectation that nursing graduates enter the profession with proficient communication skills, especially with anxious patients (Bruce et al., 2019; Hayden et al., 2014). Unfortunately, nursing students were inexperienced in communicating with anxious patients, which raised their anxiety, strained the nurse-patient relationship, and negatively impacted patient outcomes (Avery et al., 2020; Giandinoto et al., 2018; Martin & Chanda, 2016).

High-fidelity mannequins and standardized patients have effectively reduced nursing students' anxiety when caring for anxious patients; however, they face limitations in cost, sustainability, and realism (Haerling, 2018; Martin & Chanda, 2016; Quail et al., 2016). Full immersion VRS, through its highly interactive and immersive capabilities, has preliminarily demonstrated its impact on nursing students' anxiety levels in caring for anxious patients. The data from this study showed a significant reduction in anxiety levels over time, which highlights the need for consistent, repeated practice in simulation. Moreover, the cost-utility ratio of full immersion VRS is cheaper compared to high fidelity mannequin simulation as it does not require a dedicated space or faculty time to implement, nor are consumable supplies needed (Haerling, 2018). In addition, its software and hardware upgrade costs are significantly less than the cost to replace high fidelity simulation mannequins (Haerling, 2018).

Full immersion VRS has many benefits, including a high level of realism as the scenarios and avatars mimic real-life clinical situations and patients. Furthermore, full immersion VRS can be used with a group of students or assigned as independent skill practice at the students' convenience, promoting knowledge and skill retention. Knowledge and skill retention are critical for student success but challenging to maintain as there are no guaranteed opportunities in the patient care environment.

The analytics dashboard built into the full immersion VRS scenarios is pivotal for evaluation since it can objectively evaluate each performance, issue numeric grades, and provide comprehensive feedback. The feedback detailed correctly and incorrectly performed skills and established links between the skills, scenario outcomes, and course-based learning outcomes. The feedback also guided self-reflection, assisted students in identifying areas of improvement, and promoted a productive debrief. Furthermore, this objective evaluation method may reduce the occurrence of subjective assessments such as human observation, eliminating the challenges that accompany subjective feedback, especially when course grades are involved.

Recommendations for Future Research

Research on the influence of full immersion VRS in nursing education is limited, but the emerging technology is gaining popularity. However, more studies are necessary to determine the exact beneficial implications for this type of simulation and how it translates to nursing practice in the clinical setting. Future studies could reflect demographics that are more consistent with the national population of undergraduate nursing students. For example, larger sample sizes from different regions of the country that represent various ethnic and cultural values would promote the generalizability of the research. In general, the studies' samples have been less than 50, so more extensive studies across multiple campuses may elicit more meaningful data that can be applied to other nursing student populations.

Future research to enhance the full immersion VRS analytics dashboard, particularly the communication subsection, may ensure that the algorithm accurately evaluates participants' communication skills. Faculty input on the algorithm and the use of multiple algorithms to evaluate levels of communication skills may also contribute to product enhancement. Moreover, creating more communication scenarios that vary in the type of patient, situation, and complexity will increase the communication experiences available to nursing students. These additional experiences will contribute to positive student learning outcomes and promote a smoother transition to practice for the novice nurse.

Research to evaluate faculty attitudes toward immersive simulation technology and identify barriers that may hinder the growth of full immersion VRS in nursing education is essential. In addition, future educators should be encouraged to incorporate VRS technology in their teaching and simulation-based courses in the same manner as technology becomes more integrated across healthcare settings.

Since this study was the first to evaluate the influence of full immersion VRS on nursing students' anxiety levels and communication skills, more research is recommended to evaluate our findings. More importantly, conducting research that uses the analytics dashboard and its sub-components as a measurement tool is critical to determine if it is an appropriate measure for communication. As nursing education programs implement full immersion VRS into their curricula, faculty may appreciate the benefit of a built-in analytics system that measures the communication skill level of their students.

Conclusion

Full immersion VRS has been revealed as a valuable learning tool in nursing education. Current studies have supported that full immersion VRS is comparable to traditional learning modalities but is more interactive, engaging, technologically forward, and liked by students. In addition, full immersion VRS has contributed to nursing simulation through its realistic scenarios, objective skill evaluation, comprehensive feedback, and design to support independent student practice, limiting the need for faculty observation. This study found that full immersion VRS significantly reduced nursing students' anxiety levels in caring for anxious patients, which may translate to a more therapeutic nurse-patient relationship and promote positive patient outcomes. Although the study did not find significant improvement in students' communication skills, its benefit remains, prompting more research on the influence of full immersion VRS and the system's analytics dashboard.

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Appendix A: Recruitment Email

Dear Penn College Nursing Participants,

I am looking for volunteers to participate in a study using full immersion virtual reality simulation (VRS), a new type of 3D simulation that uses a headset and hand controls. The goal of this study is to determine the influence of full immersion virtual reality simulation on nursing participants' anxiety levels and communication skills. This research will help both students and nurse educators determine the best way to improve communication skills when working with anxious patients.

Participants will experience an anxious patient full immersion virtual reality simulation. Participants' anxiety levels will be assessed three times during the study by using a 10-item questionnaire: before the simulation, after completing session I, and after completing session II. The simulation will also provide a communication score for each experience.

Participation in this research study is voluntary with no impact to course grades, however, a **$10 gift card will be given to everyone who completes the study in its entirety**. The table below provides an outline of the study's procedures and the participant's role in the study. The study will require a commitment of 60 minutes: 10 minutes for step #1, 25 minutes for VRS session I, and 25 minutes for VRS session II. Please consider joining this important research to assist us with an increased understanding of how VRS will benefit you and support nursing education.

If you have further questions, I will be happy to answer them.

Thank you,

Tanae Traister, MSN, RN

Week	Data Collection Procedures

1-3	• Participants receive recruitment email
	• Interested participants:
	    o Email researcher and sign informed consent via EverSign
	    o Visit the nursing education office to draw a random ID number, complete the demographic data form, and the short form SAI pretest
	    o Schedule a date and 25-minute timeframe to complete full immersion virtual reality simulation (VRS) anxious patient session I (scheduled by the office staff).

4-7	Full Immersion VRS Anxious Patient Session I
	• The participant:
	    o Arrives with the researcher at the virtual reality classroom (ATHS W137) on their scheduled date and time.
	    o Completes the OMS orientation
	    o Dons the headset and hand controls, logs into simulation, and completes the full immersion VRS anxious patient scenario session I
	    o When finished with the scenario, calls for the researcher and enters the performance analytics area
	    o Reviews their first communication score and exits the scenario
	    o Removes headset docks the hand controls
	    o Logs into email and completes the short form anxiety posttest I
	    o Schedules the full immersion VRS anxious patient session II (25 minutes)
	    o Logs out of the computer and exits the virtual reality classroom

8-11	Full Immersion VRS Anxious Patient Session II
	• The participant:
	    o Arrives with the researcher at the virtual reality classroom
	    o Dons the headset and hand controls, logs into the simulation, and completes the same anxious patient scenario
	    o When finished with the scenario, calls for the researcher and enters the performance analytics area
	    o Reviews their second communication score and exits the scenario
	    o Removes headset and docks the hand controls
	    o Logs into email, completes the short form anxiety posttest II, and logs out of email
	    o Receives $10 gift card and exits the virtual reality classroom.
	    o The participant's role in the study is now complete

12-15	• Researcher exports data from Mind Garden and Simulation dashboard for review, analysis, and input into SPSS for statistical analysis • Provides students with a report on their performance data through email

Appendix B: Informed Consent

Informed Consent for____

This informed consent is for undergraduate nursing participants at the Pennsylvania College of Technology. I am inviting you to participate in a research study titled "Virtual Reality Simulation's Influence on Nursing Students' Anxiety and Communication Skills with Anxious Patients."

Researcher: Tanae Traister
Address:
Phone Number:
Email: tanae.traister@wilkes.edu

Wilkes University Dissertation Chair: Dr. Denise Korniewicz
Phone Number: 786-299-0741
Email: denise.korniewicz@wilkes.edu

Name of Organization: Wilkes University

Dissertation: Virtual Reality Simulation's Influence on Nursing Students' Anxiety and Communication Skills with Anxious Patients

This Informed Consent Form contains two parts:

1. **Information Sheet**
2. **Certificate of Consent**

You will be provided a copy of the complete Informed Consent Form after you have signed it.

Part I: Information Sheet

Introduction
I am Tanae Traister, MSN, RN. I am completing this research as part of my dissertation toward the completion of the Doctor of Philosophy (Ph.D.) in Nursing at Wilkes University. I am researching the influence of full immersion virtual reality simulation on nursing students’ anxiety levels and communication skills when caring for anxious patients. You are being asked to participate because you are an associate degree or bachelor’s degree nursing student at the Pennsylvania College of Technology. As a nursing participant, you will experience anxious patients in the clinical setting. I will provide you with the information you will need to make an informed decision to participate in this study. Please feel free to ask questions, and I will provide further explanation about the study.

Purpose of the Research
The purpose of this research study is to determine full immersion virtual reality simulation’s influence on nursing students' anxiety levels and communication skills when caring for patients experiencing anxiety.

Description of the Study
After receiving the recruitment email, willing participants will email the researcher and sign the informed consent form. Once the researcher has received the signed informed consent, they will email the participants with instructions to visit the nursing education office within one week of the email. Upon arrival to the nursing education office, the participant will be instructed to draw a random identification number, complete the demographic data form, complete the short form SAI pretest, and schedule a date and 25-minute virtual reality simulation session I at the VRS classroom (ATHS W137) during semester weeks four through seven.

On the date and time of the appointment, the participant will arrive with the researcher at the virtual reality classroom. Next, they will complete a brief OMS orientation, don the headset and hand controls, log into the simulation, and complete the full immersion VRS anxious patient scenario session I. When finished with the scenario, they will call for the researcher and review their communication score. After score review, they may remove the headset and dock the hand controls, exit the scenario, and log back into their email to complete the short form state anxiety inventory posttest I. After posttest I completion, they will schedule an appointment for the second session which will take place during weeks eight through 11 of the semester. They may then exit the classroom.

In the second appointment, the participant will arrive to the virtual reality classroom, don the headset and hand controls, log into the simulation, complete the same anxious patient scenario, and review their communication score. After review, they will remove the headset and dock the hand controls, log into their email and complete the short form anxiety inventory posttest II. After posttest II completion, they may log out of the computer, retrieve their $10 gift card and exit the virtual reality classroom. The participant’s role is the study is now complete. After all data collection has taken place, the researcher will email each participant with their scores from both sessions.

The maximum amount of time to complete the study is 60 minutes: 10 minutes for step #1, 25 minutes for VRS session I, and 25 minutes for VRS session II. There is no cost to being a part of this study.

Risks and Discomforts
There are minimal risks to be involved with this study. Some participants may experience motion sickness or discomfort while in the full immersion virtual reality scenario. Participants who experience discomfort have the option to stop immediately. If there are secondary symptoms such as nausea and vomiting, the participant will be sent directly to college health services.

Benefits
The direct benefits to this study are experiencing full immersion virtual reality simulation and the practice of communicating with an anxious patient in a virtual environment. The indirect benefits include the knowledge received from this study may be of value for educating students and educators about how to provide effective communication when caring for anxious patients.

Confidentiality
All documents and data related to this research study will remain confidential according to federal, state, and local laws. All data are anonymous, and Mind Garden's Transform™ System and the OMS simulation software store the data. The data gathered is accessible to the researcher and may be reviewed by Wilkes University Institutional Review Board (IRB). The IRB committee ensures that the researcher maintains compliance with the research participants' rights, that proper procedures are taking place, and that the study remains in compliance with the college's research regulations. If this research is published, no participants will be identified by name, nor will individual data be disclosed. The study's data will remain secure on the researcher's college-issued secure OneDrive cloud, which is only accessible through a secure password and login.

Termination
Participants may stop the study at any time. Any surveys that have been completed before termination will remain anonymous but will not be used for the study. The researcher may terminate a participant if they are no longer enrolled in the nursing program at the Pennsylvania College of Technology.

Compensation
Participants who complete the study in its entirety will receives a $10 gift card.

Injury Compensation
Wilkes University, the Pennsylvania College of Technology, nor federal, state, or local government agencies will provide special compensation for any injuries resulting from this study. Any injuries that take place will be at the participant's medical expense.

Part II: Certificate of Consent

Voluntary Participation
I understand that my participation in this study is entirely voluntary. There is no course grade associated with participation, nor will my refusal invoke any penalties. I am free to withdraw from the study at any time without penalty.

I voluntarily give my consent to participate in this research study. I understand that I will have access to this consent form for my records once I have provided my signature. The signature and return of this form to the researcher affirms my consent to participate in this study.

Participant's Name (Print): ____

____
Participant's Signature and Date

I, the undersigned, certify that the participant reading and signing this informed consent form are willing to participate in this study and have read the consent in its entirety to the best of my knowledge. The participant has been given a chance to ask questions and may ask questions throughout the study regarding the nature of the research and any risks or benefits of this research.

Tanae Traister (Researcher)

____
Researcher's Signature and Date

Appendix C: Signed Informed Consent w/ Ever Sign

Part II: Certificate of Consent

Voluntary Participation
I understand that my participation in this study is entirely voluntary. There is no course grade associated with participation, nor will my refusal invoke any penalties. I am free to withdraw from the study at any time without penalty.

I voluntarily give my consent to participate in this research study. I understand that I will have access to this consent form for my records once I have provided my signature. The signature and return of this form to the researcher affirms my consent to participate in this study.

Participant's Name (Print): Tanae Traister

____
Participant's Signature and Date

I, the undersigned, certify that the participant reading and signing this informed consent form are willing to participate in this study and have read the consent in its entirety to the best of my knowledge. The participant has been given a chance to ask questions and may ask questions throughout the study regarding the nature of the research and any risks or benefits of this research.

Tanae Traister (Researcher)

3/20/2021
____
Researcher's Signature and Date

Appendix D: Demographic Data Form

Please choose the answers that best apply to you. The information you provide will only be utilized in this study to help the researcher better understand the study participants

1. Identification Number: ☐

2. Age:

   - ☐ 18 – 25
   - ☐ 26 – 35
   - ☐ 36 – 45
   - ☐ 46 +

3. Ethnicity:

   - ☐ White
   - ☐ Hispanic or Latino
   - ☐ Black or African American
   - ☐ Native American or American Indian
   - ☐ Asian/Pacific Islander
   - ☐ Other/Prefer not to answer

4. Nursing Education Program:

   - ☐ Associate Degree Registered Nurse
   - ☐ Bachelor Degree Registered Nurse

5. Nursing Education Level: Choose the level you are currently in or the highest level you completed

   - ☐ Fundamentals (NUR 186 or NUR 232)
   - ☐ Medsurg 1 (NUR 188 or NUR 306)
   - ☐ Medsurg 2 (NUR 214 or NUR 320)
   - ☐ Medsurg 3 (NUR 229 or NUR 431)

6. Level of experience in communicating with patients experiencing anxiety:

   - ☐ No experience
   - ☐ Minimal (1 -2 experiences)
   - ☐ Moderate (3 – 5 experiences)

- ☐ Experienced (5+ experiences)

7. Level of experience with full immersion virtual reality simulation (using a headset and hand controls):

   - ☐ No experience
   - ☐ Minimal (used 1-2 times)
   - ☐ Moderate (used 3-5 times)
   - ☐ Experienced (used 5+ times)

Appendix E: Sample State Anxiety Inventory

Directions: A number of statements which people have used to describe themselves are given below. Read each statement and then circle the appropriate number to the right of the statement to indicate how you ***generally*** feel.

Use the following scale:
ALMOST NEVER – SOMETIMES – OFTEN – ALMOST ALWAYS

Sample items:

	ALMOST NEVER	SOMETIMES	OFTEN	ALMOST ALWAYS
I feel at ease	4	3	1	1
I feel upset	1	2	3	4
I lack self-confidence	1	2	3	4
I am a steady person	4	3	2	1

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Appendix F: IRB Approval Letters

From: IRB Administrator
To: tanae.traister@wilkes.edu
Subject: Exempt Determination
Date: Thursday, June 24, 2021 1:37:15 PM

Wilkes University IRB *Exempt Determination Notification*

To: Tanae Traister
From: Wilkes University IRB
Subject: IRB Exempt Determination - 386: Virtual Reality Simulation's Influence on Nursing Students' Anxiety and Communication Skills with Anxious Patients
Date: 06/24/2021

The Wilkes University IRB has reviewed the application **386: "Virtual Reality Simulation's Influence on Nursing Students' Anxiety and Communication Skills with Anxious Patients"** and determined that it is **Exempt** from IRB review according to 45 CFR 46.104(d)(3) on 06/24/2021.

Please note that any changes to your protocol may affect its exempt status. Contact the IRB at IRB@wilkes.edu to discuss any changes you may wish to make.

Thank you.

Wilkes University Institutional Review Board

Dr. Chris Zarpentine
Interim Chair, Institutional Review Board
Associate Professor of Philosophy
chris.zarpentine@wilkes.edu
(570) 408-4597

Pennsylvania College of Technology
A Penn State Affiliate

One College Avenue
Williamsport, PA 17701
570.326.3761 | www.pct.edu

Tuesday, April 27, 2021

Tanae Traister
Director of Nursing, Associate Degrees
Pennsylvania College of Technology
One College Avenue
Williamsport, PA 17701

RE: **Virtual Reality Simulation's Influence on Nursing Students' Anxiety and Communication Skills with Anxious Patients**

Dear Ms. Traister,

This letter officially notifies you, as the Investigator, of the approval of your project by the Administration for the protection of human subjects. The Institutional Review Board has approved this project. It is the Administration's opinion that you have provided adequate safeguards for the rights and welfare of the participants in this program.

Implementation of this survey is authorized to begin September 1, 2021. The protocol must be complete by December 31, 2021. Should you need extended time, please make such a request at least thirty days in advance of the deadline.

Please be conscientious to conduct this project in accordance with the guidelines set forth by the College. You should notify the Administration of any proposed changes to this project. You should report any unanticipated problems involving risks to participants or others to the Administration.

If you have any questions, please contact me at 570-320-2400 ext. 7567 or email at blc1@pct.edu.

Sincerely,

Brian L. Cygan
Executive Director for Assessment, Research & Planning

cc: Dr. Michael Reed