EXAMINING THE EFFECTIVENESS OF VIRTUAL INSTRUCTION FOR MEDICATION ADMINISTRATION SKILL ACQUISITION IN PRELICENSURE NURSING STUDENTS

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Jenna E. Davis

Indiana University of Pennsylvania

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Indiana University of Pennsylvania
School of Graduate Studies and Research
Department of Nursing and Allied Health Professions

We hereby approve the dissertation of

Jenna E. Davis

Candidate for the degree of Doctor of Philosophy

_____02/24/2022_____ Approval on File_____
Taylor Edwards, Ph.D.
Associate Professor of Nursing and Allied Health Professions, Advisor

_____02/24/2022_____ Approval on File_____
Johanna Boothby, D.Ed.
Assistant Professor of Nursing and Allied Health Professions

_____02/24/2022_____ Approval on File_____
Meigan Robb, Ph.D.
Assistant Professor of Nursing and Allied Health Professions

ACCEPTED

Approval on File_____ _____
Hilliary E. Creely, J.D., Ph.D.
Dean
School of Graduate Studies and Research

Title: Examining the Effectiveness of Virtual Instruction for Medication Administration Skill Acquisition in Prelicensure Nursing Students

Author: Jenna E. Davis

Dissertation Chair: Dr. Taylor Edwards

Dissertation Committee Members: Dr. Johanna Boothby
Dr. Meigan Robb

To better meet student needs, nurse educators must explore alternatives to traditional educational approaches that will accommodate student needs while still providing essential instruction and feedback for students. Virtual skills instruction is one flexible option for practicing the clinical skill of medication administration, but the effectiveness in developing skill acquisition is not known. The influence of students' self-efficacy as well as personal and professional factors such as healthcare experience and nursing program type are also unknown.

The purpose of this study was to describe the medication skill acquisition of prelicensure nursing students who participated in virtual medication skill instruction at one public community college in Pennsylvania. This study also examined student self-efficacy following virtual instruction utilizing the General Self-efficacy Scale (GSE). Lastly, the study investigated selected personal and professional factors and their influence on medication administration skill acquisition. A descriptive correlational design was utilized to examine select personal and professional characteristics and their influence on medication administration skill acquisition. A convenience sample (N = 46) of prelicensure nursing students participated.

The majority of students passed the medication administration skill (n = 33; 72%). Participants' mean GSE score was 32.5 (SD = 3.81). Gender, age, healthcare experience, computer literacy, employment status, and nursing program type showed no statistically significant association with medication administration skill acquisition. Virtual instruction was

significantly associated with medication administration skill acquisition. Findings of this study provide implications for nursing faculty and students and guide future research.

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CHAPTER 1

INTRODUCTION

Undergraduate nursing students must acquire theoretical knowledge as well as demonstrate appropriate hands-on clinical skills to provide safe care to patients. Acquisition of these critical skills requires student practice and feedback about performance from a knowledgeable instructor. However, schools of nursing are challenged to provide convenient skill practice sessions on campus for busy students. In-person practice sessions are not always possible due to scheduling or space constraints. Additionally, social distancing due to the COVID-19 pandemic has further limited in-person practice opportunities. One solution to this problem is virtual instruction, where students remotely connect with instructors and synchronously practice skills such as medication administration. Virtual instruction can provide greater flexibility for students and instructors by eliminating travel time to campus and effectively social distancing by logging-in from a remote location. Using virtual instruction is one creative solution that may assist students in becoming proficient in clinical skills. However, the effectiveness of virtual instruction for medication administration has not been established.

This chapter will discuss medication administration skill acquisition in nursing education as well as the problem and purpose of this research. An overview of the conceptual framework that guides this research will be discussed. Additionally, the research questions and definitions of key terms are presented. This chapter concludes with assumptions and significance of the study.

Background

This section will review background information on medication administration in nursing and nursing education. An overview of the research variables of skill acquisition and virtual instruction within the current study will also be presented.

Medication Administration

Medication administration consumes as much as 40% of a nurse's time during a clinical shift (Armitage & Knapman, 2013). This important skill requires a series of complex steps that relies on assessment, clinical judgment, decision making, and evaluation by the nurse. Medication administration requires careful thought as nurses must consider laboratory values, vital signs, and assessment findings prior to administration (Beydoun, 2018). Nurses must abide by the "rights" of medication administration including the right patient, right drug, right time, right route, and right dose (Hughes & Blegen, 2008). In later years, five more rights were added, including right to refuse, right knowledge, right questions, right advice, and right response or outcome (Edwards & Axe, 2015). These rights guide the medication administration process and are taught in schools of nursing to reduce medication errors.

If a nurse commits a medication error, the patient could suffer serious complications. Medication errors are costly to the healthcare facility and potentially harmful to the patient. Every year, 7,000 to 9,000 people in the United States die from medication errors (Tariq & Scherbak, 2020). The total cost of these errors exceeds 40 million dollars (Tariq & Scherbak, 2020). Consequently, medication errors are a major concern for patients, nurses, and the health care system (Karavasiliadou & Athanasakis, 2015).

Healthcare administration places great importance on patient safety, especially situations when the potential for harm is high. One example of a potential safety risk is when nurses prepare and administer medications. Some facilities have implemented approaches that minimize the risk for error. For example, to limit distractions some healthcare facilities have nurses wear vests or sashes and place signage alerting others of their involvement in medication administration (McMahon, 2017). Other institutions require a second nurse to co-sign medication

administration records (Tariq & Scherbak, 2020). Nurses of all experience levels must stay vigilant when administering medications to avoid error. Despite these initiatives, medication errors continue to occur. Distractions during medication administration are impossible to eliminate and these initiatives are only as effective as the skill of the nurse.

The safety concern of medication errors is one reason why schools of nursing emphasize teaching medication administration. Medication administration continues to be an integral part of nursing education because of how often practicing nurses administer medications and its risk for error. Nursing students must take courses in pharmacology, demonstrate competency in medication administration, and accurately complete math calculations for medication dosing. Despite medication administration's prevalence in nursing education, nursing students still struggle to master the skill (Mettiainen et al., 2014). Many nursing students lack pharmacology knowledge and struggle with mathematical calculations (Mettiainen et al., 2014). These critical skills are needed to safely administer medications. Furthermore, medication administration remains a recurring stressor reported by student nurses (Cleary-Holdforth & Leufer, 2020). Medication administration can be in multiple routes including intravenously, intramuscularly, and orally and each route has their own considerations to recall. There is a lot of pressure to accurately complete every step of a lengthy medication administration skill checklist. Therefore, nursing students need practice administering medications, as well as receiving feedback from instructors on their technique, so they can improve their performance. Medication administration is a skill that must be practiced, and nursing students are required to demonstrate competency prior to administering medications to patients in the clinical setting.

Nursing education provides practice time for medication administration. The amount of laboratory and clinical practice time to master skills and classroom teaching about medications

may vary. Nursing programs, containing clinical and didactic settings, vary in length. Associate degree programs are typically two years for a full-time student and practical nursing programs are typically one year in length for a full-time student. Medication administration is a topic that is woven throughout the nursing curriculum. Therefore, given the longer program, associate nursing students may receive more instruction and practice opportunities related to medication administration. The more education a student receives, the less likely they are to make medication errors (Mettiainen et al., 2014). Associate degree nursing programs are longer in length and students spend more time in the clinical setting providing care to patients. Part of providing care is administering medications and it is unknown how that extra time exposed to medication administration will impact skill acquisition. Consequently, this study examined the relationship between medication administration skill acquisition and nursing program type (associate or practical nursing).

Skill Acquisition

Medication administration is one type of clinical skill that must be acquired during a nursing program. Skill acquisition refers to an individual's perceived competence obtained through experience. Learners move through five stages of skill acquisition competency beginning as a novice, and advancing through the stages of advanced beginner, competent, proficient, and expert (Dreyfus & Dreyfus, 1980). Deliberate skill practice, consisting of intentional focus and repeated action, is needed to move through the stages (Welch & Carter, 2018). Deliberate skill practice helps students to acquire, improve, and retain skills over time (Halm & Crespo, 2018; Johnson et al., 2020; Welch & Carter, 2018). Deliberate skill practice equates to repetition, which helps learners commit information to long-term memory. Medication administration includes theoretical knowledge acquisition as well as hands-on skill

demonstration. Deliberate practice of medication administration might involve an instructor asking questions about the five medication administration rights, critiquing the student's responses, and the student using practice supplies such as syringes and needles to draw up liquid medication while the instructor assesses performance and provides feedback about the student's technique. Deliberate practice can be used with any route of medication administration and should incorporate each step of the associated skills checklist to ensure accuracy and completeness.

To help students be successful, schools of nursing must intentionally incorporate opportunities for students to practice medication administration. Opportunities can be created in the didactic setting, the clinical setting, or as mandated or optional visits to a skills laboratory for practice. One-on-one skill instruction with repetition and feedback increases student competence and, subsequently, student satisfaction (Ozturk et al., 2020). Students should be encouraged to practice their skill often, seeking out learning sessions.

Deliberate practice, innate ability, and years of relevant experience influence skill acquisition (Welch & Carter, 2018). Deliberate practice can be incorporated throughout nursing education. However, nurse educators have no impact on a student's innate ability. Students enter prelicensure nursing programs with varying levels of experience. Students could have no previous exposure to clinical skills prior to their start of nursing school. Alternatively, students may have years of experience working in an acute care setting and witnessing medication administration. Other students could be employed as medical assistants and already have experience administering medications. Therefore, the experience and skill they bring to the learning situation varies. Because experience influences skill acquisition, the relationship between healthcare experience and medication administration skill acquisition was studied.

Skill acquisition requires practice. Medication administration warrants such practice. To provide more practice sessions, virtual instruction can be utilized. Student nurses should strive to move through the stages of skill acquisition, reaching competency early in nursing school and striving for proficiency by the end of nursing school. Being proficient in administering medications means adhering to safe medication practices such as following the five rights, which consequently helps to reduce potential medication errors.

Virtual Instruction

Skills practice can be facilitated in-person or virtually. Virtual instruction often consists of at least one instructor and at least one student synchronously sharing audio and video. Virtual instruction is often tailored to the student's needs. The instructor could demonstrate the correct technique before the student practices, or the student may practice with the instructor watching and providing feedback. The use of a skills checklist removes bias by evaluating students with consistent criteria. To reduce objectivity, all clinical instructors are trained on the use of the skills checklist by the clinical team leaders. Students are provided the skills checklist on the first day of the course so they can first learn the skill and then practice the skill according to the checklist.

Skills practice via virtual instruction, a type of distance learning technology, is not restricted by geographic and institutional boundaries (Simpson, 2003). Therefore, students can log-in to learn from the comfort of their homes or other convenient location, effectively increasing access to education for all students (Simpson, 2003). In addition to the location convenience, distance education technologies are cost-effective options for numerous reasons. Students can save travel costs by not physically attending the college to participate in skills

practice. These sessions can also save parents costs associated with childcare, since childcare arrangements are not always necessary for virtual instruction (Phillips et al., 2010).

One major drawback of virtual instruction involves the technology requirements. Students need a device with audio and video capabilities as well as Internet access. Internet access could be a concern for students for various reasons including financial constraints, a lack of internet service in the area where they live, and concerns about online privacy, cybersecurity, and personal safety (National Center for Education Statistics [NCES], 2018). Students and instructors alike must navigate the technology platform used to connect remotely. Often, the school's information technology department can assist with set-up and demonstrations. For virtual instruction to be effective, schools of nursing must plan and offer resources to accommodate students who do not have a personal computer, internet access, or a knowledge of how to use the technology platforms offered. Computer literacy, the ability to use computers and computer-related technology, is a factor for students utilizing virtual instruction. Therefore, computer literacy's relation to medication administration skill acquisition was studied.

Self-efficacy

Student self-efficacy relates to mastery of clinical skills. Self-efficacy is defined as the belief in a student's abilities to mobilize the motivation, cognitive resources, and courses of action needed to exercise control over their work (Bandura, 1997). Self-efficacy is also referred to as confidence (Tucker et al., 2009). Throughout nursing education, students must become proficient in hands-on skills such as medication administration for nursing practice. Safe, quality care of patients requires mastery of psychomotor skills such as medication administration. Novice registered nurses often lack confidence when performing clinical skills such as medication administration (Missen et al., 2016; Perry, 2011; Zieber & Sedgewick, 2018). A lack

of adequate practice of clinical skills during their undergraduate education contributes to their lack of confidence (Missen et al., 2016). Skill acquisition remains a time-consuming process, but it is necessary for students to practice medication administration and gain confidence. Skills acquisition required for successful and safe clinical practice can best be achieved when students feel confident in their ability to perform them (Roberts & Johnson, 2009).

While medication administration is largely seen as a hands-on skill, there is extensive theoretical knowledge that must be transferred into practice. Students must understand how a drug is metabolized in the body, the action of the medication, its side effects, potential complications with administration, and more. Additionally, students need the ability to use a computer to safely administer the medication. Students must navigate the computer system to look up compatibility of the medication, provide education about the medication to the patient, and scan the bar code to document the medication as given.

A student's degree of self-efficacy can impact their competence in clinical skills. If a student is confident in their understanding, their skill performance is improved because they do not question their knowledge. Therefore, this study measured self-efficacy in nursing students following a medication administration practice session with the General Self-efficacy Scale (GSE).

Statement of the Problem

The Institute of Medicine (IOM) calls on nursing education to design effective care delivery models to reduce patient risk (IOM, 2010). Safe medication administration is one way to reduce patient risk and nursing education can provide the needed foundation for safe care. Students may encounter obstacles participating in traditional in-person skills practice (Phillips et al., 2010; Simpson, 2003). To better meet student needs, nurse educators must explore

alternatives to traditional educational approaches that will accommodate student needs while still providing essential instruction and feedback for students. Virtual skills instruction is one flexible option for practicing the clinical skill of medication administration, but the problem is its effectiveness in developing skill acquisition is not known. The influence of students' self-efficacy as well as personal and professional factors such as healthcare experience and nursing program type are also unknown.

Purpose

The purpose of this quantitative study is to describe the medication skill acquisition of prelicensure nursing students who participated in virtual medication skill instruction at one public community college in Pennsylvania. This study also examined student self-efficacy following virtual instruction utilizing the GSE. Lastly, it investigated selected personal and professional factors and their influence on medication administration skill acquisition.

This research study design used a descriptive, correlational approach for the data. Descriptive correlational studies describe relationships among variables and are appropriate for this study given the limited research examining virtual instruction and medication administration in undergraduate nursing students (Polit & Beck, 2017). Additionally, the video footage of students administering medications during an in-person simulation exercise was analyzed for proficiency of medication administration via the skills checklist.

Research Questions

This study aimed to answer the following research questions.

1. How effective is medication administration skill acquisition taught via virtual instruction for prelicensure nursing students?

2. What is the level of prelicensure nursing student self-efficacy following virtual skill instruction of medication administration?

3. What is the relationship between personal and professional factors (gender, age, healthcare experience, computer literacy, employment status, nursing program type, virtual instruction practice hours) of prelicensure undergraduate nursing students and medication administration skill acquisition?

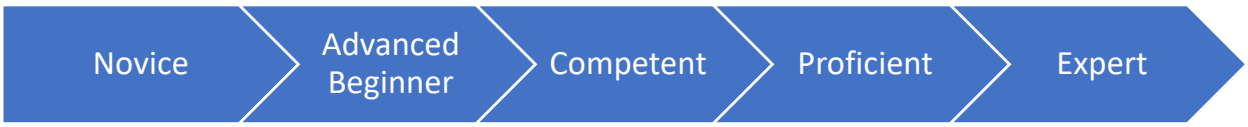
Conceptual Framework

Conceptual frameworks are the foundation from which to examine a phenomenon of interest. The *Dreyfus Model of Skill Acquisition* (1980) was selected as the conceptual framework for this research because it aligns with medication administration which requires repetition and practice to become proficient.

After studying airplane pilots, chess players, and automobile drivers, Dreyfus and Dreyfus (1980) developed a model that explained a sequential approach to skill acquisition. The Theory of Skill Acquisition includes five stages: novice, advanced beginner, competent, proficient, and expert, as shown in Figure 1 (Dreyfus & Dreyfus, 1980). Progression through the stages is based on experience and educational instruction. A complete literature review of skill acquisition is presented in chapter two.

Figure 1

Dreyfus Model of Skill Acquisition



Definitions of Terms

The following conceptual and operational definitions of terms were used throughout the study:

1. *Personal and professional factors* are items of demographic information that describe the participants. In this study, the personal and professional factors being studied were gender, age, healthcare experience, computer literacy, employment status, and nursing program type. These factors will be measured with the Demographic Questionnaire.
2. *Prelicensure nursing students* are defined as students enrolled in a nursing program who have not yet received their registered nurse licensure. Prelicensure nursing students, who are either associate degree or practical nursing students, were the population under study.
3. *Self-efficacy* is defined as the belief in a student's abilities to mobilize the motivation, cognitive resources, and courses of action needed to exercise control over their work (Bandura, 1997). Self-efficacy was measured in this study with the GSE.
4. *Skill acquisition* refers to an individual's perceived competence obtained through experience. Skill acquisition is comprised of five dimensions: novice, advanced beginner, competent, proficient, and expert (Dreyfus & Dreyfus, 1980). Skill acquisition was measured via the oral medication administration skill checklist.
5. *Virtual instruction* is one type of distance learning technology (Phillips et al., 2010). In this study, virtual instruction includes synchronous video and audio practice sessions with at least one instructor and at least one student. Participants in this study were students who had utilized virtual instruction for practicing medication administration.

Assumptions

Assumptions are self-evident truths about the sample, theoretical framework, or variables within the study (Calabrese, 2012). This study was guided by the assumptions that (1) undergraduate nursing education will continue to teach the skill of medication administration to nursing students; (2) undergraduate nursing students face barriers when meeting for in-person instruction; and (3) virtual instruction will continue to exist in nursing education.

Significance

The task of medication administration, which is frequently completed by nurses, contains a high risk of error. While nursing education incorporates teaching that focuses on safe medication administration into the curriculum, students may not feel confident in their abilities (Missen et al., 2016; Zieber & Sedgewick, 2018). Deliberate skills practice has been found to increase students' confidence and ability, but the effectiveness of virtual skills practice and its impact on student self-efficacy is unknown (Halm & Crespo, 2018; Johnson et al., 2020). Nurse educators need to provide a multitude of practice opportunities so students can refine their skills.

Students face challenges to attend in-person practice sessions held on campus. Time and costs can hinder a student's participation in these valuable learning activities. Virtual skills instruction conveniently allows students to log-in to skill practice sessions remotely. Since medication administration is a hands-on task, it is often taught solely in-person. However, with flexibility and planning, medication administration can be practiced remotely using distance education technology. Distance education is growing, with more programs using online educational methods for teaching. This expansion of distance education is fueled by the COVID-19 pandemic and recommendations to social distance.

This study investigated the effectiveness of virtual instruction of medication administration. The results will assist educators in choosing to incorporate medication administration practice sessions virtually. Furthermore, this study examined student self-efficacy following virtual skills instruction, determining if students feel better prepared to administer medications. This educational delivery method change in nursing education may have an important impact on practicing nurses administering medications. If graduates are skilled and confident in their abilities, they may provide timely, accurate, and quality care. Nurse educators strive to produce knowledgeable and competent graduate nurses who can safely administer medications to patients. Graduate nurses who are confident in their abilities and skilled in medication administration may have less errors. Reduction of medication administration errors, a large patient safety concern, is of utmost importance to nurses, administrators, and patients as it is costly and can lead to patient harm.

The Quality and Safety Education for Nurses (QSEN) Institute is one national initiative from the Institute of Medicine. The QSEN safety competency, defined as "minimizes the risk of harm to patients and providers through both system effectiveness and individual performance" is one competency developed for prelicensure nursing programs (QSEN, 2020, para. 9). The safety competency includes the skill of demonstrating effective use of technology and standardized practices (QSEN, 2020). Virtual instruction is a teaching strategy that uses technology to enhance students' practice of clinical skills. The use of a medication skills checklist standardizes medication administration practices and evaluation of performance in nursing education. These approaches will help to ensure consistency and accuracy of the skill and ultimately prepare a qualified nurse graduate with the needed skill set to safely deliver patient care.

Chapter Summary

Chapter one introduced medication administration in undergraduate nursing students. While skills practice is recommended for safe nursing care, there remains a lack of literature examining the effectiveness of virtual skills instruction. The introduction and background identified a problem statement and subsequent research questions. The Theory of Skill Acquisition was presented as a framework to guide the study. Finally, assumptions and definitions of terms were provided for this quantitative study. Chapter two will review the literature on virtual skills instruction, medication administration, and the instruments that were used in the study.

CHAPTER 2

LITERATURE REVIEW

The purpose of this quantitative study is to describe the medication skill acquisition of prelicensure nursing students who participated in virtual medication skill instruction at one public community college in Pennsylvania. This chapter provides a review of literature relevant to medication administration and skills acquisition via virtual instruction. Accordingly, the literature reviewed focused on higher education and prelicensure nursing students. The chapter begins by providing a description of each topic's search strategy. Next, the chapter provides a synthesis of the literature in relation to medication administration, skills acquisition, and virtual instruction. Theoretical literature relating to the Dreyfus model of skill acquisition is synthesized. Finally, the chapter provides a review of the tool chosen for this study, the General Self-efficacy Scale (GSE).

Medication Administration

Search Method

Because the literature on medication administration is so vast, the search was limited to the databases of CINAHL Complete and ProQuest within the last five years to obtain nursing-focused medication administration studies. The search terms of 'medication administration', 'safety', and 'nursing students' were utilized. The search was also limited to English language, peer-reviewed full-text articles. The search result's abstracts were reviewed for relevancy and 14 articles are presented. The literature review starts with a broad perspective of practicing nurses and narrows to nursing students specifically.

Safety

Medication errors are common in hospitals (Armstrong et al., 2017; Durham et al., 2016; Hammoudi et al., 2018; Jheeta & Franklin, 2017; Johnson, 2016; Karavasiliadou & Athanasakis, 2015; Khalil et al., 2020; McLeod et al., 2015; McMahon, 2017; Orbaek et al. 2014; Westbrook et al., 2017; Wright & Bonser, 2020). Many studies have been devoted to how practicing registered nurses can decrease medication errors, but little literature focuses on prelicensure nursing students. Interventions for practicing registered nurses to decrease medication errors include a 'Do Not Interrupt' bundle (Westbrook et al., 2017), a medication safety vest for nurses to wear while administering medications (McMahon, 2017), medication administration re-education (Khalil et al., 2020), mindfulness practices (Durham et al., 2016), reflective practices and policy changes (Wright & Bonser, 2020), and an electronic prescribing system (Jheeta & Franklin, 2017). These studies focused mostly on changing the process of nurses administering medications, with only one study focusing on re-education of safe medication administration. Therefore, this research study focused on the education and practice of medication administration. Additionally, this study investigated virtual instruction, which would allow nurses and nursing students to practice medication administration in an alternative format to in-person instruction.

A systematic review of literature by Karavasiliadou and Athanasaki in 2015 determined many factors contributing to medication errors in clinical practice. The categories of individual and health system related causality factors were identified. Both categories contribute to medication errors equally, so strategies to reduce errors by the individual and by the health system are pertinent (Karavasiliadou & Athanasaki, 2015). An umbrella study of systematic reviews conducted by Khalil et al. (2020) aimed to synthesize literature investigating the

effectiveness of medication safety interventions. The systematic review of 23 studies showed four interventions effective in reducing errors for practicing nurses: medication administration education, reconciliation or review, specialist pharmacists' roles and physical or design modifications (Khalil et al., 2020). Education of medication administration is a common theme for reducing medication errors and a strong educational foundation is necessary for nurses to feel confident when administering medications after graduation from nursing school. Therefore, this study of educating prelicensure nursing students on medication administration skill acquisition via virtual instruction was pertinent.

Other data collection approaches haven been used to understand medication administration and yield similar concerns. McLeod et al. (2015) performed a mixed-methods ethnographic approach involving observational fieldwork, field notes, participant narratives, photographs, and spaghetti diagrams to identify system factors that facilitate successful medication administration in three inpatient wards. The 43 nurses observed during 56 medication administration rounds were interrupted a median of 5.5 times per hour and distracted a median of 9.6 times per hour. System configurations and features, behavior types among nurses, and patient interactions were the three themes identified as influencing medication administration (McLeod et al., 2015).

Multiple studies suggest interruptions are linked to medication errors (Hammoudi et al, 2018; McLeod et al., 2015). A study of factors associated with medication administration errors was performed by Hammoudi et al. (2018). This descriptive cross-sectional study of 367 nurses was conducted at a large public hospital. Their study of factors associated with medication administration errors revealed medication packaging, nurse-physician communication, pharmacy processes, nurse staffing, and transcribing issues as reasons for errors. Reasons nurses would not

report the medication errors include administrative response, fear of reporting, and disagreements regarding the definition of a medication administration error (Hammoudi et al., 2018). These findings indicate a need for more education of medication administration best practices.

Skill acquisition is a task nurses must be proficient in even when nursing school is finished. Policies regarding medication administration practices vary at different healthcare facilities and are updated periodically. Therefore, nurses must learn and adhere to the most recent policy. A cross-sectional study by Armstrong et al. (2017) of 159 nurses working on 15 units at four different agencies found that nurses had low perceived skills needed for implementing updated safety practices. The Nurses' Attitudes and Skills with Updated Safety Concepts (NASUS) scale was utilized for nurses to self-report their attitudes and perceived skills in relation to medication administration. Each item of the NASUS scale utilizes a continuous analog scale, ranging from 0-100, with 100 equating to high attitude and perceived skill. Participating nurses' attitudes ranged from 30-86, with a median of 68, while their perceived skills ranged from 33-92, with a median of 60. These results suggest nurses had low perceived skills needed for implementing updated safety practices (Armstrong et al., 2017). If nurses believe they do not have a required skill, more education and practice are needed to achieve competency. Virtual instruction is one way to educate nurses and provide practice with immediate feedback.

Another way to reduce medication errors is to incorporate findings from the Durham et al. study about a medication safety pilot program aiming to increase registered nurses' "sensitivity to potential error risk, improve behaviors, and reduce observed medication administration errors" (2016, p. 75). An interprofessional team used process improvement to

develop a medication safety pilot program that was visualized in this observational study. To develop the instructor-led pilot educational session, 138 medication administrations by 26 registered nurses were observed. The pilot educational sessions sought to bring awareness to medication errors and teach mindfulness practices such as 'brief breath meditation'. Mindfulness is defined as "the basic human ability to be fully present, aware of where we are and what we're doing, and not overly reactive or overwhelmed by what's going on around us" (Mindful, 2021, p. 1). Eleven sessions were held, and 99 registered nurses attended the sessions. Following the program, error interception practices increased by 92%, and medication errors decreased by 76%. Additionally, nurses make fewer errors after the program (Wald $\chi 2 = 2.85$; $p = .091$) and if they have cared for the patient previously (Wald $\chi 2 = 22.42$; $p = .065$) and make more errors as complexity (≥5 medications) increases (Wald $\chi 2 = 2.85$; $p = .000$) (Durham et al., 2016). Only the finding of the nurses' errors increasing with complex medication passes is statistically significant. Nurses stated utilizing a mindfulness strategy to achieve situational awareness prior to medication administration.

Medication administration is as large of a mental process as it is a hands-on skill. Research studies have been centered on nurses practicing mindfulness and limiting distractions to decrease medication errors (Durham et al., 2016; McLeod et al., 2015; McMahon, 2017; Westbrook et al., 2017). Westbrook et al. (2017) observed 227 nurses administering medications in a hospital in Australia. In a randomized controlled study, nurses used a 'Do Not Interrupt' bundle including wearing a vest when administering medications, strategies for diverting interruptions, and nurse and patient education on the research study interventions. On hospital units without the interventions, nurses experienced an average of 57 interruptions per every 100 medication administrations. Over 87% of these interruptions were not related to the medication

task being observed. In the hospital units with the ‘Do Not Interrupt’ bundle in place, interruptions decreased to 34 per every 100 medication administrations (34%; 95% CI 30-38; p = .01). However, nurses stated the vests were time consuming, cumbersome, and hot to wear, so therefore it is not a feasible intervention (Westbrook et al., 2017). Although the strategies for diverting interventions were not explicitly listed, it highlights the need for focus while administering medications. Virtual skill instruction involves mental focus and concentration. Student nurses can talk out loud, observe the instructor completing the task, and ask questions synchronously.

McMahon (2017) also found a reduction of medication errors after implementing registered nurses wearing safety vests. A vest labeled ‘Do Not Disturb’ coupled with signage stating to not disturb nurses during medication administration in medication preparation areas and patient rooms led to an 88% decrease in medication error rates. Additionally, external noise decreased when the nurses wore the vests (p = .03) (McMahon, 2017). However, the study had a small sample size (n = 28) of registered nurses at a single hospital. This study did not report if nurses would continue the intervention after the study ended.

Other safety approaches for medication administration have been studied as Jheeta & Franklin (2017) aimed to explore the impact of implementing an electronic prescribing and administration system on the safety of medication administration in an inpatient hospital setting in England. The electronic prescribing and administration system was a replacement for paper charting. With this system, physicians entered orders into a computer and nurses electronically documented medications as given. Barcode scanning was not included with this electronic system. Observations were made at 15 pre- and 15 post-implementation time points. Although types of errors changed, the rate of errors remained the same. Furthermore, the electronic

prescribing system greatly increased documentation discrepancies from five in 460 before implementation (1.1%; 95% CI 0.1–2.0%) to 18 in 557 after implementation (3.2%; 95% CI 1.8-4.7; p = .04) (Jheeta & Franklin, 2017). Therefore, it was not safer to implement an electronic system and bypass nursing judgment during the medication administration process.

Nursing Students

Registered nurses, who have completed their education and are licensed, commit medication errors. Therefore, nursing students without any experience may be fearful of committing medication errors (Orbaek et al., 2014). Registered nurses, with varying degrees of experience, perform workarounds when administering medications and student nurses observe the practicing nurses administering medications while not always following best practice (Orbaek et al., 2014; Wright & Bonser, 2020). Through more skills practice via virtual instruction, student nurses can feel confident in administering medications by best practice.

To understand nursing students better, Orbaek et al. (2014) conducted two focus group interviews of 16 pre-graduate nursing students to explore their experiences and competencies with the technology-driven medication administration process. The systematic phenomenological-hermeneutic study revealed the students expressed positivity and confidence in using technology but were fearful of committing medication errors. The nursing students expressed a feeling of isolation in practical learning situations due to observing experienced registered nurses deviating from best practice guidelines (Orbaek et al., 2014).

Although the best practices of medication administration are taught in schools of nursing, barriers to implementing best practices during clinical practice exist. Wright & Bonser (2020) conducted a baseline audit of 200 observations of medication administrations against best practice recommendations to assess the effectiveness of best practice changes. In baseline audits,

three of the eight best practices criteria revealed deficits in current practice (Wright & Bonser, 2020). After identifying barriers of implementing the best practices and changing the criteria, follow-up audits revealed improved outcomes.

Medication administration is a complex task and best practice can be linked to a nurse's confidence level. Johnson (2016) conducted face-to-face interviews with seven nursing students in a baccalaureate nursing program in the U.S. to describe upper-level nursing students' understanding of and experiences with medication administration and patient safety. The descriptive phenomenological study used Colaizzi's analysis to determine three major themes: a learning curve referring to the rigor of the pharmacology course, gaining self-confidence, and reliance on a preceptor. Under the learning curve theme, two subthemes of fear of harming a patient from making a mistake and appreciating the complexity of the working environment and the intricacy of the patients (Johnson, 2016). Self-confidence, a synonym for self-efficacy, is a significant quality for student nurses to hone.

Skills and simulation laboratories are excellent locations for students to practice and gain confidence. Craig et al. (2021) sought to examine the effects of a medication simulation on knowledge, competency, and confidence levels of undergraduate nursing students. This quasi-experimental study utilized the Jeffries simulation framework and had a sample of 83 third-year baccalaureate nursing students. The intervention group received a medication safety enhancement clinical simulation which included integrated technology such as an electronic health record, an automated medication dispensing tower, and barcode medication administration. The control and intervention groups then participated in a medication simulation without the above-mentioned integrated technology. Both groups then had their knowledge assessed by the Medication Safety Knowledge Assessment and their competency was assessed

via the Medication Safety Critical Element Checklist. Findings were analyzed using independent samples t-tests. Although the result was not statistically significant ($p = 0.075$), both groups increased in posttest knowledge scores ($M = 16.94$ to $M = 18.45$ for the intervention group and $M = 17.18$ to $M = 17.82$ for the control group) (Craig et al., 2021). The intervention group performed significantly better in the second simulation experience than students in the control group who did not have the first simulation experience ($M = 14.69$, $SD = 2.92$ for the intervention group; $M = 11.98$, $SD = 3.12$ for the control group; $p < .001$). These findings suggest an increased number of simulation experiences allow students to become comfortable in the environment and perform better. Administering medications safely is a skill student nurses must practice, and simulation is one teaching and learning method educators can utilize so students attain competency.

In another simulation study, Chan et al. (2019) examined the generation of medication errors and the differences that may exist based on nursing students' perceived confidence. The exploratory study used data from a previous randomized control trial of 69 baccalaureate nursing students in Canada. The authors used 'confidence' as a synonym for self-efficacy throughout the article and sent a confidence survey to students prior to a simulation experience. Students self-reported their confidence levels as moderate on a 7-point Likert scale ($M = 4.18$, $SD = 1.29$). During the simulation, students administered medications to standardized patients while data collectors observed and completed a Medication Error Heuristic Tool. The researchers analyzed this data with a Mann-Whitney U-Test and found all but one result to be statistically insignificant. Medication barcode scanning error was linked to self-perceived confidence ($U = 440.5$; $p = .04$; $z = -2.09$). This finding suggests that students' perceived level of confidence related to medication administration demonstrated a significant difference in the prevalence of

scanning-related medication errors (Chan et al., 2019). This study was conducted outside of the United States with a low sample size and only one statistically significant result. Therefore, more research is needed to link nursing student confidence to medication administration errors.

Summary

Medication administration is a complex skill needed for safe practice. However, even nurses with experience commit medication errors. Student nurses with limited practice experience may be at a higher risk for committing medication errors. Therefore, it is important to learn and practice the skill correctly. The reviewed research suggests that interventions such as wearing a vest and posting 'Do Not Disturb' signage decreased errors but were not feasible to implement long-term. Additionally, interventions such as an electronic prescribing and administration system did not decrease medication errors. However, practicing mindfulness is one strategy nurses can employ to stay focused on best practice and to draw from their strong educational foundation when administering medications.

This study examined virtual instruction of medication administration. Virtual instruction is an educational method that students can participate in remotely and during flexible hours, hopefully increasing student participation. Virtual instruction practice sessions can assist students in practicing proper technique of medication administration, a vital skill for nurses. Virtual instruction may help to decrease medication administration errors by providing more practice time for student nurses.

Gaps in the Literature

Despite the large body of knowledge regarding medication administration, virtual instruction of medication administration in nursing students is lacking from the current literature. More studies are needed to understand how nursing students best learn and retain medication

administration best practices. This study examined virtual instruction of medication administration and attempted to determine if it is a viable replacement or supplement to traditional in-person instruction. Incorporating virtual instruction provides flexibility and could increase satisfaction of students and instructors. Methods of learning that enhance skill acquisition and contribute to fewer medication errors are worthy of study.

Skill Acquisition

Search Method

Skill acquisition is an important aspect of medication administration and teaching. To obtain nursing-focused skill acquisition studies, the databases of CINAHL Complete and ProQuest were utilized in this search. The search terms of 'skill(s) acquisition', 'nursing', and 'student' were utilized. The search was also limited to English language, peer-reviewed full-text articles within the last five years. The search result's abstracts were reviewed for relevancy and nine articles are presented. Classic articles relating to the Dreyfus model were included and date back to 1979. These six additional articles will be discussed first.

Dreyfus Model of Skill Acquisition

Historical/Theoretical Review

The *Dreyfus Model of Skill Acquisition* was initially developed through a study of simulation and response rules among aircraft pilots (Dreyfus & Dreyfus, 1979). Response rules are "a particular sequence of basic movements" (Dreyfus & Dreyfus, 1979, p. 2). Through their research, a simulation model of instruction was deemed most effective for the aircraft pilots for acquisition of emergency response skills. Three models of skill acquisition developed: non-situational, intermediate, and situational. In non-situational skill acquisition, beginner aircraft pilots memorize rules and develop experience. The intermediate model of skill acquisition

consisted of aircraft pilots developing their skills by identifying specific characteristics recalled from previous situations. Aircraft pilots can spontaneously and unconsciously respond to situations after adequate experience. The situational model of emergency behavior includes aircraft pilots advancing their skill acquisition by completing instructor-led simulation exercises. As the instructor changes the simulation scenarios, the aircraft pilots must draw on previous experiences and memorized knowledge to respond with purposeful actions. These three phases of skill acquisition demonstrate steps and advancement of knowledge and experience. Simulation was reported as the most effective tool in skill acquisition for aircraft pilots (Dreyfus & Dreyfus, 1979).

Dreyfus and Dreyfus (1980) built upon their previous work to expand the three-phase model into a five-step model of skill acquisition: novice, competent, proficient, expert, and mastery. Further research by Dreyfus and Dreyfus in 1986 refined the names of the five steps: novice, advanced beginner, competent, proficient, and expert. Each step of the skill acquisition model is characterized by tasks increasing in difficulty and skills advancing through experience. Although the *Dreyfus Model of Skill Acquisition* was originally developed for aircraft pilots, it is now used in many fields including nursing. The model was designed for use in students who are just learning a particular skill. This study focused on undergraduate nursing students first learning the skill of medication administration. Therefore, the *Dreyfus Model of Skill Acquisition* was used as the conceptual framework for this study.

Nursing Students

Virtual instruction is feasible for nursing students as well as practicing nurses since learners can practice skills virtually from anywhere and one instructor can assist multiple learners. Practicing nurses, especially newly graduated nurses, can benefit from education, or re-

education, even after nursing school is completed. A study of newly graduated nurses by Missen et al. (2016) found essential clinical skills, such as critical thinking and problem solving, working independently, and assessment procedures, were found to be poorly executed and affecting their competence. The descriptive quantitative study aimed to explore perceptions of qualified nurses on the abilities of newly registered nursing graduates to perform a variety of clinical skills. Participants were recruited through the Australian Nursing and Midwifery Foundation and 245 nurses from Australia participated (Missen et al., 2016). The nurses were given a survey tool of 51 clinical skills and open-ended questions to rate new graduate nurses on a 5-point Likert scale of 'very poor', 'poor', 'adequate', 'good' and 'very good'. In the category of administering subcutaneous and intramuscular injections, 52.5% of nurses rated new graduate nurses as 'good' or 'very good' and only 32.5% of nurses rated new graduate nurses as 'good' or 'very good' in the category of medication knowledge. This highlights the need for more practice and education of medication administration throughout nursing school and beyond.

The clinical setting can feel very different from the didactic, or classroom, portion of nursing school. A study by Ewertsson et al. (2015) found nursing students felt the clinical skills lab "formed a bridge" between the two settings. The descriptive qualitative study sought to describe nursing students' experiences of learning in the clinical skills lab as a preparation for their clinical practice. Participants were fourth semester nursing students at a university in Sweden. The 16 nursing students participated in semi-structured interviews that were analyzed using content analysis. The theme of "walking a bridge" can be understood as a learning process that extends over time, with knowledge and skills coming back and forth from the clinical setting to the clinical skills laboratory setting. One subtheme of note is the need for teacher contact, with many students expressing wanting more time with a teacher during engaging teacher-led sessions

(Ewertsson et al., 2015). Virtual skills sessions can help to fill gaps in this area by increasing the number of teacher-led sessions available to students.

All opportunities for skills practice are highly sought after by nursing students (Zieber & Sedgewick, 2018). Twenty-four senior undergraduate nursing students participated in a study examining the effect of a significantly advanced knowledge and skill intervention on competence, confidence, and knowledge retention. The mixed quantitative and qualitative approach utilized two psychometric tools as knowledge tests on advanced cardiac information as well as one-on-one participant interviews. The study included Canadian nursing students who were enrolled in a community health course. The two tools included the *Nursing Anxiety and Self-confidence with Clinical Decision-making Tool* and the *Nursing Student Competence Scale* and were administered immediately prior to the day of seminar, at the end of the day, and three months later in this pretest-posttest design study. The seminar day was an intensive one-day advanced cardiac skills knowledge and simulation activity. Perceived competence significantly increased from the pre-test to both posttests, suggesting students retained competence following the seminar session ($F(1.31, 24.81) = 7.55$; $p = .007$; Partial eta^2 = 0.284). Additionally, perception of confidence significantly increased from the pre-test to both posttests ($F(1.453, 27.602) = 25.564$, $p < 0.001$, partial $\chi 2 = 0.574$). Knowledge retention, however, increased greatly at the first posttest, but was not as high at the three-month posttest ($F(2, 40) = 30.806$, $p < 0.001$, partial $\chi 2 = 0.606$) (Zieber & Sedgewick, 2018). This indicates students can recall the information immediately following the instruction, but retention of knowledge later is not as high. This study of skill acquisition demonstrates simulation experiences combined with skills knowledge sessions increase perceived competence, perceived confidence, and knowledge retention over time.

Another study focused on knowledge retention sought to "explore the effect of deliberate practice combined with skill practice during high-fidelity simulation scenarios on urinary catheter insertion skill competency and retention" (Johnson et al., 2020, p. 150). A convergent, parallel mixed-methods design was utilized. The quantitative portion of the study was a randomized controlled trial that included a pretest and two posttests at 14 and 21 weeks following the intervention. The convenience sample included 28 prelicensure baccalaureate nursing students at a private liberal arts college in southeast United States. The group utilizing deliberate practice with peers prior to the simulation (n = 10) demonstrated the largest reduction in errors of urinary catheter insertion from pretest to posttest. Although this sample is small, the results indicate peer deliberate practice assists with skill acquisition. Qualitatively, students viewed peer deliberate practice positively as practicing with peers "was perceived as more relaxed, comfortable, and helpful while providing an opportunity for reflection" (Johnson et al., 2020, p. 152-153). Peer deliberate practice may be one method of assisting students learning new skills, but more research is needed.

Virtual reality is also a learning method with limited research. Virtual reality is a simulated experience that can be similar to or completely different from the real world. Virtual reality is used for entertainment purposes such as gaming and educational purposes such as nursing instruction. Bracq et al. (2019) sought to assess acceptability and usability of a new virtual reality (VR) simulator for procedural skill training among scrub nurses. The simulator training system was tested with a convenience sample of 16 non-expert participants and 13 expert scrub nurses from a neurosurgery department of a French University hospital. The simulation scenario was designed for students to practice preparing an instrumentation table for a craniotomy surgery. For data analysis, independent subgroups were compared using Mann-

Whitney tests, pre- and post-simulation with paired student t-tests, and correlations between main variables using Bravais-Pearson coefficients. The two groups of expert and non-expert users rated the VR simulator on items such as mental demand, physical demand, performance, effort, frustration, simulator sickness, and time. None of the results were statistically significant. Users stated the simulator was fun and had high realism/immersion ($t(28) = -2.84$; $p = .08$). However, some users reported the simulator to be uncomfortable to wear and difficult to understand (Bracq et al., 2019). Again, this study noted a small sample size with data that was not statistically significant. Additionally, the discomfort of the device would most likely limit its use.

Another alternative method to in-person skill acquisition is video podcasting, which is a podcast with a video element. A hermeneutic phenomenological study by Stone et al. (2020a) sought to explore the meaning of undergraduate nursing students' experiences of using video podcast as an adjunct to existing teaching methods in developing confidence in clinical skills. By using Mayer's Cognitive Theory of Multimedia Learning, a clinical instructor created three 12–18-minute clinical skills video podcasts on the topics of intravenous infusion set-up, intramuscular injection, and intravenous medication bolus administration. Students could view the skills videos at any stage while enrolled in the course, and the specific skills were part of the course assessment, meaning the student must pass the skills to meet the course objectives. The three skills were also demonstrated in weekly lectures and clinical practice laboratories. The Australian study included a purposive sample of 10 second-year undergraduate nursing students. Through 15-minute face-to-face semi-structured interviews, three themes emerged: 'accessibility for learning the skill', 'preparation for learning and practice', and 'student-directed learning'. Students expressed it was easier to view the instructor in the video podcast versus in the

laboratory with other students, that they appreciated the opportunity to watch the video podcasts as often as they wanted and on demand, such as the evening before the assessment when laboratory time was difficult to obtain. However, students ultimately expressed they preferred the combination of video podcasts and in-person learning. Students stated they understood the need to be self-directed for success and appreciated the opportunity to watch the video podcasts remotely. Video podcasts are easy to access and allow a flexible means to learning clinical skills, while appearing to promote self-confidence and self-efficacy in undergraduate nursing students (Stone et al., 2020a).

Another study exploring this content delivery approach was a systematic review by Stone et al. (2020b). They examined the current evidence of the effectiveness of the use of video or video podcasts technology. Utilizing an integrative review framework, the literature was searched for studies about video podcasts, confidence, and skill development in undergraduate nursing students. Four studies met the inclusion criteria, with six themes emerging from the data: "pedagogy; skills performance and competency; student satisfaction and confidence in relation to skills development; technical constraints; time as an institutional, curricular, and academic/student challenge; and meeting the generational needs of students" (Stone et al., 2020b, p. 10). The review concluded video technology teaching methods utilized in combination with traditional teaching methods produce the greatest positive learning environment (Stone et al., 2020b).

Similarly, combining peer-to-peer deliberate skill practice with simulation is best for nursing student outcomes (Johnson et al., 2020). A convergent parallel mixed-methods design was used to explore the effect of peer-to-peer deliberate practice combined with skill practice during high-fidelity simulation scenarios on urinary catheter insertion skill competency and

retention. The convenience sample of 28 prelicensure baccalaureate nursing students at a private liberal arts college in the United States completed the pretest assessment of urinary catheter insertion and were randomized into three groups. The three groups attended required simulation days where various amounts of peer-to-peer deliberate practice were embedded. Qualitatively, students who participated in deliberate practice were invited to be interviewed following the simulation day. The students described peer-to-peer deliberate practice as “more relaxed, comfortable, and helpful while providing an opportunity for reflection” (Johnson et al., 2020, p. 153). Interestingly, “all participants agreed a simulation scenario was not the best place to learn and refine a skill” (Johnson et al., 20202, p. 153). The two groups with deliberate practice included in the simulation day scored higher on the urinary catheter insertion skill demonstration posttest than the group who did not have any peer-to-peer deliberate practice (Johnson et al., 2020). However, the results were not statistically significant. This study is another example of how teaching and learning methods are best used in conjunction with each other rather than as a standalone method.

While simulation is prevalent in the nursing literature, virtual reality is a newer method of simulation learning and not much is known on the topic. A 2020 systematic review by Rourke searched nursing literature for virtual reality simulation in relation to skill acquisition in pre-registration student nurses. All nine studies included in this review utilized a quasi-experimental design. Virtual reality groups outperformed simulation groups in posttest knowledge scores, cognitive gain, skill performance scores, and skill success rate. Data collection tools and outcome measurements varied, making it difficult to compare study results. However, virtual reality had similar or superior results when compared to traditional simulation (Rourke, 2020).

Virtual simulation can take many forms including software on a computer or other device and in-person or remote use and instruction. Rossler et al. (2019) utilized an experimental pretest-posttest design to examine the effectiveness of an in-person virtual skill trainer on operating room fire safety skills among prelicensure nursing students. The 20 nursing students were randomized to a control or intervention group, then knowledge and skills acquisition of fire safety in an operating room were assessed. All students completed a didactic educational session, then the intervention group completed five independent and monitored skill trainer sessions. Finally, all students completed a posttest one week following the didactic session. Although there were no statistically significant findings in knowledge, the intervention group demonstrated statistically significant skill performance of following emergency procedures for a fire and demonstrating the pull-aim-squeeze-sweep technique, with the Fisher exact test demonstrating "significant relationships" ($p = .001$) (Rossler et al., 2019, p. 90). These findings indicate students were able to acquire the correct skill technique and procedure through virtual skills trainers. However, virtual reality is an expensive teaching and learning method and there is still limited research on its use and effectiveness.

Summary

A combination of teaching and learning methods is best for student learning. Methods such as virtual reality, simulation, video podcasting, and other technologies are being used to teach clinical skills to undergraduate nursing students. However, more research is needed to determine effectiveness of any single teaching method.

Gaps in the Literature

Multiple skill acquisition studies presented were performed outside of the United States. Therefore, generalizability is limited. Also, many studies had small sample sizes and not all

results were statistically significant. Furthermore, no skill acquisition studies presented utilized synchronous virtual instruction. Consequently, studies examining the effectiveness of skill acquisition through virtual instruction are warranted.

Virtual Instruction

Search Method

Virtual instruction is a teaching and learning method that can be utilized for undergraduate nursing students to acquire the skill of medication administration. To obtain virtual instruction studies, the databases of Academic Search Complete, CINAHL Complete, ERIC, and ProQuest were utilized in this search. The search terms of 'virtual instruction', 'nursing', and 'higher education' were utilized. The search was also limited to English language, peer-reviewed full-text articles. The search result's abstracts were reviewed for relevancy and seven articles are presented.

Historical Review

In 1998, Stadtlander conducted an online graduate seminar on psychology. Stadtlander (1998) found that students suffered computer problems such as being unable to access a computer frequently, students had unrealistic expectations for instructor availability, online discussions easily diverted off-topic, and student evaluations of the instructor were unfavorable when students experienced frustration with the course technology (Stadtlander, 1998). More than twenty years later, distance education is now an integral component of higher education. Despite distance education's wide use in higher education, it is challenging to implement in undergraduate nursing education due to the acquisition of hands-on skills such as medication administration.

Benner et al. (2009) has called for a radical transformation of nursing education because of the findings of the Carnegie National Nursing Education Study. The study examined three dimensions of nursing education and development: the learning of theory and scientific methods, the mastery of skillful practice, and the formation of professional identity and agency. The Carnegie National Nursing Education Study included site visits to nursing departments at institutes of higher education and a national survey of faculty and students conducted in collaboration with the American Association of Colleges of Nursing, the National League for Nursing (NLN), and the National Student Nurses' Association. Citing shortages of nurses, a chaotic health system, and economic pressure, Benner et al. (2009) described a practice-education gap. This gap represents the challenges of academia to keep pace with the rapid changes of nursing practice. Recommendations from the study include varying the means of assessing student performance by including simulation exercises and skills laboratories and broadening the clinical experience to "not only make the profession more visible to a broader population of prospective students, but to also allow for greater flexibility in accommodating students' home and work schedules" (Benner et al., 2009, para. 43). Virtual instruction is one teaching and learning method to meet this need and broaden the clinical experience. Virtual instruction also assists nursing programs facing the issues of scarcity of clinical placements for students, limited onsite laboratory space, and alternate clinical experiences (Foronda et al., 2017). A lack of qualified faculty to teach nursing students is further worrisome (Forneris & Scroggs, 2014). Clinical faculty often do not have any experience educating students and their orientations are quick with little emphasis on teaching and evaluating nursing students (Forneris & Scroggs, 2014).

Nursing Students

With the recent COVID-19 pandemic, schools of nursing were challenged to become creative in their teaching and learning approaches. Social distancing requirements and traditional in-person clinical experiences conflicted, and virtual instruction became an attractive alternative to obtain clinical hours. Fogg et al. (2020b) first performed a needs assessment of both undergraduate and graduate nursing programs across three campuses in Texas. In this state, regulatory requirements dictate the number of virtual hours campuses can use to replace in-person clinical hours. After providing virtual clinical experiences, student surveys were conducted to determine the effectiveness of the transition to online only clinical experiences. Students cited negative issues with virtual instruction including limited internet access, lack of motivation, and faculty inexperience teaching in an online environment. However, most students stated virtual experiences provided valuable opportunities to enhance their learning (Fogg et al., 2020b).

Similarly, Esposito and Sullivan (2020) found students enjoyed the interactive experience and heightened sense of teamwork of virtual simulation during the COVID-19 pandemic. Seventeen third-year undergraduate nursing students experienced a sudden shift to the online environment during their clinical nursing course. Clinical experiences became simulated via video conferencing facilitated by instructors and included pre-assignments and weekly written reflections. The video conferenced clinical day included collective case study work, student-developed care plans, and the viewing and debriefing of video vignettes (Esposito & Sullivan, 2020). The students' reflections were utilized as the data source for this study, a large limitation as the data was not confidential. However, the theme of online learning promoting togetherness and productivity is common in other virtual instruction literature.

Claman (2015) studied student engagement in synchronous virtual environments. In a quasi-experimental two-group study, 21 nurse practitioner students received either synchronous or asynchronous virtual instruction. The Community of Inquiry Survey measures engagement and results demonstrated a significantly higher score for synchronous learners compared to asynchronous learners ($t_{(1766)} = 2.21$; $p < .05$). The Community of Inquiry survey specifically measures teaching presence, social presence, and cognitive presence. The nurse practitioner students logged in to a multi-user virtual world environment where the synchronous students completed a case study analysis discussion while the students assigned to the asynchronous group answered a reflective prompt on a discussion post. This pilot study analyzed the data with a t-test for independent samples (Claman, 2015). The small, self-selected sample is a large limitation for generalizing findings, but the pilot study reported favorable results for the synchronous virtual learning environment.

Virtual simulation is one form of virtual learning that is synchronous. Using a mixed-method study Foronda et al. (2016) found virtual simulation was a fun method for nursing students to learn concepts of disaster triage. Six undergraduate nursing students participated in the virtual simulation of an earthquake and triaged patients using the Sort, Assess, Lifesaving Interventions, and Treatment/Transport model. The virtual simulation was a computer program that students navigated through with an avatar. Instructors were present during the virtual simulation to answer questions and facilitate the clinical experience. Students took a pre- and posttest of 20 multiple choice questions and although scores improved with the posttest (*M* 62.5% (*SD* = 15.73 pre-test; *M* 69.16% (*SD* = 10.68) posttest), the results were not statistically significant ($p = .17$). The qualitative data revealed themes of fun, appreciation for immediate feedback, better than reading, and technical issues. Once again, students cited technology issues

as a hinderance to virtual learning. However, students found the virtual simulation fun and better than simply reading about how to care for patients in emergent situations such as an earthquake. Students also cited an appreciation for immediate feedback, a quality present in synchronous learning only (Foronda et al., 2016). This study has a small sample size and results that are not statistically significant, justifying further research of virtual instruction.

In addition to learning how to triage disaster patients, instructors can utilize virtual instruction for students to learn how to perform a health history (Liu et al., 2018). In a retrospective analysis, instructors in China studied history-taking instruction of undergraduate nursing students via the software WeChat. WeChat is a messaging and social media application. The pilot study consisted of 57 undergraduate nursing students performing 570 health history-taking sessions on 17 different virtual patients. The virtual patients had in-depth varying health histories with details relating to their family history, present conditions, past medical history, perception of their health, values, and more. Students were instructed to utilize the Functional Health Pattern framework when conducting health histories. Students frequently missed the health history categories of coping and stress, personal history, cognitive perception, sexual-reproductive, and activity and exercise. The vast majority (97%) of students believed the software was helpful in learning how to perform a patient's health history (Liu et al., 2018). The utilization of virtual patients via the software of WeChat is a form of virtual simulation.

Fogg et al. (2020a) studied virtual simulation's impact on students' acquisition of clinical judgment. Clinical judgment is a broad term and clinical educators struggle with how to teach this high-level thinking to undergraduate nursing students. In a repeated measures pilot study, Fogg et al. (2020a) used the Lasater Clinical Judgment Rubric to evaluate clinical judgment skills of undergraduate nursing students following a virtual simulation. Participants included 234

baccalaureate nursing students enrolled in their pediatric clinical course. Data analysis included paired t-tests and results showed students had significant improvements from the first case to the final case (3.079 pre to 3.238 post; $p = .000$). Additionally, students' self-perception of their clinical judgment abilities increased following the virtual simulation (Fogg et al., 2020a).

Virtual simulation can be used in conjunction with in-person simulation instruction. In a 2020 study by Mabry et al., 151 undergraduate nursing students in three cohorts participated in an asynchronous virtual simulation prior to completing their in-person synchronous simulation. During the virtual simulation, students were given virtual feedback, which allowed the students to use deliberate practice with the virtual patient, obtain more feedback, practice with the virtual patient, and so on as desired. The quasi-experimental, cross-sectional design used a presurvey and postsurvey over 9 months. The modified self-efficacy scale was administered prior to the virtual simulation experience and following the in-person high-fidelity simulation experience. The combination of virtual simulation and in-person simulation experiences increased student perception of self-efficacy in all three cohorts ($t(57) = 3.36$, $p = .001$; $t(45) = 2.12$, $p = .005$; $t(46) = 2.86$, $p = .037$) (Mabry et al., 2020).

Summary

Distance education is widely used in higher education, but implementation challenges in undergraduate nursing education persist. The recent COVID-19 pandemic required creative solutions to in-person clinical instruction. Virtual instruction can promote a sense of togetherness during a time when face-to-face gatherings are restricted. Virtual instruction can take many forms including software programs such as WeChat, virtual simulation, or video conferencing. Instructors have the option to virtually instruct synchronously or asynchronously, although synchronous instruction appears to increase student engagement. Virtual instruction has been

found effective in teaching students how to perform health histories and can aid in development of clinical judgment. However, more research is needed related to acquisition of skills via virtual instruction.

Gaps in the Literature

Current literature reporting studies using virtual instruction had small sample sizes, results that were not statistically significant, studies that used international data collection sites, and frequently consist of pilot studies. Further studies are needed to advance the science and help inform nursing educators. Implementation of virtual instruction in undergraduate nursing clinical courses requires sufficient planning and technology resources. Virtual instruction may assist nursing students to acquire clinical skills such as medication administration, but more rigorous research is needed.

Instruments

The instruments used in this study were a researcher-developed demographic questionnaire, an oral medication administration skills checklist, an intramuscular injection medication administration skills checklist, and the General Self-efficacy Scale. The oral medication administration skill checklist has not been used in previous literature. A checklist is a list of specific behaviors or actions to be observed with a place for marking whether they were present during the performance (Brookhart & Nitko, 2015). Checklists are commonly used in nursing education to assess skills and document the continuing competence of the student nurse (Oermann & Gaberson, 2017). Checklists are beneficial because learners can review and evaluate their performance prior to assessment by the instructor (Oermann & Gaberson, 2017). The rest of this section focuses on the General Self-efficacy Scale.

Self-efficacy

"General self-efficacy (GSE) is the belief in one's competence to tackle novel tasks and to cope with adversity in a broad range of stressful or challenging encounters, as opposed to specific self-efficacy, which is constrained to a particular task at hand" (Luszczynska et al., 2005a, p. 80). While general self-efficacy is the belief in one's ability to successfully accomplish a wide variety of tasks and to handle stressful or challenging life situations, specific self-efficacy (e.g., health behavior-related self-efficacy) is the belief that one can master a particular type of problem (Scholz et al., 2002). General self-efficacy seeks a constant sense of personal competence to effectively handle a variety of stressful situations (Schwarzer, 1993). Put another way, self-efficacy can be thought of as "the self-perception of capabilities" (Li et al., 2019, p. 687). This is an imperative trait of nurses as stressful situations are common in healthcare practice. Therefore, general self-efficacy is valuable to study in nursing students.

General Self-efficacy Scale

The General Self-efficacy Scale (GSE) was created to assess perceived self-efficacy regarding coping and adaptation abilities in activities occurring daily and isolated stressful events (Schwarzer & Jerusalem, 1995). This instrument has been used internationally for over two decades. It has been used in many different healthcare fields including nursing, nutrition, mental health, orthopedics, and rheumatology (Allari et al., 2020; Barlow et al., 1996; Chou et al., 2014; Karabacak et al., 2019; Li et al., 2019; Savas et al., 2011; Schultz et al., 2020).

Search Method. The GSE literature is often difficult to obtain in the English language. To obtain studies, the databases of CINAHL Complete, MedLine Complete, ProQuest, and PubMed Central were utilized in this search. The search terms of 'General Self-efficacy Scale', 'nursing', and 'student' were utilized. The search was also limited to English language and peer-

reviewed full-text articles within the last five years. The search result's abstracts were reviewed for relevancy and six articles are presented.

Nursing Students. In nursing education, the General Self-efficacy Scale is commonly studied in relation to simulation (Karabacak et al., 2019; Li et al., 2019; Terzi et al., 2019a). In a randomized controlled trial by Li et al. (2019), 132 undergraduate nursing students in China completed the Clinical Communication Ability Scale, the Jefferson Scale of Empathy-Health Professionals, and the General Self-efficacy Scale. The nursing students were in their first year of the program and were randomly assigned to either the control or experimental group. The students in the experimental group participated in simulation classes with deliberate practice sessions. The experimental group significantly increased their clinical communication scores ($t(65) = -15.77$; $p < .01$) and their empathy scores ($t(65) = -16.46$; $p < .01$) following the simulation. Additionally, students' self-efficacy scores significantly improved in the posttest of the experimental group ($t(65) = 3.69$; $p = .003$) (Li et al., 2019). These findings indicate deliberate practice during simulation exercises can increase students' communication, empathy, and self-efficacy.

In another study of self-efficacy and simulation, Terzi et al. (2019a) sought to compare the effects of a high-fidelity simulator and conventional teaching model used during blood pressure measurement instruction on students' self-confidence, self-efficacy, and anxiety levels. In a randomized controlled experimental study, 59 undergraduate nursing students from Turkey completed the Self-Confidence Scale, the General Self-Efficacy Scale, and the Beck Anxiety Scale. The students in both the experimental and control groups received instruction and demonstration of blood pressure measurement and completed all three scales. Then, the students in the control group practiced blood pressure measurements on each other while the students in

the experimental group practiced on the high-fidelity simulator. Finally, all participants returned the next day to measure blood pressures on subjects and complete all three scales for a second time. Unlike the study by Li et al. (2019), Terzi et al. (2019a) found no statistically significant difference between students' pre-test and posttest total scores of self-confidence (Z = -1.8, p = .68), general self-efficacy (Z = -1.5, p .14), and anxiety scales (Z = -1.9, p = .06) (Terzi et al., 2019a). Therefore, these findings are in conflict, and it is unclear which factors impact self-efficacy scores. Therefore, more research is needed to suggest correlation between confidence, efficacy, anxiety, and simulation exercises.

In another study investigating simulation, Karabacak et al. (2019) aimed to evaluate the effects of simulation-based learning on the self-efficacy and performance of undergraduate nursing students in Turkey. Students' performance was evaluated using an Objective Structured Clinical Assessment and performance evaluation checklists while their self-efficacy was measured using the General Self-efficacy Scale. The 65 nursing student participants received theoretical instruction and 20 hours of laboratory training on communication, patient transferring, and body mechanics. Then, students completed the General Self-efficacy Scale and the proficiency assessment form. Next, students completed a simulation scenario with standardized patients while instructors completed a performance evaluation checklist. Finally, students again completed the General Self-efficacy Scale, the proficiency assessment form, and students rated their own performance using the performance evaluation checklist while watching a video recording of the simulation scenario. The General Self-efficacy Scale used in this study was the 23-item Turkish version, with potential scores ranging from 17 to 85. The students' mean self-efficacy scores decreased from 52.68 (± 10.19) before the scenario to 49.59 (± 12.90) after the scenario (p = .001). The only statistically significant finding from the proficiency

assessment was the objective of "establishing a safe patient unit" ($t(64) = 2.27$; $p = .03$) (Karabacak et al., 2019). It is unclear as to why students' self-efficacy scores decreased, although the low sample size may have impacted the results. In conclusion, there are conflicting findings, and more studies are needed on this topic before implementing a standardized patient simulation to teach communication, transferring, and proper body mechanics to nursing students.

Self-efficacy may however impact students' clinical skills, such as drawing blood from a patient. Terzi et al. (2019b) sought to identify the self-confidence and self-efficacy levels of undergraduate nursing students when performing blood draws for the first time. The descriptive, cross-sectional study included participants receiving theoretical instruction, practicing blood draws on a simulator, and one week later performing a venous blood draw on a volunteer peer. Participants completed the Self-confidence Scale and the General Self-efficacy Scale following the blood draws. The total Self-confidence Scale mean score was 130.09 with a SD of 15.94, indicating a high level of self-confidence as the scale's highest possible score is 165 and lowest possible score is 33. The 70 undergraduate nursing students from Turkey also had high levels of self-efficacy, with a mean total General Self-efficacy Score of 31.71 and a SD of 3.92. The General Self-efficacy Scale has possible total scores from 10 to 40, with higher numbers equating to higher levels of self-efficacy. Finally, a positive statistically significant relationship was detected between the self-confidence and self-efficacy total mean scores of the students during blood drawing and it was identified that self-efficacy of the students increase as their self-confidence increases ($r(70) = .517$; $p = .000$) (Terzi et al., 2019b). With self-confidence being a synonym for self-efficacy, it is unsurprising these two factors are related. Students who feel confident in their ability will feel as if they can succeed in challenging situations, such as

drawing blood from patients. It is unknown if other skills such as medication administration impacts students' self-efficacy.

Self-efficacy has use in nursing education beyond skill acquisition. Self-efficacy plays a role in any task or situation that requires the student to confidently succeed. Cadet (2018) investigated the relationship between readiness to learn and positive self-efficacy for online learning. The correlational study included 27 newly enrolled baccalaureate nursing students in New York City. The Test of Online Learning Success and the General Self-efficacy Scale were anonymously administered to participants electronically. Due to the small sample size, Spearman's rank-order correlation was used to analyze the data (Cadet, 2018). The GSE used was 10-items, but it utilized a five-point Likert scale. Therefore, possible total scores ranged from 10 to 50, with mean total scores of 40.11. Most of the results had statistically insignificant findings, but the study failed to report which results were statistically significant. The lack of detail in the results and the low sample size raise questions about the generalizability of the findings.

Although it is unclear if online learning impacts self-efficacy, clinical instructors do impact nursing students' self-efficacy. Clinical is stress-inducing and high-stakes because students must translate theory into practice and patients are not simulators or actors. Clinical instructors can assist students by demonstrating caring for their learning. Allari et al. (2020) used a descriptive correlation design to assess the perception of nursing students of clinical instructors' caring behavior and explore the correlation of that perception and their self-efficacy. The sample involved 200 undergraduate nursing students in Saudi Arabia. A self-reported electronic questionnaire consisting of the Inventory for Nursing Students' Perceptions of Instructor Caring and the General Self-efficacy Scale were sent to the nursing students. A mean

total GSE score was not reported. A Pearson correlation revealed the Inventory for Nursing Students' Perceptions of Instructor Caring correlated weakly but significantly with general self-efficacy ($r(200) = .282$; $p < .01$). Additionally, a stepwise multiple regression analysis revealed self-efficacy is a significant predictor of nursing students' perceptions of instructor caring ($R^2 = .642$, $p = .021$) (Allari et al., 2020). Therefore, it is important for clinical instructors to ensure they are perceived as caring to nursing students. Although self-efficacy is a concept for nursing students to acquire, it is not a trait that is inherently present. Instructors, teaching and learning methods, and learning formats may all impact students' self-efficacy.

Summary. The General Self-efficacy Scale, although widely used internationally, has limited studies in the English language. Five out of the six articles presented were studies outside of the United States. However, research suggests that instructors can impact students' self-efficacy levels by their behavior during teaching experiences and by the planning and delivery of course content.

Gaps in the Literature. More literature is needed for the GSE in the United States. Additionally, small sample sizes, differences in clinical topics studied, and statistically insignificant results further limit generalization of the available studies. Self-efficacy is helpful for individuals to tackle stressful situations. Nursing education has many stress-inducing events, including virtual instruction methods and medication administration during clinical practice. Studying self-efficacy levels of nursing students in the United States is a gap in the literature and its findings can impact nursing education.

Chapter Summary

This chapter provided a literature review of medication administration, skills acquisition, virtual instruction, and self-efficacy. The General Self-efficacy Scale and related literature was

presented. Limitations of the studies and gaps in literature were identified as well as the need for further research. Chapter three will describe the methodology of the study.

CHAPTER 3

METHODOLOGY

This chapter describes the methods that were used in this study. The chapter begins by describing the study design, setting, and sample. Attributes of the researcher-developed demographic questionnaire and the General Self-efficacy Scale (GSE) are then presented, followed by a description of ethical considerations. This chapter concludes with a detailed data collection procedure and data analysis plan.

Design

For this study, a quantitative design was utilized with analysis of video footage of medication administration demonstrated by students during the simulation, the General Self-Efficacy Scale, an established survey instrument, and a researcher-developed demographic questionnaire. This study is a descriptive correlational design which examines relationships among variables (Polit & Beck, 2017). The variables under examination are virtual skills instruction, self-efficacy, gender, age, healthcare experience, computer literacy, employment status, nursing program type, and virtual instruction practice hours. The descriptive correlational approach is appropriate for this study because more research is needed in virtual instruction of medication administration skills before inferring causation. Furthermore, there is limited information in the literature about these variables, so the descriptive correlational design will describe the variables and relationships that occur naturally between and among them.

The purpose of this quantitative study is to describe the virtual medication administration skill acquisition of prelicensure nursing students at one public community college in Pennsylvania. Specifically, the study aimed to answer the following questions:

1. How effective is medication administration skill acquisition taught via virtual instruction for prelicensure nursing students?

2. What is the level of prelicensure nursing student self-efficacy following virtual skill instruction of medication administration?

3. What is the relationship between personal and professional factors (gender, age, healthcare experience, computer literacy, employment status, nursing program type, virtual instruction practice hours) of prelicensure undergraduate nursing students and medication administration skill acquisition?

Setting

The setting for this study was a public community college in Southcentral Pennsylvania. The college features three simulation rooms and five high-fidelity manikins in its simulation department. The college has multiple prelicensure nursing tracks including a two-year associate degree program and a one-year practical nursing program. The simulation department faculty and staff design, schedule, and implement structured simulation learning experiences as part of clinical hours for nursing students. The nursing laboratory and simulation team leader in conjunction with the nursing faculty design, schedule, and implement structured simulation learning experiences as part of clinical hours for nursing students. The nursing laboratory and simulation team leader and nursing faculty work together to manage the technology of manikins during the simulation, in addition to conducting pre-briefing, facilitating/observing the students during the simulation scenario implementation, and conducting debriefing. The simulation nursing laboratory and simulation team leader develop mock medical records that include medication administration orders, surgical and medical history of the simulated patient, laboratory values, social history, and more for each simulation scenario.

The virtual practice environment takes place in two locations: where the student is located and where the instructor is located. Students can log in remotely from home or another quiet area. Instructors can log in from the skills laboratory, an empty classroom, their office, their home, or another quiet location. This location flexibility is one of the largest benefits of virtual instruction. Virtual instruction can be mandatory, especially if the school campus is closed, or optional for students seeking assistance outside of mandated time in the laboratory. This study's location chose to implement virtual instruction sessions following the start of the COVID-19 pandemic in Spring of 2020. Length of the virtual instruction session varies, with predetermined availability set by the instructor. Therefore, the demographic questionnaire asks how many total hours a student spent practicing medication administration via virtual instruction rather than the number of virtual instruction sessions attended.

When practicing detailed and crucial skills, it is imperative for the instructor to be able to watch all the students present during the session. Therefore, group sessions are usually kept to a maximum of five students. This allows the instructor to correct technique in real time, provide feedback, and helps encourage students to ask questions in the small group. To start, the students request a demonstration from the instructor, who follow along and guide students as they practice. However, when students attend multiple sessions or as the semester progresses, students often lead the direction of the session with specific questions or multiple practice attempts with the instructor's encouragement. The instructors at the study setting are nurses and are involved with creation and revision of all skills checklists at the college. Therefore, the instructors are content experts and well-equipped to host virtual practice sessions.

All nursing students at the college are given a nursing tote, a large, zippered bag with supplies needed for skill practice. The nursing totes are included in the cost of attendance at the

college. Contents include needles, syringes, alcohol wipes, gauze, gloves, simulated liquid and tablet medications, medicine cups, and injectable pads. Students also have a medication drug guide book as a required text. Instructors have access to the supplies and equipment in the skills laboratory, including all the supplies students have as well as anatomy textbooks and posters showing injection sites and large injectable models to demonstrate injection sites and technique. During the simulation exercise, students will utilize the supplies at the college's simulation laboratory. Although the virtual practice sessions are optional for students, the simulation scenario is a mandatory activity that is part of the student's on-campus clinical day. Practice sessions are also available in-person as well. Students have the option to attend virtual practice sessions, in-person practice sessions, a combination of both, or none at all.

This setting was an ideal location to conduct this study because of its incorporation of medication administration in simulations and number of available subjects meeting the inclusion criteria. A sample of students representing associate and practical nursing pre-licensure nursing students was recruited.

Sample

This section describes the sampling approach for the research study. The study's population and sample, ethical considerations for human subjects, eligibility criteria, sample size, and power analysis are presented.

Population and Sample

The study's population includes prelicensure nursing students in the United States. For this study, the sample included prelicensure nursing students within associate and practical nursing programs in Pennsylvania. A convenience sample of students enrolled in a prelicensure

nursing program granting associate and practical nursing degrees within geographic proximity to the researcher was utilized.

Ethical Considerations for Human Subjects

Institutional review board (IRB) approval was obtained from Indiana University of Pennsylvania and the setting of the study prior to conducting the study (Appendices B and C). An overview of the study was presented to participants via the informed consent pages (Appendix D) of the packet and via a zoom meeting that explained the purpose of the study as well as risks and benefits of participation. Informed consent was implied if participants complete and return the survey packet. Students who did not wish to participate were given an alternate assignment to complete. The alternate assignment consisted of a short, written reflection about the simulation experience. All information obtained was kept confidential by omitting student identifiers on the survey packet and storing information in a locked cabinet and password-protected computer. Participants can withdraw their responses at any time by emailing the researcher with their unique identifier code, which students created on the cover letter.

Eligibility Criteria

This section discusses the eligibility criteria for the study participants. Both the inclusion and exclusion criteria are presented.

Inclusion Criteria. The study's inclusion criteria states participants must be:

1. enrolled in the associate or practical nursing program.
2. enrolled in the first nursing course with a clinical component of their nursing program.
3. taking the nursing course for the first time.
4. at least 18 years of age.

Exclusion Criteria. Students meeting the following criteria were excluded from the study:

1. not enrolled in the associate or practical nursing program.
2. not enrolled in the first nursing course with a clinical component of their nursing program.
3. repeating a nursing course.
4. under the age of 18.

Sample Size

This research study utilized descriptive statistics and the Chi-Square Test of Independence for data analysis. For data to be meaningful, the Chi-Square Test of Independence should have at least five frequencies per cell (Pallant, 2016). This study utilized eight cells as it has eight variables, equating to a sample size of 40 participants. To account for a 10% attrition rate, the minimum required sample size was 44 participants. However, the researcher strove for more participants to increase the generalizability of the findings. The researcher collected data over one semester to reach at least 44 participants.

Recruitment

After obtaining IRB and site approvals, a convenience sampling approach was used to recruit potential study participants. The nursing faculty who are team leaders for the associate fundamentals of nursing courses were contacted by the researcher via email regarding student participation in the research study. After establishing contact, the researcher communicated with course faculty to determine data collection times when the students were present on campus for the simulation scenario. The virtual practice sessions were optional and offered throughout the semester, so the timeframe between the sessions and the simulation scenario varied.

Polit and Beck (2017) cite face-to-face recruitment as more effective than recruitment via telephone, email, or letter. However, the current COVID-19 pandemic calls for social distancing whenever feasible. Therefore, the researcher utilized Zoom software to virtually explain the study. A designated simulation staff member at the setting accepted the Zoom meeting request, distributed and gathered the study packets, and collected the video footage. The researcher verbally outlined the purpose of the study and answered any questions pertaining to the study while the staff member provided a cover letter with study explanation to potential participants. Students were informed that participation in the study did not influence course grades.

Incentive

An optional incentive was offered to increase participation. The last page of the survey included a contact information form in which participants could provide their name and email address. The students separated the contact information form and placed it in a separate container if they wished to be entered into the drawing for the incentive. The simulation laboratory director placed all the contact forms into a basket and randomly drew the winner. The simulation laboratory director emailed the electronic gift card to the student at their provided email address. After the winner was chosen and the incentive was sent to the selected participant, the contact information forms were shredded. All participants who completed the optional contact information form were entered into the incentive drawing to receive a $25 Amazon gift card.

Instruments

This section reviews the study instruments including a description of the oral medication administration skill checklist and the GSE, reliability and validity, scoring, and coding of responses. Each participant received a survey packet that includes a demographic questionnaire and the GSE.

Demographic Questionnaire

The demographic questionnaire, found in Appendix E, was included in the survey packet. Students wrote directly on the survey packets, with no other documents necessary. Questions include information regarding gender, age, healthcare experience, computer literacy, employment status nursing program type, and time spent practicing medication administration via virtual instruction. The demographic questionnaire contains eight closed-ended questions, seven of which are multiple choice. There is one fill in the blank question, which asks participants to list their age.

Skills Checklist

The oral medication administration skills checklist is used by the college to determine if a student passes an oral medication administration. The skill checklist was developed by the skills laboratory staff in conjunction with nursing faculty, with fundamental nursing textbooks as resources. Students have access to these skills checklists through the college's website. Students are instructed to download and access the skills checklist for practice, and faculty use the checklist when teaching the skills to students. Skills with checklists include injections, intravenous push, intravenous flush, continuous intravenous, intravenous piggyback, and oral medication administration. The simulation required students to administer oral medications, so the oral medication administration checklist was utilized in this study. The skills checklists were created for all raters to reliably evaluate students by guiding raters to observe the same items when making evaluative decisions. Students must pass the medication administration skill within two attempts to pass the clinical nursing course. The attempts are on separate days, so students have time to practice the skill after a failed attempt. Students are dismissed from the course after failing one or more skills on the second attempt. By the time the students attend the simulation,

they will have passed their medication administration skills. There are many items on the oral medication administration skill checklist (Appendix H). For this study, participants administered oral medications during the simulation while clinical faculty conducted the simulation. To ensure reliability, the sole researcher was the only one evaluating simulation footage of the students with the oral medication administration skill checklist. The researcher watched the video footage of students administering medications, completed each skill checklist for each participant, and determined if a student passed the skill. The researcher did not notify the student if they completed the skill successfully as simulation is purely for practice and the researcher did not complete the skills checklist until watching the recorded simulation later. The researcher recorded a pass or a failure for the observed skill for each participant.

General Self-efficacy Scale

The General Self Efficacy Scale (GSE), found in Appendix A, is a 10-item unidimensional instrument that is a self-reported measure of self-efficacy. “The scale was created to assess a general sense of perceived self-efficacy with the aim in mind to predict coping with daily hassles as well as adaptation after experiencing all kinds of stressful life events” (Schwarzer & Jerusalem, 1995, p. 35). The questionnaire is one page in length and participants rate how true a statement is to them. The options for responses include (1) not at all true, (2) hardly true, (3) moderately true, and (4) exactly true (Schwarzer & Jerusalem, 1995). There is also a shortened form of the GSE, with only six items (Romppel et al., 2013), but the longer version was utilized in this study. The GSE took approximately four minutes for students to complete (Schwarzer & Jerusalem, 1995). Permission to reproduce the GSE is found in Appendix G.

GSE Coding and Scoring

The GSE is 10 items and scores for each item ranged from one to four. Scores were summed across all items to give a total instrument score range from 10 to 40. Higher scores indicate a higher general sense of perceived self-efficacy. There is no recoding. Published norms suggest a mean of 29.98 (SD 4.6) and are derived from data on 1,660 adults in Germany (Schwarzer, 1993). This tool is ideal for this study because it is not lengthy and effectively measures the proposed variable of self-efficacy.

GSE Reliability and Validity

The first version of the GSE, developed in Germany, was created in 1979 and later revised and adapted to 32 other languages (Luszczynska et al., 2005b; Schwarzer, 2014; Schwarzer & Jerusalem, 1995). The GSE has been used in numerous research projects, with internal consistencies between alpha = .75 and .91, with the majority in the high .80s (Scholz et al., 2002; Schwarzer & Born, 1997). These research projects have had students as well as patients as participants. Two-year test-retest reliability was found to be lower, with a value of .47 among migrants from East Germany (Schwarzer, 1993). Later, test-retest reliability was studied in 174 cardiac surgery patients in Germany and found to be r = .67 (Schröder et al., 1998).

The scale has evidence for construct validity as it correlates with depression, anxiety, and optimism (Schwarzer et al., 1997). The scale has established criterion-related validity (Scholz et al., 2002; Schwarzer & Jerusalem, 1995). Concurrent validity was supported by associations with the psychosocial variables of self-esteem, internal control beliefs, optimism, anxiety, depression, shyness, and pessimism (Schwarzer, 1993; Schwarzer & Scholz, 2000). The GSE correlates negatively with depression, anxiety, and physical symptoms (Schwarzer, 1993). Factor analyses demonstrated that the scale measures a unitary concept (Barlow et al., 1996; Schwarzer, 1993).

Procedures

IRB approval was obtained prior to data collection. Access to participants was obtained by contacting the nursing faculty team leaders for the associate and practical nursing fundamentals of nursing courses. The researcher contacted the team leaders via email to determine their willingness to assist with this study and recruitment and then establish times to collect study data from participants. During participant recruitment, course instructors were not present. The researcher, via Zoom, provided students a verbal overview of the study and invited them to participate if they met the inclusion criteria. Students were informed participation was voluntary and had no impact on their course grade. Students were also informed they can withdraw at any point by emailing the researcher with their unique identifier code.

The study packet containing the cover letter, the GSE, the demographic questionnaire, and the contact information form for prize drawing was distributed to all students by the simulation staff member. The cover letter listed the purpose of the study, the risks and benefits of participation, instructions on creating the unique identifier code, contact information of the researcher, and directions for an alternate activity if the student chose not to participate. Consent was implied if the student completed and returned the GSE.

The researcher remained in the Zoom meeting during the distribution and collection of study packets to answer any questions from the students and the simulation staff member hand collected the study packets. The first page of the study packet, containing the researcher's contact information and the student's unique identifier code, was separated from the packet and handed back to the students in case the student wished to withdraw from the study. When submitting their completed study packet tools, participants received a sticker to place on their badge with their unique identifier code. This code enabled the researcher to match the video

footage to the survey packet containing demographic information and survey data. Students who chose not to participate had a fake number placed on their badge, so only the researcher knew who participated in the study. Students separated the optional prize drawing contact information form (Appendix F) from the rest of the study packet. They then deposited their completed study forms in designated containers in the classroom. The papers were stored in a locked file cabinet. The researcher arranged a time to meet the simulation staff member to collect the study materials. All electronic data was stored on the researcher's password-protected computer. Data was manually entered into the Statistical Package for the Social Sciences (SPSS) version 26 software by the researcher. The survey packets will be kept by the researcher for three years in a locked file cabinet before being shredded.

Video footage of the students was collected on the same day as the study packets. The video footage includes students administering medications during a non-graded simulation scenario which was already planned as a required on-site clinical activity. Students participated in the simulation exercise in groups of four or five, and all students had the opportunity to administer medications. The simulation activity includes a manikin who is a patient admitted in the hospital. The students must administer multiple oral medications. The oral medications include as needed medications, so the students must identify the reason for giving the medication, calculate the correct dose, safely administer the medication, and document the medication as given. All students have passed the oral medication administration skill previously in the semester but are repeating the skill during this simulation scenario.

The video footage was captured by the simulation staff onto a flash drive. The flash drive was placed in the collection box, then the video footage was uploaded to the researcher's password-protected computer and deleted from the flash drive. Students were identified on the

video via their unique identifier code on their ID badge. The data from the video footage was analyzed for proficiency of medication administration via the medication administration skills checklist (Appendix H).

Data Analysis

First, a code book was developed for coding of survey data. All coded data was entered into a database by the researcher. Survey data was analyzed using SPSS version 26 software. Prior to analysis, survey data was screened for data entry errors and outliers. The following section details the statistical approaches for analyzing demographic data and the research questions.

Demographic Data

Descriptive statistics were used to summarize the demographic data. Frequencies and percentages were computed for gender, computer literacy, employment status, nursing education program type, healthcare experience, and hours spent utilizing virtual instruction. Means, standard deviations, and ranges were computed for age as this was the only scale variable in which participants filled in the blank with their current age.

Research Question one

Research question one aimed to determine how effective virtual instruction is for medication skill acquisition. The video footage of students administering medications during the simulation scenario was analyzed to determine if students would pass the medication skill based on the oral medication administration skills checklist. The frequency of students who pass the skill under study versus the students who failed the skill was analyzed using descriptive statistics.

Research Question two

Research question two aimed to determine the level of self-efficacy via a Likert scale assessment. This data was obtained from students completing the GSE. First, the scale's validity was determined using Cronbach's alpha. Next, the data from the GSE will result in a score for each student, with the higher the score meaning the higher the level of self-efficacy. The GSE items are summed to arrive at a total score. This data was analyzed using descriptive statistics.

Research Question Three

Research question three aimed to explore the differences in multiple personal and professional factors and medication administration skill acquisition. The statistical method of Chi-Square Test of Independence was utilized because the dependent variable of skill acquisition is a categorical variable with possible answers of pass or fail. The independent variables, the personal and professional factors, are also categorical (Forister & Blessing, 2020; Pallant, 2016). The Chi-Square Test of Independence assesses differences in proportions (Polit & Beck, 2017). The only assumption of the Chi-Square Test of Independence concerns minimum expected cell frequency, where each cell must have at least five values. This assumption should not have been violated in this study because the required minimum sample size is set at 44 participants.

Chapter Summary

This chapter presented the study design, setting of the study, and sampling plan. The study instrument of the GSE was discussed. The chapter concluded with the statistical analysis plan. Chapter Four presents the results of this study.

CHAPTER 4

RESULTS

Chapter four describes the statistical analyses of the data collected. The chapter begins with a description of the sample demographics. Next, the chapter contains a detailed report of the results of each of the research questions posed in chapter one.

Sample Description

This study recruited prelicensure nursing students within associate and practical nursing programs at one public community college in Pennsylvania. The study's inclusion criteria states participants must be enrolled in the associate or practical nursing program, enrolled in the first nursing course with a clinical component of their nursing program, taking the nursing course for the first time, and at least 18 years of age. Potential participants were excluded from the study if they were not enrolled in the associate or practical nursing program, not enrolled in the first nursing course with a clinical component of their nursing program, repeating a nursing course, or under the age of 18.

COVID-19 continued to impact this study during data collection as the researcher only had access to students in the associate degree program. Between the two fundamentals of nursing courses, 57 students were present on the two data collection days and 46 students participated in the study. Of the 46 participants, all fully completed the GSE, the demographic questionnaire, and completed the videotaped simulation experience in its entirety. The final sample of 46 participants represents an 81% participation rate.

Demographic data were collected to describe the sample characteristics. Chi-square tests are non-parametric. Therefore, the data was not assessed for normality (Pallant, 2016). The

majority of participants were female (*n* = 39; 85%) while 15% (*n* = 7) were male. Table 1 describes the participants' gender.

Table 1

Participants' Gender

Gender	*n*	%
Female	39	85
Male	7	15

Participants ranged in age from 19- to 43-years-old with a mean age of 29 (*n* = 46; *SD* = 5.78). Table 2 describes the age of participants. Participants' age was transformed for data analysis purposes. The variable was changed from a scale value into a nominal value by moving those aged less than 25 into group one (*n* = 15; 33%), those aged between 26 and 35 into group two (*n* = 24; 52%), and those aged greater than 35 into group three (*n* = 7; 15%). Table 3 describes the age groups.

Table 2

Participants' age

Age	*M*	*SD*	*n*	Min	Max
Entire Sample	28.74	5.78	46	19	43

Table 3

Participants' age Groups

Age Group	*n*	%
Under 25	15	33
26-35	24	52
36 and Above	7	15

Participants reported their employment status and employment type. Among the sample, 76% of participants were employed on a full- or part-time basis (*n* = 35), and 48% of participants were employed in the healthcare field (*n* = 22). Participants also reported their years of

experience working in healthcare. Of the participants with healthcare experience, the majority had greater than 5 years of experience (*n* = 13; 28%). To decrease the potential for violation of assumptions in the Chi-square test, healthcare experience was transformed into a new variable, healthcare experience groups. No healthcare experience was group one (*n* = 11; 24%), less than one year of experience through three years of experience was group two (*n* = 17; 37%), and three years of healthcare experience or greater was group three (*n* = 18; 39%). Participants also reported their computer literacy as novice (*n* = 2; 4%), intermediate (*n* = 31; 68%), or advanced (*n* = 13; 28%). The number of medication administration virtual instruction practice hours reported by participants varied from 0 hours (*n* = 1; 2%), 1-2 hours (*n* = 12; 26%); 2-3 hours (*n* = 16; 35%); and greater than 3 hours (*n* = 17; 37%). Table 4 describes the employment status, employment type, healthcare experience, healthcare experience groups, computer literacy, and virtual instruction practice hours, collectively referred to as participants' demographic information.

Table 4

Participants' Other Demographic Information

Demographic	*n*	%
Employment Status		
Employed, full-time	15	33
Employed, part-time	20	43
Not employed	11	24
Prefer not to answer	0	0
Employment Type		
Healthcare field	22	48
Non-healthcare field	13	28
Not currently employed	11	24
Healthcare Experience		
None	11	24
Less than 1 year	6	13
1-2 years	6	13
2-3 years	5	11
3-4 years	1	2
4-5 years	4	9
Greater than 5 years	13	28
Healthcare Experience Group		
1	11	24
2	17	37
3	18	39
Computer Literacy		
Novice	2	4
Intermediate	31	68
Advanced	13	28
Virtual Instruction Practice Hours		
0 hours	1	2
1-2 hours	12	26
2-3 hours	16	35
Greater than 3 hours	17	37

Research Question one

The first research question asked, "How effective is medication administration skill acquisition taught via virtual instruction for prelicensure nursing students?" The effectiveness of medication administration skill acquisition was measured by obtaining the frequency of students who passed the skill via evaluation by the researcher utilizing the medication administration

skills checklists. The researcher viewed the videotaped student medication administrations while completing the medication administration skill checklist. The majority of students passed the medication administration skill (n = 33; 72%), and 13 students failed the medication administration skill (28%). Table 5 describes the evaluation of the medication administration skill.

Table 5

Participants' Medication Administration Skill Acquisition

Evaluation	*n*	%
Pass	33	72
Fail	13	28

Research Question two

The second research question asked, "What is the level of prelicensure nursing student self-efficacy following virtual skill instruction of medication administration?" Self-efficacy was measured via the General Self-efficacy Scale. The GSE contains answers of one through four for each of its 10 items, with four indicating a higher level of self-efficacy. The Cronbach's alpha coefficient was calculated for the GSE in this specific study at .85, indicating high reliability (Pallant, 2016). Table 6 contains descriptive statistics for the GSE items.

Table 6

Participants' General Self-efficacy Scale Descriptive Statistics

Item	*M*	*SD*	Min	Max
1: Problems	3.22	.417	3	4
2: Means	2.80	.687	2	4
3: Goals	3.28	.502	2	4
4: Confidence	3.30	.591	2	4
5: Resourcefulness	3.20	.582	2	4
6: Effort	3.57	.501	3	4
7: Calm with coping abilities	3.28	.655	2	4
8: Find solutions	3.22	.629	2	4
9: Think of solution	3.30	.628	1	4
10: Handle whatever	3.33	.598	2	4

The GSE items were added together for each participant to receive a total score. Total scores ranged from 25 to 40, with possible scores of 0 through 40. The mean score was 32.5 (SD = 3.81). Table 7 describes the GSE total scores of participants.

Table 7

Participants' Total General Self-efficacy Scale Score

Score	*n*	%
25	2	4
26	1	2
27	1	2
28	1	2
29	5	11
30	6	13
31	3	7
32	4	9
33	8	17
34	0	0
35	4	9
36	3	7
37	4	9
38	0	0
39	2	4
40	2	4

Research Question Three

The third research question asked, "What is the relationship between personal and professional factors (gender, age, healthcare experience, computer literacy, employment status, nursing program type, virtual instruction practice hours) of prelicensure undergraduate nursing students and medication administration skill acquisition?"

This research question is answered by completing a Chi-square test of independence for each personal and professional factor along with whether a student passed or failed the medication administration skill during simulation.

Gender and Medication Administration

A chi-square test for independence (with Yates' Continuity Correction) indicated no significant association between gender (male or female) and medication administration skill acquisition (pass or fail), χ^2 (1, n = 46) = .00, p = 1.00, *phi* = -.00. This chi-square test violates

the assumption that the lowest expected frequency in any cell should be five or more in one cell (Pallant, 2016). Therefore, Fisher's exact probability test can be utilized instead as this is a two-by-two table, meaning two categories with each variable. Fisher's exact probability test revealed no statistically significant association between gender and medication administration skill acquisition (two-tailed $p = 1.00$). Due to the sample size and the distribution of the data, no further testing was possible for this research question. Tables 8 and 9 describe the chi-square test for gender and medication administration skill acquisition. Figure 2 is a bar chart of the gender and medication administration skill acquisition Chi-Square test.

Table 8

Gender and Medication Administration Skill Acquisition Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.000[a]	1	.984		
Continuity Correction[b]	.000	1	1.000		
Likelihood Ratio	.000	1	.984		
Fisher's Exact Test				1.000	.651
Linear-by-Linear Association	.000	1	.984		
N of Valid Cases	46				

Note. a. 1 cells (25.0%) have expected count less than 5. The minimum expected count is 1.98.

b. Computed only for a 2x2 table.

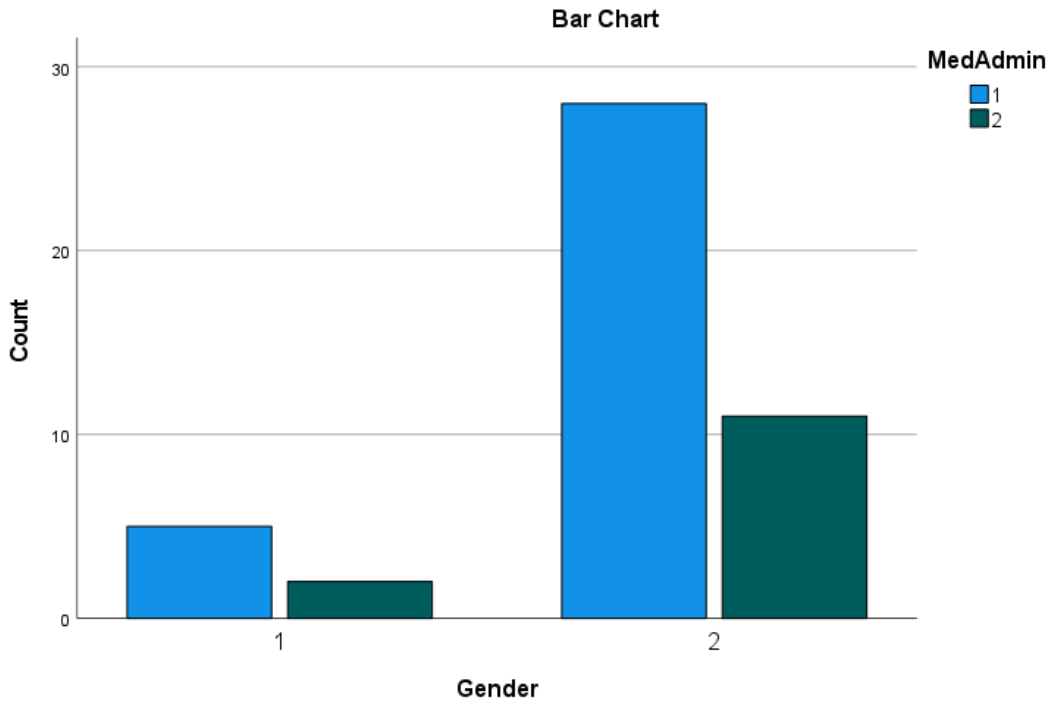
Table 9

Gender and Medication Administration Skill Acquisition Symmetric Measures

		Value	Approximate Significance
Nominal by Nominal	Phi	-.003	.984
	Cramer's V	.003	.984
N of Valid Cases		46	

Figure 2

Gender and Medication Administration Skill Acquisition Chi-Square bar Chart



Age Groups and Medication Administration

Age groups were categorized into three groups as Group 1 is 19-25 years of age, Group 2 is 26-35 years of age, and Group 3 is 36-43 years old. A chi-square test for independence indicated no significant association between age groups and medication administration skill acquisition, χ^2 (2, n = 46) = 1.82, p = .40, *phi* = .20. This chi-square test violates the assumption that the lowest expected frequency in any cell should be five or more in two cells. Due to the sample size and the distribution of the data, no further testing was possible for this research question. Tables 10 and 11 describe the chi-square test for age groups and medication administration skill acquisition. Figure 3 is a bar chart of the age groups and medication administration skill acquisition Chi-Square test.

Table 10

Age Groups and Medication Administration Skill Acquisition Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	1.820[a]	2	.403
Likelihood Ratio	1.853	2	.396
Linear-by-Linear Association	1.757	1	.185
N of Valid Cases	46		

Note. a. 2 cells (33.3%) have expected count less than 5. The minimum expected count is 1.98.

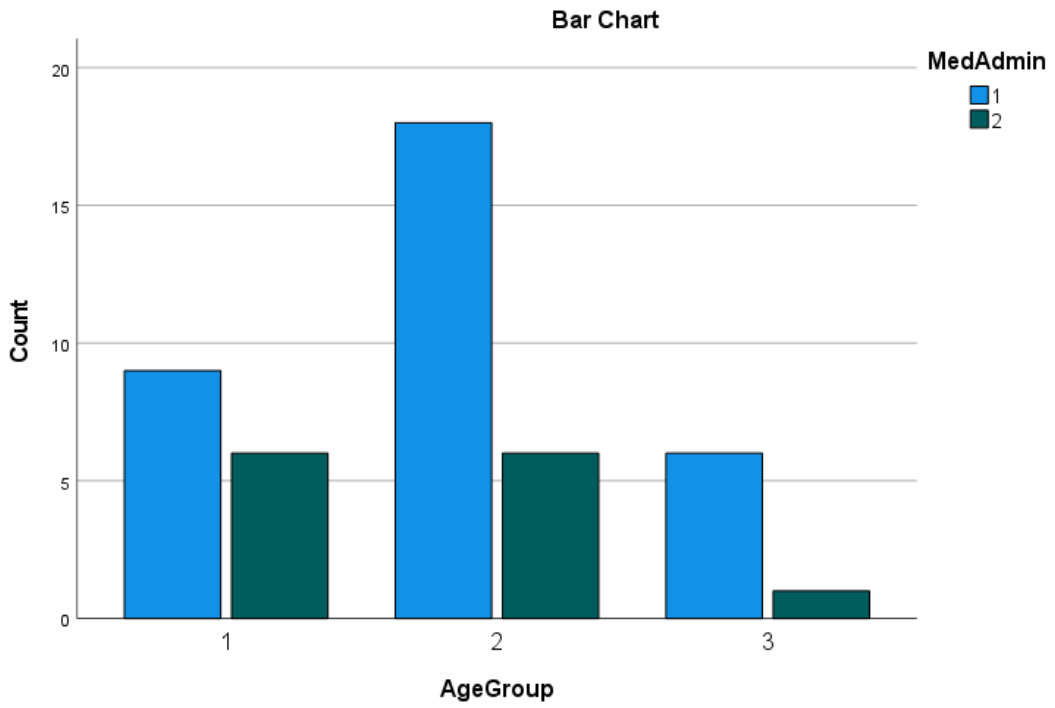
Table 11

Age Groups and Medication Administration Skill Acquisition Symmetric Measures

		Value	Approximate Significance
Nominal by Nominal	Phi	.199	.403
	Cramer's V	.199	.403
N of Valid Cases		46	

Figure 3

Age Groups and Medication Administration Skill Acquisition Chi-Square bar Chart



Employment Status and Medication Administration

Participants responded their employment status was either employed full-time, employed part-time, or not employed. A chi-square test for independence indicated no significant association between employment status and medication administration skill acquisition, χ^2 (2, *n* = 46) = .05, *p* = .97, *phi* = .03. This chi-square test violates the assumption that the lowest expected frequency in any cell should be five or more in two cells. Due to the sample size and the distribution of the data, no further testing was possible for this research question. Tables 12 and 13 describe the chi-square test for employment status and medication administration skill acquisition. Figure 4 is a bar chart of the employment status and medication administration skill acquisition Chi-Square test.

Table 12

Employment Status and Medication Administration Skill Acquisition Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	.054[a]	2	.973
Likelihood Ratio	.054	2	.973
Linear-by-Linear Association	.003	1	.955
N of Valid Cases	46		

Note. a. 2 cells (33.3%) have expected count less than 5. The minimum expected count is 3.11.

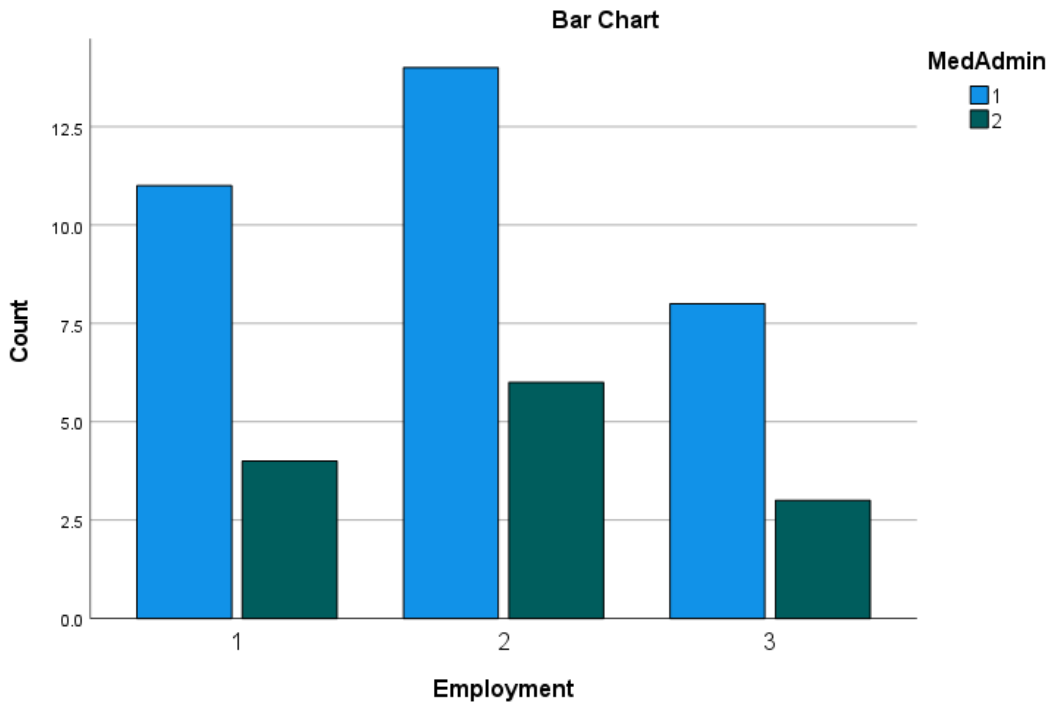
Table 13

Employment Status and Medication Administration Skill Acquisition Symmetric Measures

		Value	Approximate Significance
Nominal by Nominal	Phi	.034	.973
	Cramer's V	.034	.973
N of Valid Cases		46	

Figure 4

Employment Status and Medication Administration Skill Acquisition Chi-Square bar Chart



Employment Type and Medication Administration

Participants responded their employment type was either in the healthcare field, in a non-healthcare field, or not currently employed. A chi-square test for independence indicated no significant association between employment type and medication administration skill acquisition, χ^2 (2, n = 46) = .06, p = .97, *phi* = -.04. This chi-square test violates the assumption that the lowest expected frequency in any cell should be five or more in two cells. Due to the sample size and the distribution of the data, no further testing was possible for this research question. Tables 14 and 15 describe the chi-square test for employment type and medication administration skill acquisition. Figure 5 is a bar chart of the employment type and medication administration skill acquisition Chi-Square test.

Table 14

Employment Type and Medication Administration Skill Acquisition Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	.056[a]	2	.972
Likelihood Ratio	.056	2	.973
Linear-by-Linear Association	.002	1	.965
N of Valid Cases	46		

Note. a. 2 cells (33.3%) have expected count less than 5. The minimum expected count is 3.11.

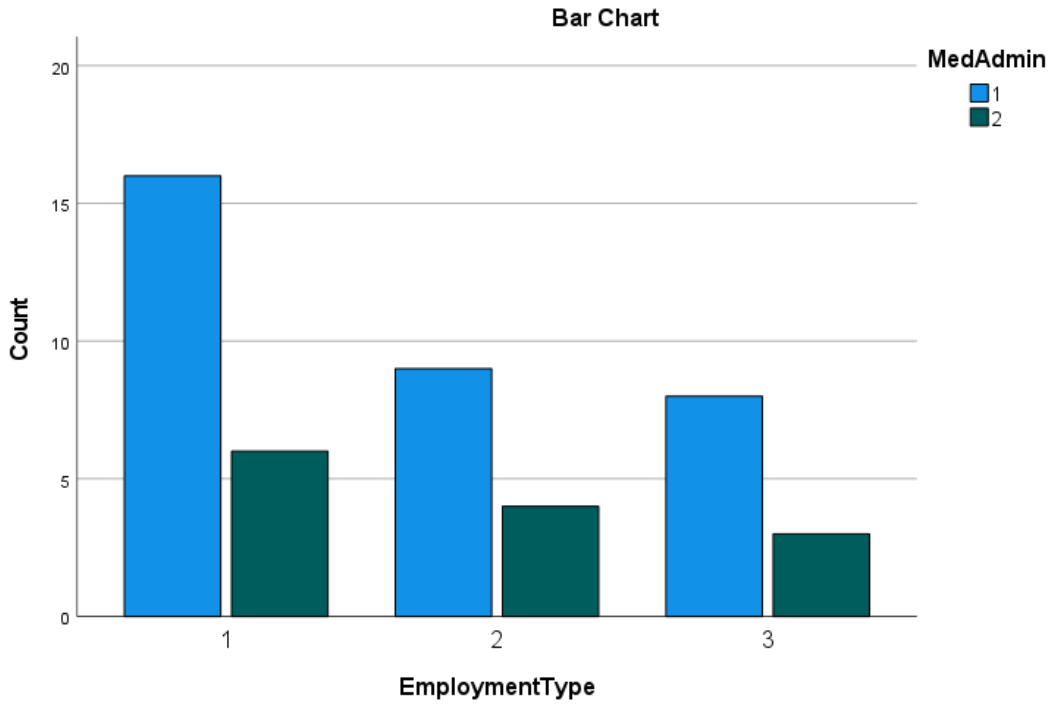
Table 15

Employment Type and Medication Administration Skill Acquisition Symmetric Measures

		Value	Approximate Significance
Nominal by Nominal	Phi	.035	.972
	Cramer's V	.035	.972
N of Valid Cases		46	

Figure 5

Employment Type and Medication Administration Skill Acquisition Chi-Square bar Chart



Healthcare Experience Groups and Medication Administration

Healthcare experience groups included Group 1 with no experience, Group 2 with less than 1 year through 3 years, and Group 3 with 3 or more years' experience in the healthcare field. A chi-square test for independence indicated no significant association between healthcare experience and medication administration skill acquisition, χ^2 (2, n = 46) = 5.58, p = .35, *phi* = .06. Despite condensing this variable into three groups, this chi-square test violates the assumption that the lowest expected frequency in any cell should be five or more in two cells. Due to the sample size and the distribution of the data, no further testing was possible for this research question. Tables 16 and 17 describe the chi-square test for healthcare experience groups and medication administration skill acquisition. Figure 6 is a bar chart of the healthcare experience groups and medication administration skill acquisition Chi-Square test.

Table 16

Healthcare Experience Groups and Medication Administration Skill Acquisition Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	5.580[a]	2	.061
Likelihood Ratio	5.820	2	.054
Linear-by-Linear Association	1.532	1	.216
N of Valid Cases	46		

Note. a. 2 cells (33.3%) have expected count less than 5. The minimum expected count is 3.11.

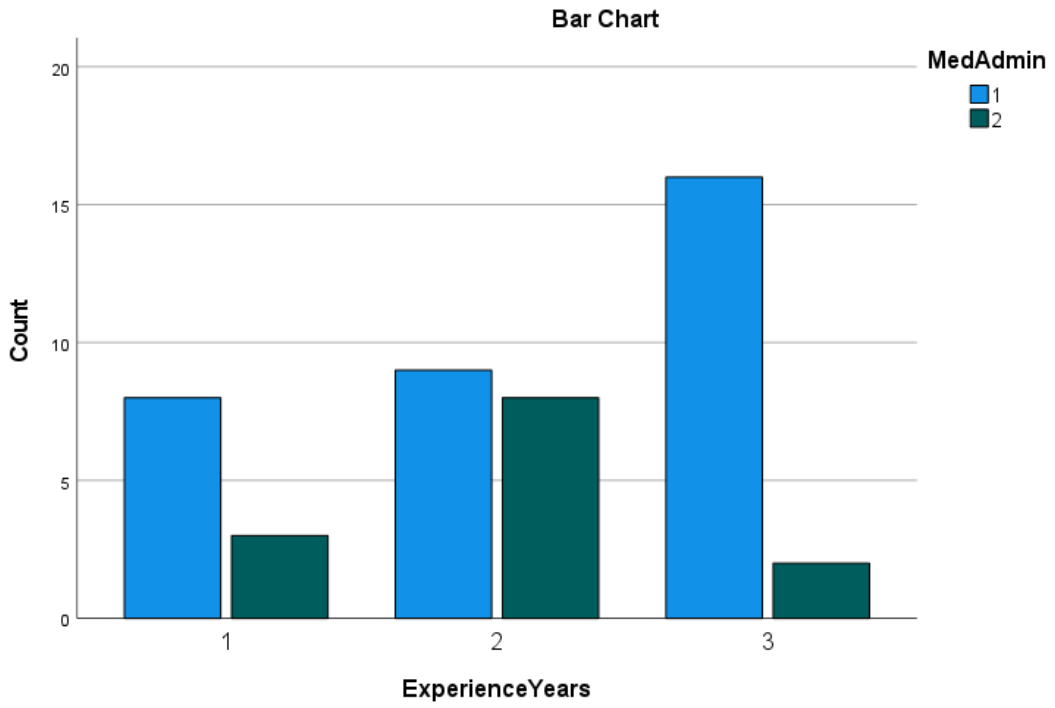
Table 17

Healthcare Experience Groups and Medication Administration Skill Acquisition Symmetric Measures

		Value	Approximate Significance
Nominal by Nominal	Phi	.348	.061
	Cramer's V	.348	.061
N of Valid Cases		46	

Figure 6

Healthcare Experience Groups and Medication Administration Skill Acquisition Chi-Square bar Chart



Computer Literacy and Medication Administration

Participants rated their computer literacy as novice, intermediate, or advanced. A chi-square test for independence indicated no significant association between computer literacy and medication administration skill acquisition, χ^2 (2, n = 46) = 1.63, p = .44, *phi* = .19. This chi-square test violates the assumption that the lowest expected frequency in any cell should be five or more in three cells. Due to the sample size and the distribution of the data, no further testing was possible for this research question. Tables 18 and 19 describe the chi-square test for computer literacy and medication administration skill acquisition. Figure 7 is a bar chart of the computer literacy and medication administration skill acquisition Chi-Square test.

Table 18

Computer Literacy and Medication Administration Skill Acquisition Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	1.627[a]	2	.443
Likelihood Ratio	1.563	2	.458
Linear-by-Linear Association	.310	1	.578
N of Valid Cases	46		

Note. a. 3 cells (50.0%) have expected count less than 5. The minimum expected count is .57.

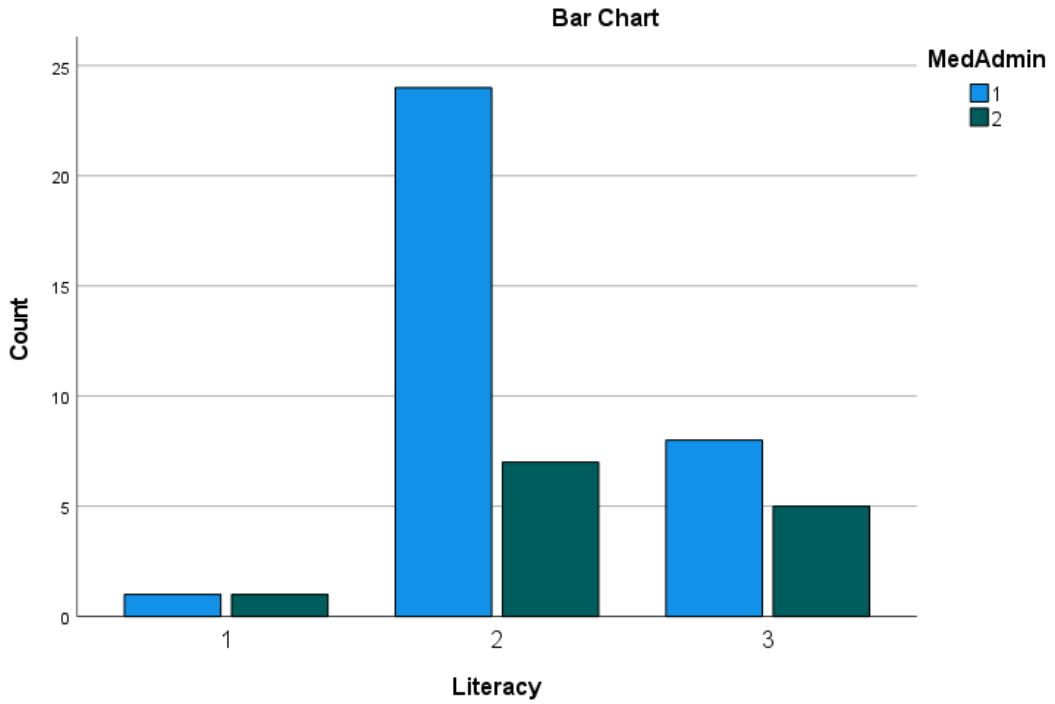
Table 19

Computer Literacy and Medication Administration Skill Acquisition Symmetric Measures

		Value	Approximate Significance
Nominal by Nominal	Phi	.188	.443
	Cramer's V	.188	.443
N of Valid Cases		46	

Figure 7

Computer Literacy and Medication Administration Skill Acquisition Chi-Square bar Chart



Virtual Instruction Practice Hours and Medication Administration

Participants reported their virtual instruction practice hours as 0 hours, 1-2 hours, 2-3 hours, or greater than 3 hours. A chi-square test for independence indicated a significant association between virtual instruction practice hours and medication administration skill acquisition, χ^2 (3, n = 46) = 22.88, p < .00, *phi* = .71. This chi-square test violates the assumption that the lowest expected frequency in any cell should be five or more in five cells. Due to the sample size and the distribution of the data, no further testing was possible for this research question. Tables 20 and 21 describe the chi-square test for virtual instruction practice hours and medication administration skill acquisition. Figure 8 is a bar chart of the virtual instruction practice hours and medication administration skill acquisition Chi-Square test.

Table 20

Virtual Instruction Practice Hours and Medication Administration Skill Acquisition Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	22.879[a]	3	<.001
Likelihood Ratio	25.838	3	<.001
Linear-by-Linear Association	20.647	1	<.001
N of Valid Cases	46		

Note. a. 5 cells (62.5%) have expected count less than 5. The minimum expected count is .28.

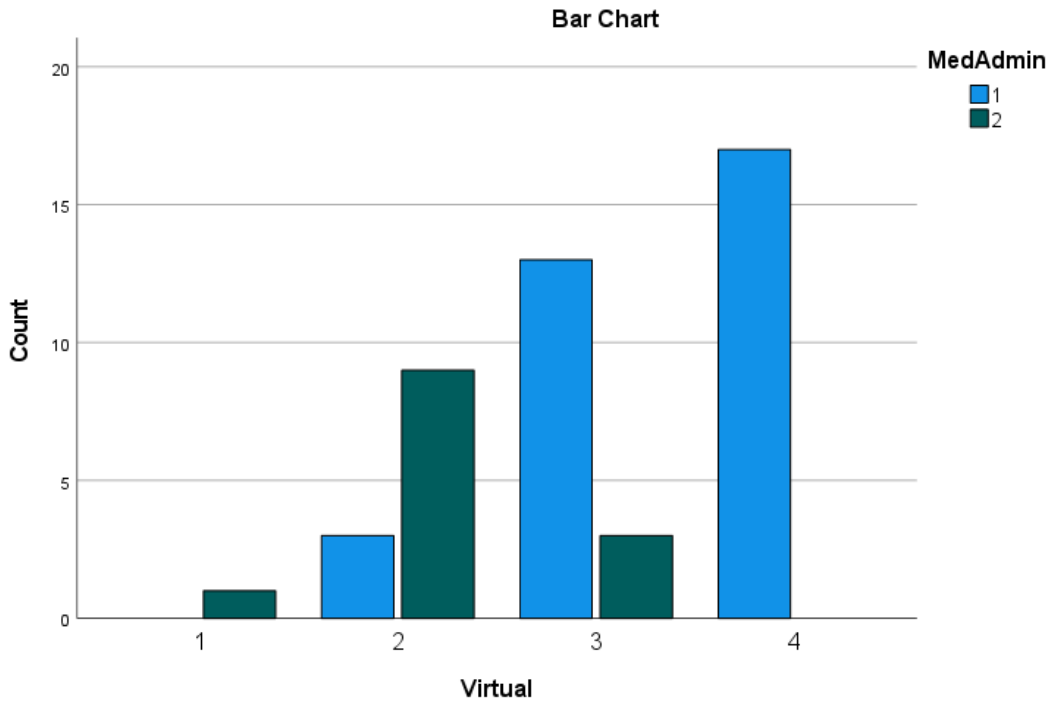
Table 21

Virtual Instruction Practice Hours and Medication Administration Skill Acquisition Symmetric Measures

		Value	Approximate Significance
Nominal by Nominal	Phi	.705	<.001
	Cramer's V	.705	<.001
N of Valid Cases		46	

Figure 8

Virtual Instruction Practice Hours and Medication Administration Skill Acquisition Chi-Square bar Chart



Chapter Summary

This chapter described the sample demographics and statistical analyses conducted to answer the study's research questions. Chapter five will discuss these findings, including the implications and limitations of this study as well as recommendations for future research.

CHAPTER 5

DISCUSSION AND IMPLICATIONS

Chapter five provides a discussion of the study's findings, examining prelicensure undergraduate nursing students' medication administration skill acquisition via virtual instruction. The chapter starts with a discussion of the sample demographics and a comparison to nationally reported prelicensure undergraduate nursing students. Limitations of the study are acknowledged. Implications for academic nurse educators are presented. The chapter concludes with recommendations for future study.

Discussion

This section includes a discussion of the study findings as presented in chapter four. The study's sample demographic data and nationally reported prelicensure undergraduate nursing student statistics are described. Finally, the section includes a discussion of the three research questions.

Sample Demographics

The eight demographic questions provided a strong description of participants. The most recent nationally reported prelicensure undergraduate nursing student statistics are the NLN Biennial Survey of Schools 2019-2020. These were considered in relation to the study's sample demographics. According to the NLN (2020), 87% of students enrolled in a pre-licensure RN program are female. This data is further broken down by program type, with 85% of associate degree nursing students identifying as female (NLN, 2020). The current study is an exact match, with 85% of associate degree nursing student participants identifying as female, suggesting the study demographics correlate well with nationally reported statistics.

For age, the NLN reported ranges by program type, with 38.9% of associate degree nursing students under the age of 25 (NLN, 2020). In this study, 15 out of 46 (32.6%) participants are under the age of 25. Although the study sample reported a lower percentage of associate degree nursing students under the age of 25, both data sources still represent a sizeable amount of nursing students under the age of 25. The NLN broke down the other age groups differently, with 25.9% of students aged 26-30, 23.7% aged 31-40, 8.9% of students aged 41-50, 2.0% of students aged 51-60, and 0.8% of students aged 61 or older (NLN, 2020). The percent of students decreased as the age bracket increased, indicating more younger students enrolled in associate degree nursing programs. In this study, 16 students (34.8%) were aged 26-30, 14 students (30.4%) were aged 31-40, one student (2.1%) was aged 41-50, and there were no students older than 50. This study's age statistics correlate well with nationally reported data, indicating a representative sample. No other nationally reported nursing student age and gender statistics are available and the additional demographic data reported in this study has not been previously reported nationally.

In this study, 76% of participants were currently employed (n = 35) and 48% of participants were currently employed in the healthcare field (n = 22). Participants reported their current or previous healthcare experience as no healthcare experience (n = 11; 24%), less than three years of healthcare experience (n = 17; 37%), or greater than three years of healthcare experience (n = 18; 39%). Participants also reported their computer literacy as novice (n = 2; 4%), intermediate (n = 31; 68%), or advanced (n = 13; 28%). The number of virtual instruction practice hours reported by participants varied from 0 hours (n = 1; 2%), 1-2 hours (n = 12; 26%); 2-3 hours (n = 16; 35%); and greater than 3 hours (n = 17; 37%).

Literature reviewed for this study that had a sample of nursing students did not include any of the additional demographic data such as employment, healthcare experience, computer literacy, or virtual instruction practice. Reviewed literature either did not list demographic data of the sample or only included gender and/or age of the nursing students.

The majority of the sample of nursing students in this study were presently employed, but less than half were presently employed in the healthcare field. Of those who currently or previously worked in the healthcare field, most reported more than three years of experience. Even though unlicensed personnel may not be permitted to administer medications at their workplace, they are present and observant of the process, which may have caused these students to acquire the medication administration skill easier or retain the skill longer. Furthermore, some students may be employed as medical technicians and have the ability to administer medications, additionally complicating the study's discussion of findings.

Almost all students reported at least one hour of virtual practice of medication administration. The course faculty offered many virtual practice sessions throughout the semester, providing the students with many opportunities to hone their medication administration skills. Despite students being exposed to technology for many years and having numerous required online activities, most students rated themselves as intermediate for computer literacy. A student's computer literacy, and therefore their comfortability with virtual learning, may have influenced their time spent practicing medication administration and their simulation performance.

Research Question one

The first question asked, "How effective is medication administration skill acquisition taught via virtual instruction for prelicensure nursing students?" Skill acquisition was assessed

utilizing the oral medication administration skill checklist. The oral medication administration skill checklist is comprised of 31 items under the following five categories: assessment and planning, implementation—preparing medications, implementation—at client's bedside, recording/reporting, and evaluation. Students can receive an 'S' for satisfactory, an 'NP' for needed prompting, or a 'U' for unsatisfactory. The checklist is either 'Pass' or 'Fail', and the researcher completed an oral medication administration skill checklist for each participant.

Many students passed the medication administration skill (*n* = 33; 72%), but 28% of students failed (*n* = 13). All participants had successfully passed the oral medication administration skill using the same checklist during a prior clinical day. However, simulation is designed to be a safe learning environment where mistakes may be made (Franklin et al., 2013). Additionally, the researcher explained that participation in this study did not influence course grades and students' outcome of the medication administration skill checklist would not be communicated to the course instructor. Therefore, students were most likely not as concerned with satisfactorily meeting all items on the checklist and were more engrossed in the simulation scenario. Furthermore, this was a different format for the students to administer medications and they were being videotaped for the study, potentially contributing to the pass rate. This study adds to the body of nursing education knowledge as there have been no studies examining prelicensure nursing students during a simulation with this oral medication administration skill checklist.

During this simulation, the students were able to complete their administration of medications without interruption. Multiple studies suggest interruptions are linked to medication errors (Hammoudi et al, 2018; McLeod et al., 2015). Therefore, the simulation was not fully realistic, possibly influencing the high student pass rate. Furthermore, nursing students have

reported the complexity of the working environment and the intricacy of the patients as barriers to administering medications safely (Johnson, 2016). These conditions did not exist during the simulation in this study. Despite these differences, an increased number of simulation experiences allow students to become comfortable in the environment and perform better (Craig et al., 2021).

In measuring how effective medication administration skill acquisition is taught via virtual instruction, it is vital to recognize the student's level of ease in using technologies. For students who perceive themselves as having a low level of computer literacy, utilization of technologies may be a struggle and skill acquisition may be more of a challenge to obtain in a virtual environment. For this study, most students self-reported their computer literacy proficiency as intermediate, or confident. This mid-level rating likely did not have a large impact on the students' ability to acquire medication administration skills virtually.

Research Question two

The second research question asked, "What is the level of prelicensure nursing student self-efficacy following virtual skill instruction of medication administration?" The General Self-efficacy Scale (GSE) was utilized to measure self-efficacy. This 10-item scale contains possible answers of one through four, with one indicating a low level of self-efficacy and four indicating a high level of self-efficacy. Therefore, total possible scores ranged from 10 to 40. The GSE had a high reliability, indicating this scale would get a similar result if applied over again.

Chapter four contains descriptive statistics for individual item scores and for total GSE scores. Participants rarely self-reported an answer of one or two to any of the items, with only one participant reporting an answer of one or 'Not at all true' on item number nine, 'If I am in a bind, I can usually think of something to do.' There were 38 total answers of two or 'Hardly

true', with 16 of them being to item number two, 'If someone opposes me, I can find means and ways to get what I want.' Two respondents answered four to all 10 items, indicating the highest level of self-efficacy. Total scores ranged from this highest possible score of 40 to a low of 25, which is moderately higher than the lowest possible score of 10. The mean total score of participants was 32.5 (SD = 3.81), indicating a high overall level of perceived self-efficacy.

The General Self-efficacy Scale has been used in many healthcare fields. In studies including nursing students, the mean total GSE score is sometimes not reported or the scale has a different range due to using a five-point Likert scale or additional items due to translation into other languages. Karabacak (2019) used a longer Turkish version, so the mean total scores of 49.59 to 52.68 are much higher than what is possible with the 10-item version of the GSE. Li et al. (2019) reported mean total GSE scores of control and experimental groups during a pretest and a posttest ranging from 35.76 to 41.23. Similarly, Terzi et al. (2019a) reported mean total GSE scores of control and experimental groups in pretest and a posttest ranging from 28.47 to 31.07. Terzi et al. (2019b) reported a mean total GSE score of 31.71. Cadet (2018) utilized a five-point Likert scale on the 10-item GSE, so possible scores ranged from 10 to 50 and the mean total GSE score was 40.11. These differences in potential mean total scores make comparison of results difficult.

General self-efficacy is the belief in one's ability to successfully accomplish a wide variety of tasks and to handle stressful or challenging life situations. Therefore, it is imperative for nurses and nursing students alike to have high levels of self-efficacy. Nurses are faced with a multitude of tasks they must accomplish during each patient encounter, including obtaining a health history through conversation, performing an accurate and comprehensive physical assessment, administering medications, executing prescribed treatments and therapies,

meticulously documenting, and collaborating with the patient's holistic healthcare team. Competing demands, including emergent or unexpected complications, complicate a nurse's workflow and require successful prioritization and delegation to handle these often stressful and challenging situations. The specific sample used for this study included nursing students in an associate degree program. Associate degree nursing students have two years of preparation to become a safe, competent nurse. It is essential to provide quality learning opportunities to improve self-efficacy with specific skills given the length of the program. The results of the GSE for this study indicated the students reported high levels of general perceived self-efficacy. Self-efficacy was measured once, so it is possible students would have also reported high levels of general perceived self-efficacy prior to any virtual practice sessions.

Although the participants reported a high overall level of general perceived self-efficacy, completing this study virtually may have complicated the results. Virtual instruction and self-driven learning require students to take initiative. Because the offered virtual practice sessions are optional, students control their skill acquisition. According to the Theory of Skill Acquisition, nursing students start in the novice stage of learning and practice throughout the advanced beginner stage. Nurse educators evaluate students to ensure competency, but ideally nursing students move through the sequential learning to proficient (Dreyfus & Dreyfus, 1980). This progression occurs when students deepen their understanding and mastery of the skill, likely contributing to a high level of general perceived self-efficacy.

Research Question Three

The third research question asked, "What is the relationship between personal and professional factors (gender, age, healthcare experience, computer literacy, employment status, nursing program type, virtual instruction practice hours) of prelicensure undergraduate nursing

students and medication administration skill acquisition?" Chi-square tests of independence were performed on all personal and professional factors in relation to the students' medication administration skill acquisition. Unfortunately, for gender (χ^2 (1, n = 46) = .00, p = 1.00, *phi* = -.00), age (, χ^2 (2, n = 46) = 1.82, p = .40, *phi* = .20), healthcare experience (χ^2 (2, n = 46) = 5.58, p = .35, *phi* = .06), computer literacy (χ^2 (2, n = 46) = 1.63, p = .44, *phi* = .19), employment status (χ^2 (2, n = 46) = .05, p = .97, *phi* = .03), and employment type (χ^2 (2, n = 46) = .06, p = .97, *phi* = -.04) there was no statistically significant association with medication administration skill acquisition. Despite obtaining more than the minimum required sample size, all chi-square tests for independence violated the assumption that the lowest expected frequency in any cell should be five or more in five cells. Because the chi-square statistic is calculated by comparing observed frequencies and expected frequencies, when the assumption is violated, the result should be interpreted prudently (Polit & Beck, 2017).

Because data analysis resulted in assumption violations, it is possible that these personal and professional factors are not associated with medication administration skill acquisition. Perhaps other factors correlate stronger with virtual acquisition of medication administration and further research is needed for determination. Nonmodifiable factors such as gender and age may not play a role in determining a student's ability to acquire skills in a virtual environment. It is feasible that virtual instruction practice hours outweigh all other demographic factors on the path to student success.

There is a gap in the literature of studies linking nursing student skill acquisition to personal and professional factors such as healthcare experience, computer literacy, and virtual practice hours. New graduate nurses are lacking skills in key clinical areas (Missen et al., 2016). Therefore, more skill practice is necessary. Zieber and Sedgewick (2018) found nursing students

to highly seek opportunities to practice skills as students wish to feel confident and competent and deliberate skill practice has been shown to improve nursing student skill acquisition and knowledge retention (Johnson et al., 2019).

Virtual instruction practice hours were significantly associated with medication administration skill acquisition (χ^2 (3, n = 46) = 22.88, p < .00, *phi* = .71). Despite data that violated assumptions, results provide meaningful implications for nursing faculty, administration, and students. Students are more likely to retain medication administration skills after practicing virtually. This may be due to the flexibility virtual instruction offers. Feasibly, students appreciate the opportunity to practice vital nursing skills without needing to physically be present at their school. These findings support the need for creative and diverse learning offerings.

Limitations

This descriptive correlational study addressed the research questions, but limitations of the study include convenience sampling, use of the GSE, self-reported data, and the study's sample size.

The study's participants were obtained through a convenience sample at one public community college in geographical proximity to the researcher. Access to students was limited due to the COVID-19 pandemic and study participants were from the same associate degree nursing program. Therefore, the results of this study may not be generalizable to nursing students in practical nursing or baccalaureate programs.

The GSE had a high reliability in this study, but it previously has been used in many different healthcare fields including nursing, nutrition, mental health, orthopedics, and rheumatology (Allari et al., 2020; Barlow et al., 1996; Chou et al., 2014; Karabacak et al., 2019;

Li et al., 2019; Savas et al., 2011; Schultz et al., 2020). The GSE was designed to study self-efficacy in adults during daily and isolated stressful events (Schwarzer & Jerusalem, 1995). In this study, the GSE was used to measure task-specific self-efficacy in nursing students. Therefore, this study used the GSE not as it was intended, and its use limits the inferences that can be drawn from the findings.

Data collected through the demographic questionnaire and GSE were self-reported, which may increase the possibility of exaggeration by participants. Students may have structured their results in a more favorable manner by inflating their healthcare work experience, computer literacy, or the number of hours the student spent virtually practicing medication administration. Furthermore, students may have falsely reported their level of self-efficacy or tried to perform well specifically during the medication portion of the simulation rather than engrossing themselves in the simulation as designed, thus impacting the study's results. Again, the students were also previously evaluated on the medication administration skill and their performance during this simulation could have altered the results, thus making it a substantial limitation of this study.

While the sample size was met, it is a limitation as it restricts generalizability of this study's findings. Although more than the minimum number of sample participants were obtained, the distribution of the data resulted in all Chi-square tests of independence violating the assumption that the minimum frequency in any cell should be five or more. Furthermore, this study yielded only one statistically significant finding. The findings of the data analysis are the largest limitation of this study as the Chi-Square tests for independence should be interpreted with caution.

Implications

The purpose of this study was to analyze prelicensure nursing students' medication administration skill acquisition and the factors that influence it. Although there were limited statistically significant results, implications are provided for faculty, administration, and students.

Faculty Implications

Despite some statistically insignificant findings, the positive correlation between virtual practice sessions and medication administration skill acquisition was made. The virtual environment provides a means for student learning as evidenced by these study results. Also, in unplanned circumstances such as quarantining during a pandemic or weather-related instances prohibiting face-to-face experiences, the virtual learning format can provide rich learning experiences. Faculty can advocate for incorporating increased virtual offerings, knowing students are building and strengthening their skill development.

Virtual instruction practice hours or medication administration can be included in all courses that contain a clinical component focusing on medication administration. This may be all or some of the nursing courses. Virtual practice sessions are appropriate for nursing courses beyond the first year. Even though a student has successfully demonstrated competency, practice hours can hone the skill and encourage knowledge retention. Clinical experiences are not uniform, and students may go weeks without administering a medication in-person. Offering virtual practice sessions allows opportunity for all students to receive feedback on their skills.

Virtual instruction may further strengthen clinical judgment and reasoning capabilities of nursing students of all levels. Additionally, this format may offer flexibility and convenience for both faculty and students. Furthermore, faculty can appreciate and encourage students' problem-

solving abilities through the knowledge of a high self-efficacy level in prelicensure undergraduate nursing students.

Administration Implications

Transforming practice sessions to the virtual environment provides many benefits for nursing administration. Virtual instruction frees up laboratory and classroom space as well as laboratory personnel. Virtual practice sessions are a valid alternative to in-person practice sessions and administrators responsible for scheduling appreciate its flexibility. Recommendations for administration include providing technical support and training for faculty to implement virtual instruction as well as staying abreast on current best practices for this alternative teaching modality.

Technical support and training are vital for faculty who implement virtual practice sessions. Just as computer literacy was varied in the students in this study, computer literacy varies in faculty as well. Training sessions are necessary to provide faculty the ability and confidence to employ virtual technology. Then, technical support must be available for faculty to ensure a smooth delivery. Costs can be associated with technical support and training, so nursing administration must budget for these added expenses.

This study's results include support for incorporating virtual medication administration skill practice sessions. Further studies are needed to better shape best practices of virtual skill practice sessions. In nursing programs that incorporate virtual practice sessions, the nursing administration must stay abreast of current best practices. This can be delegated to an existing faculty member or committee, but the administration should confirm and implement their findings.

Student Implications

Students can view the utilization of virtual instruction as a rigorous option for medication administration skill acquisition. Virtual instruction is a supplemental learning modality that allows for the bridging of theory and practice that ultimately enhances clinical judgment and reasoning. Therefore, virtual practice sessions are a valid selection for honing skills that are often viewed as requiring in-person instruction.

However, students should not view virtual instruction practice sessions as a standalone task. Instead, they should consider ways to purposefully incorporate practice sessions into their current methods for studying course material. Combining a variety of learning modes are helpful for students to stay motivated and engaged with the content. Students should consider how to incorporate virtual instruction practice hours into preparation, evaluation, and when necessary, remediation of skills.

Students should view virtual instruction practice hours as experiential learning opportunities that support their development of clinical reasoning, clinical judgment, and clinical problem-solving skills. Although virtual instruction may have been introduced recently due to COVID-19 restrictions, its benefits are undisputed. Prelicensure undergraduate nursing students are resilient in their degree pursuit, adapting to the current culture of social distancing and creative teaching and learning modalities.

Recommendations

This descriptive correlational study was unique in studying the medication skill acquisition of prelicensure nursing students who participated in virtual practice sessions at one public community college in Pennsylvania. The study participants demographically aligned with nursing students across the United States. The relationship between virtual practice hours and

medication administration skill acquisition was explored and serves as a basis for future research related to virtual acquisition of medication administration skills.

Inclusion criteria for this study were students enrolled in the associate or practical nursing program, yet only associate degree nursing students comprised the study participants. Future studies may focus on practical nursing or baccalaureate nursing students. Future studies could also include a sample of nursing students who are in their first year of nursing school versus students in their fourth year as senior students have had more time practicing medication administration. This knowledge may further establish a correlation between virtual instruction and medication administration skill acquisition.

Virtual instruction modes continue to grow, especially fueled by social distancing recommendations. One-on-one instruction, group instruction, asynchronous, and synchronous learning modalities all comprise virtual instruction. Examining these differences would provide rich data to further support the need for flexible and convenient ways for nursing students to practice medication administration skills virtually. Other nursing skills, such as physical assessment or wound care, are often reserved for in-person instruction and may effectively be transformed into the virtual environment. Furthermore, concepts such as delegation, prioritization, time management, and clinical judgment could be assessed using virtual instruction. The possibility of future study designs is vast, and exploration is justified. Further studies that examine virtual skills practice may contribute to the nursing literature and support the expansion of skill acquisition in nursing students.

Based on this study's results, future research can focus on task-specific self-efficacy rather than general perceived self-efficacy. The General Self-efficacy Scale is not specific to medication administration or to prelicensure nursing students. Task-specific self-efficacy would

provide results that are more generalizable to nursing students practicing medication administration virtually.

Conclusions

Chapter five provided a discussion of the sample in relation to nationally reported nursing student statistics as well as results of the study's research questions. Furthermore, the study's limitations, implications, and recommendations were stated. This study sought to add to the body of knowledge on self-efficacy and virtual instruction among undergraduate nursing students.

Findings of this study support virtual practice for medication administration skill acquisition. As a result of this study, nurse educators are charged with providing a multitude of opportunities for undergraduate nursing students to practice skills virtually. Nursing students must demonstrate proficiency in hands-on skills and educators can assist their learning by offering creative solutions such as virtual instruction.

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Appendix A

General Self-efficacy Scale (GSE)

	Not at all true	Barely true	Moderately true	Exactly true
1. I can always manage to solve difficult problems if I try hard enough.	1	2	3	4
2. If someone opposes me, I can find means and ways to get what I want.	1	2	3	4
3. It is easy for me to stick to my aims and accomplish my goals.	1	2	3	4
4. I am confident that I could deal efficiently with unexpected events.	1	2	3	4
5. Thanks to my resourcefulness, I know how to handle unforeseen situations.	1	2	3	4
6. I can solve most problems if I invest the necessary effort.	1	2	3	4
7. I can remain calm when facing difficulties because I can rely on my coping abilities.	1	2	3	4
8. When I am confronted with a problem, I can usually find several solutions.	1	2	3	4
9. If I am in a bind, I can usually think of something to do.	1	2	3	4
10. No matter what comes my way, I'm usually able to handle it.	1	2	3	4

Appendix B

IRB Approval From Indiana University of Pennsylvania

Indiana University of Pennsylvania
www.iup.edu

Institutional Review Board for the
Protection of Human Subjects
School of Graduate Studies and Research
Stright Hall, Room 113
210 South Tenth Street
Indiana, Pennsylvania 15705-1048

P 724-357-7730
F 724-357-2715
irb-research@iup.edu
www.iup.edu/irb

October 03, 2021

Dear Jenna Davis:

Your proposed research project, "EXAMINING THE EFFECTIVENESS OF VIRTUAL INSTRUCTION FOR MEDICATION ADMINISTRATION SKILL ACQUISITION IN PRELICENSURE NURSING STUDENTS," (Log No 21-180) has been reviewed by the IRB and is approved as an expedited review. In accordance with Federal Regulation and IUP Policy, your project does not require continuing review. While you will not be required to request continuing review for this project, you are required to request any changes to this approved protocol and notify our office of any adverse events.. This approval does not supersede or obviate compliance with any other University requirements, including, but not limited to, enrollment, degree completion deadlines, topic approval, and conduct of university-affiliated activities.

You should read all of this letter, as it contains important information about conducting your study.

Now that your project has been approved by the IRB, there are elements of the Federal Regulations to which you must attend. IUP adheres to these regulations strictly:

1. You must conduct your study exactly as it was approved by the IRB.
2. Any additions or changes in procedures must be approved by the IRB before they are implemented.
3. You must notify the IRB promptly of any events that affect the safety or well-being of subjects.
4. You must notify the IRB promptly of any modifications of your study or other responses that are necessitated by any events reported in items 2 or 3.

The IRB may review or audit your project at random *or* for cause. In accordance with IUP Policy and Federal Regulation, the Board may suspend or terminate your project if your project has not been conducted as approved or if other difficulties are detected.

Although your human subjects review process is complete, the School of Graduate Studies and Research requires submission and approval of a Research Topic Approval Form (RTAF) before you can begin your research. If you have not

Appendix C

IRB Approval From Study Site

IRB Memorandum

DATE: September 25, 2021
TO: Jenna Davis
FROM: IRB Committee
SUBJECT: Study for Fall 2021

1. You are approved to begin research
2. You will need to explicitly state that, "at one public community college in Pennsylvania" and this "A convenience sample of students enrolled in a prelicensure nursing program granting associate and practical nursing degrees within geographic proximity to the researcher will be utilized."
3. Study site cannot be referenced in the dissertation, presentations or presentations in any way including acknowledgements.
4. In the event that there are any changes to your study the IRB must be notified.

Appendix D

Informed Consent

Indiana University of Pennsylvania
www.iup.edu

Department of Nursing
and Allied Health Professions
Doctorate of Philosophy in Nursing
Johnson Hall, Room 248
1010 Oakland Avenue
Indiana, Pennsylvania 15705-1063

P 724-357-3269
F 724-357-3267

You are invited to participate in this research study. The following information is provided to help you to make an informed decision whether to participate. If you have any questions, please do not hesitate to ask. You are eligible to participate because you are a student enrolled in a prelicensure nursing education program in Pennsylvania.

Study Purpose The purpose of this study is to describe the virtual medication administration skill acquisition of prelicensure nursing students at one public community college in Pennsylvania. Participation in this study will require approximately 20 minutes of your time, as you will be asked to complete two brief questionnaires.

Procedure Students who choose to participate will complete the demographic questionnaire and the General Self-efficacy Scale. All students will be given a numbered sticker for their ID badge and be videotaped during the simulation. The video will be provided to the researcher, who will watch the video later. The researcher will correspond the participants' numbered stickers to their questionnaires for data analysis. The researcher will evaluate the students during simulation on their medication administration technique. The researcher will continue to recruit participants until at least 44 students participate.

Compensation and Benefits Your participation in this study is voluntary and has no bearing on your nursing course grade. The results of this study may assist nurse educators in choosing to incorporate medication administration practice sessions virtually. Each participant, after completion of the survey will be offered to be entered into a drawing to receive a $25.00 Amazon gift card. You are free to decide not to participate in this study. If you wish to withdraw from the study, you may email the researcher at any time.

Risks Unpleasant feelings may surface as the survey items ask questions regarding self-efficacy/confidence related to nursing practice. These feelings are common in nursing education and pose a minimal risk. The faculty members teaching this course will not know who participated in this study.

Confidentiality If you choose to participate in this study all information will be held in strict confidence. The identification number used on your badge serves to match you to your questionnaires. The videotape will be destroyed after scoring and all paperwork will be kept in a locked cabinet for the required three years before also being destroyed. All data will be de-identified and none of your individual responses will be traced back to you. The information obtained in the study may be published in scholarly journals or presented to nursing education professionals, but

your identity will be kept strictly confidential. All data will be reported in aggregate without sharing individual identifiers of participants. If you are willing to participate in this study, your consent will be implied by completing and submitting the attached questionnaires. Once you are finished, please remove the prize drawing contact information sheet, and place each item in the labeled collection boxes at the front of the classroom. Thank you for your time and participation.

Participation If you choose not to participate, turn the survey over and write a reflection on preparing for the simulation experience. When finished with your reflection, place your packet of information, including your reflection, in the collection boxes at the front of the room. If you do not participate in the study, you are not eligible to receive the Amazon gift card.

If at any time you wish to withdraw your participation from the study, please email the Project Director at tpqw@iup.edu.

Please complete the following questions to create your unique identifier code. This will be used to keep your data confidential.
What is the first letter of your mother's first name? (Ex.: L) _____
What is the first letter of your middle name? *If you have no middle initial, enter N.* (Ex.: E) _____
How many **older** brothers do you have? *Include half-brothers and stepbrothers*. (Ex.: 1) _____
How many **older** sisters to you have? *Include half-sisters and stepsisters*. (Ex.: 2) _____
What is the month in which you were born? *Enter the complete name.* (Ex.: January) _____
Write your unique identifier code with the letters and numbers listed above in order. (Ex.: LE12January) _____
Write your unique identifier code on the following 2 pages.

Thank you for your willingness to participate in the study. Please feel free to contact me if you have any questions.

Project Director:	Faculty Sponsor:
Jenna Davis	Dr. Taylor Edwards
Doctoral Student	Faculty and Dissertation Chair
Department of Nursing & Allied Health	Department of Nursing & Allied Health
1010 Oakland Ave., Room 210	1010 Oakland Ave., Room 226
Indiana, PA 15705	Indiana, PA 15705
Phone: 717-824-5934	Phone: 724-357-7988
tpqw@iup.edu	hmxn@iup.edu

This project has been approved by the Indiana University of Pennsylvania Institutional Review Board for the Protection of Human Subjects (Phone: 724-357-7730).

Appendix E

Demographic Questionnaire

Unique identifier code: _____

Directions: Please circle the response that best represents you.

1. What is your gender?
    a. Male
    b. Female
    c. Prefer not to answer
    d. Prefer to self-describe: _____

2. Please list your age: _____

3. Please identify your employment status.
    a. Employed, full time
    b. Employed, part-time
    c. Not employed
    d. Prefer not to answer

4. Please indicate your type of employment.
    a. Healthcare field
    b. Non-healthcare field
    c. Not currently employed

5. How much experience do you have working in the healthcare field? (Omit clinical experiences)
    a. None
    b. Less than 1 year
    c. 1-2 years
    d. 2-3 years
    e. 3-4 years
    f. 4-5 years
    g. Greater than 5 years

6. What type of nursing program are you enrolled in?
    a. Associate degree
    b. Practical nursing program

7. How would you rate your computer literacy proficiency? Computer literacy is defined as the ability to use computers and computer-related technology.
    a. Novice (limited knowledge and experience)
    b. Intermediate (competent)
    c. Advanced (an authority)

8. How many hours have you spent practicing medication administration via virtual instruction?
    a. 0 hours
    b. 1-2 hours
    c. 2-3 hours
    d. Greater than 3 hours

Appendix F

Prize Drawing Contact Information Form

Contact Information for Prize Drawing

Name: _____

Phone number where best reached: _____

E-mail address: _____

Appendix G

Permission to Reproduce GSE

Freie Universität Berlin

Fachbereich Erziehungs-
wissenschaft und Psychologie
- Gesundheitspsychologie -

Professor Dr. Ralf Schwarzer
Habelschwerdter Allee 45
14195 Berlin, Germany

Fax +49 30 838 55634
health@zedat.fu-berlin.de
www.fu-berlin.de/gesund

Freie Universität Berlin, Gesundheitspsychologie (PF 10),
Habelschwerdter Allee 45, 14195 Berlin, Germany

Permission granted

to use the General Self-Efficacy Scale for non-commercial reseach and development purposes. The scale may be shortened and/or modified to meet the particular requirements of the research context.

http://userpage.fu-berlin.de/~health/selfscal.htm

You may print an unlimited number of copies on paper for distribution to research participants. Or the scale may be used in online survey research if the user group is limited to certified users who enter the website with a password.

There is no permission to publish the scale in the Internet, or to print it in publications (except 1 sample item).

The source needs to be cited, the URL mentioned above as well as the book publication:

Schwarzer, R., & Jerusalem, M. (1995). Generalized Self-Efficacy scale. In J. Weinman, S. Wright, & M. Johnston, *Measures in health psychology: A user's portfolio. Causal and control beliefs* (pp.35-37). Windsor, UK: NFER-NELSON.

Professor Dr. Ralf Schwarzer
www.ralfschwarzer.de

Appendix H

Medication Administration Skills Checklist

_____ _____

Nursing Program Student's Name (print) Clinical Group

Administration of Medications

Performance Checklist

_____

Instructor's Name Date

Rating: Pass Fail

_____

Student's Signature Date

KEY: S = Satisfactory; performed/demonstrated correctly without cue or prompt.
NP = Needed prompt or cue; action is correct.
U = Unsatisfactory; did not address or performed/demonstrated incorrectly.

I. ASSESSMENT AND PLANNING	S	NP	U	Comments
1. Check accuracy and completeness of MAR with HCP's prescriptions (orders).				
2. Correctly interpret all abbreviations and symbols used in prescriptions.				
3. Clarify any unclear or unsafe medication prescriptions (orders).				
4. Verbalize/demonstrate drug knowledge, including classification, action, indication, safe dosage range, nursing considerations, adverse effects & reason of med for client.				
5. Complete required assessments related to prescribed medications at appropriate time.				
6. Correctly utilize client's assessment data in regards to scheduled and unscheduled medications for safe outcomes.				
7. Determine any contraindications to administering medications.				
8. Report contraindications and demonstrates appropriate nursing action.				
II. IMPLEMENTATION Preparing Medications				
1. Perform hand hygiene before preparing medications.				
2. Verify name, date of birth and allergies on client M.A.R.				
3. Perform three safety checks of the 5 Rights of Medication Administration prior to administration:				
a. **Perform 1st Check**: Remove medication from drawer and compare label on medication with the M.A.R. or eMAR (verifying the 5 rights) and check expiration date of medication.				
b. Correctly perform necessary calculations and gather supplies.				
c. **Perform 2nd Check** after preparing the medication. Then place medication into cup.				

d. **Perform 3rd check**: 1) If taking medication out of wrapper at med cart, perform **third check** after pouring medication into medication cup **(or)** 2) If opening medication wrapper at bedside, **perform third check after identifying the client,** prior to opening the wrapper.				
4. a. Indicate when medication cart should be locked. b. Keep medications in sight at all times.				
IMPLEMENTATION AT CLIENT'S BEDSIDE **5.** Enter room, perform hand hygiene, introduce self, correctly identifies client, date of birth, and confirm allergies, initially & upon each **re-entry** of the room.				
	S	NP	U	Comments
6. If agency protocol, scans client's ID barcode, while identifying client.				
7. Provide privacy as needed and assist client to upright position.				
8. Perform required pre-administration assessments, if not already completed.				
9. If opening medication wrapper at bedside, perform **third safety check** and scan the bar code if required prior to opening wrapper and placing medication in to cup.				
10. Explain medication's purpose to client.				
11. Administer medications using the Rights of Medication Administration.				
12. Verbalizes/demonstrates correct nursing interventions related to prescribed route.				
13. Appropriately sequences the administration of several medications.				
14. Remains with client until each med is swallowed. (Does not leave meds at the client's bedside).				
15. Economize time and steps.				
16. Leave client in a safe, comfortable position.				
17. Handle supplies and disposes of waste properly.				
18. Include appropriate actions from the "Standard Protocol /Universal Steps for all Nursing Procedures," addressing client safety, identification, education, standard client precautions, hand hygiene, privacy, body mechanics and time frames.				
III. RECORDING/REPORTING				
1. Correctly document administration of meds & assessments (if applicable).				
2. Verbalize how to chart if medication is omitted.				
3. Record appropriate note for prn medication administration				
4. Verbalize correct nursing actions to initiate if an error occurs.				
IV. EVALUATION				
1. Returns within an appropriate time to evaluate client's response to medications.				

How your performance will be evaluated:

a. A "Pass" rating means that you have achieved an overall satisfactory rating on your performance of the procedure.

b. A "Fail" rating means that you did not adequately meet required standards. You have one opportunity to repeat the test to demonstrate competence, and to pass the test.