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Relationships Between Healthcare Technology Experience, Acceptance, Attitudes, Self-Efficacy and Readiness in Pre-Licensure Nursing Students

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RELATIONSHIPS BETWEEN HEALTHCARE TECHNOLOGY EXPERIENCE, ACCEPTANCE, ATTITUDES, SELF-EFFICACY AND READINESS IN PRE-LICENSURE NURSING STUDENTS

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Abstract

Introduction Technology is embedded in many aspects of healthcare. This is especially true in nursing, where technology is used daily in charting, medication administration, clinical decision-making, healthcare team communication, and information resource utilization. In nursing programs, students are exposed to healthcare technologies and expected to use them once entering the workforce. Healthcare technologies such as electronic health records (EHR), barcode medication administration, medication dispensing machines, and mobile technologies are critical to adopt to leverage their efficiencies and safety mechanisms to provide the best patient care. Despite evidence indicating the benefits of using healthcare technologies, new graduate nurses enter the workforce unprepared to use them due to a complex interaction of factors, including their acceptance of technology, attitudes toward technology, self-efficacy with using the technology, and experience with using the technology. This study aimed to investigate the factors that influence technology acceptance, attitudes, self-efficacy, and experience on technology readiness in pre-licensure nursing students applying a comprehensive approach. Furthermore, this study investigated the extent to which technology acceptance, attitudes toward technology, and technology self-efficacy mediate the relationship between technology experience and technology readiness.

Methods A convenience sample of final-term pre-licensure nursing students aged 18 years or older enrolled in four Southern Nevada Nursing schools were asked to answer items in an electronic, anonymous survey. Students selected represented those about to graduate and enter the workforce as novice nurses; thus, an understanding of their technology readiness was captured as the study outcomes. The survey consisted of questions from the following instruments and demographic information: Modified Technology Acceptance Model

Questionnaire, Pretest for Attitudes Toward Computers in Healthcare v.3, Technology Self-efficacy Scale, Technology Readiness Index 2.0, modified Technology Experience Questionnaire.

Results To answer the first research question, hierarchical multiple linear regression was used to assess whether attitudes, self-efficacy, and technology acceptance predicted technology readiness while controlling for age and level of education. The significance of the regression results indicated that the variables predict technological readiness collectively, explaining 63% of the variance (F (7,72) = 21.73, p < .001). To answer the second research question, three separate hierarchical multiple linear regressions were carried out to evaluate whether technology experience predicted technology acceptance, self-efficacy, and attitudes and indicated that technology experience significantly predicted both technology acceptance (F (5,80) = 3.18, p = <.001) and attitudes toward technology (F (5,75) = 3.63, p = .005), explaining 13% and 12% of the variances, respectively. For the third research question, three separate mediation analyses were conducted to evaluate if technology acceptance, attitudes towards technology, or self-efficacy, mediated the link between technology experience and technology readiness and revealed that attitudes toward technology and technology acceptance mediated the direct relationship found between technology experience and technology readiness.

Discussion This study demonstrated that technology experience influences pre-licensure nursing students' technology readiness and is further influenced by process of change feelings, such as technology acceptance and attitudes. Nursing schools are responsible for preparing competent nurse graduates to deliver safe care; therefore, it is vital that healthcare technology education is included in nursing education. The results suggest that nursing programs should establish

curricula emphasizing the importance of these tools and invest in training and resources to provide more hands-on experiences.

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Dedication

I would like to dedicate this dissertation to my four sons, Daxton, Alexander, Lincoln, and Zachary Boyce. You were my inspiration to pursue this degree, and I hope the sacrifices you have endured for me are repaid to you with many opportunities for success in your future. I hope through my pursuit of higher education that I have instilled in you that nothing in life is insurmountable.

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Chapter 1: Introduction

Introduction

Technologies are used in healthcare to access, maintain, and communicate information and perform critical patient care tasks to provide safe, quality, and cost-effective care across the healthcare continuum. The ability of these technologies to improve clinical outcomes has led employers to expect new nurse graduates to utilize them effectively and efficiently upon entering the workforce, just as they would any essential clinical skill (Miller et al., 2014; Wolters Kluwer Health, 2020). Even with this expectation, nurse graduates and faculty have reported that healthcare technology education has been lacking or inconsistent while in nursing school, and they feel ill-prepared to utilize many of the technologies without extensive on-the-job training and hands-on experience (Miller et al., 2014; Mollart et al., 2021; Shin et al., 2018). Nursing students' readiness to utilize these technologies and the factors that influence their readiness require further investigation to understand this population's educational needs.

Prelicensure nursing students' experience, acceptance, attitudes, and self-efficacy toward healthcare technology may affect their readiness to learn and use technology in healthcare settings (Anderberg et al., 2019, Fadel et al., 2020; Van Houwelingen et al., 2017). Foundational evidence has shown that several personal and behavioral factors influence technology readiness (Dixon, 1999; Gong & Yan, 2004; Igbaria & Iivari, 1995; Venkatesh & Davis, 1996). A deeper insight of these influencing factors will allow schools to tailor curricula to address them to improve their effective use of the technologies. Future nurses adept at using these technologies will be critical to leverage the efficiencies and safety mechanisms to provide the best patient care.

This chapter examines the topic's background and describes the problem and its significance to nursing. The purpose of the study is then described. In conclusion, the study's research topics and theoretical and operational definitions are given.

Background and Statement of the Problem

Technology is embedded in many aspects of healthcare. This is especially true in nursing, where technology is utilized in daily work through charting, medication administration, clinical decision-making, healthcare team communication, and information resource usage (Eskandari et al., 2019; Pepito & Locsin, 2018; Risling, 2017; Strudwick, 2015). Nursing students are introduced to healthcare technologies in their nursing programs and are expected to utilize them upon entering the workforce (Elewa & El Guindy, 2017; Mollart et al., 2021; Shin et al., 2018). Healthcare technologies such as electronic health records (EHR), barcode medication administration, medication dispensing machines, and mobile technologies are critical to adopt to leverage their efficiencies and safety mechanisms to provide the best patient care (Carayon et al., 2017; Ferrah et al., 2017; Institute of Medicine [IOM], 2012; Raman, 2015; Zheng et al., 2021). However, despite evidence showing the advantages of using healthcare technologies, new graduate nurses are entering the workforce lacking the readiness to use these technologies attributed to a complex interaction of factors such as their acceptance of technology (Habibi-Koolae et al., 2015; Ifinedo, 2016; Rajkovic et al., 2018; Saleh et al., 2016; Strudwick, 2015), their attitudes toward technology (Cho et al., 2021; Fadel et al., 2020; Kemp et al., 2019; Rajkovic et al., 2018; Tubaishat, 2018), their self-efficacy with using the technology (Davis, 1989; Pan, 2020; Roney et al., 2017), and their experience with using technology (Anderberg et al., 2019; Elewa & El Guindy, 2017; Van Houwelingen et al., 2017). A lack of understanding of

the relationships between these factors and their collective influences on the technology readiness of pre-licensure nursing students persists.

Knowledge of the relationships of these factors among nursing students is limited because previous research had an approach of focusing on the concept of technology acceptance and primarily of nurses already working in the profession and after a specific type of healthcare technology, the EHR, was implemented (Alexander & Figlietti, 2017; Chirchur et al., 2021; Nguyen et al., 2017; Rajkovic et al., 2018). Technology readiness in healthcare is different from technology acceptance. It is defined as the tendency of healthcare workers to adopt and effectively use new healthcare technologies to accomplish goals in their workplace (Caison et al., 2008). The nature of not being ready to use healthcare technology includes the inability to navigate technologies for task completion, excessive time utilizing the technologies, lack of information literacy skill development, and inability to leverage the workflow efficiencies they provide (Parasuraman & Colby, 2015). Technology readiness goes beyond the system-specific influences of usefulness and ease of use within technology acceptance because it includes the elements of technology literacy in conjunction with personality traits, including optimism, innovativeness, and confidence (Davis, 1989; Kuo et al., 2013; Parasuraman, 2000). Healthcare technologies have expanded beyond just the EHR, with technologies such as barcode medication administration, medication dispensing machines, and mobile technologies advancing as essential tools in nursing in recent years (Coyne, 2020; Risling, 2017; Zheng et al., 2021). Understanding the relationships of factors that influence nursing students' technology readiness before entering professional practice is essential to prepare new graduate nurses adequately. Furthermore, when nursing students do not realize the benefits of healthcare technologies, they risk developing resistance behaviors as new technologies are introduced in their professional workplace (Cho et

al., 2021). A comprehensive approach that examines the factors of technology acceptance, attitudes, self-efficacy, and experience of pre-licensure nursing students on their healthcare technology readiness from the standpoint of nurses' full range of healthcare technologies is needed to understand their relationships.

Significance of the Problem

Multiple disciplines use healthcare technologies in the workplace, and nurses are one of the key users affected. Nurses represent approximately 58% of healthcare employees and are among the largest technology user groups (U.S. Bureau of Labor Statistics, 2021; Zadvinskis et al., 2018). Understanding the factors influencing nursing students' technology readiness can significantly affect patient safety and improve patient care (Carayon et al., 2017; Howe et al., 2018; IOM, 2012). By utilizing these technologies' efficiencies and safety nets, nursing students will enter the profession, spending more time providing safe and effective patient care (IOM, 2012; Lee & Kim, 2020; Lin, 2017). Additionally, a positive introduction to healthcare technology in nursing school can influence student nurses' feelings of adequacy and readiness when exposed to technology in clinical and career settings (Anderberg et al., 2019; Elewa & El Guindy, 2017).

Nursing schools do not provide consistent and standardized education and training in technologies used in healthcare due to numerous barriers, leaving many novice nurses ill-prepared to transition into clinical practice (Mollart et al., 2021; Strahan, 2017; Wolters Kluwer Health, 2020). According to Mollart et al. (2021), 71.1% of nursing students did not feel prepared to use an EHR, and 98.5% believed they would be more confident using information systems if there had been training opportunities in their prelicensure programs. Even as technology has become a staple in our everyday lives, a deficiency in incorporating healthcare

technology training in nursing curricula remains. Nes et al.'s (2021) scoping review of the literature between 2018-2020 showed that pedagogical models designed to teach technology literacy in nursing programs are lacking. It is further noted that this technology literacy, defined as the ability to develop critical thinking and skills in using, managing, and understanding technology in education and the workplace, is necessary for nursing students to become proficient and competent and thus ready to use healthcare technology (Raman, 2015). This lack of healthcare technology integration into nursing courses affects nursing students' preparedness to use the technologies. When nursing students cannot understand when information is necessary, what type of information is required, and how to organize it effectively, a knowledge gap prevents them from progressing to a level of critical thinking (Anderberg et al., 2019). This can impair their comprehension of how technology works and have a negative effect on patient care (Zheng et al., 2021). The inconsistent approach to technology education in nursing schools must be further examined as a potential precursor to inadequate technology readiness from both a skill and behavioral perspective.

Employers found that new nurse graduates were inadequately prepared to use healthcare technologies upon entering the workplace, and nurse faculty reported that new nurse graduates were not proficient in using the EHR and other technologies in clinical settings (Miller et al., 2014; Shin et al., 2018). In a retrospective report of new nurse graduates' strengths and weaknesses, 76% of respondents comprised of nurse managers, nurse educators, nursing directors, academic faculty, and deans ranked access to healthcare technology as the highest key factor for nurse graduates being more prepared (Wolters Kluwer Health, 2020). Another study aimed at understanding knowledge gaps in healthcare technology skills between new graduate nurses' self-reported skills and nurse managers’ perspectives of their skills identified a mismatch

in reported strengths (Miller et al., 2014). The new graduate nurses noted strengths in healthcare technology knowledge and skills, such as lab and diagnostic results retrieval, accessing EHR content and prior admission data, and care and discharge planning. In contrast, nurse managers described these as areas for improvement. This study suggests that nurses are not well prepared for healthcare technology use while in nursing programs to the extent that they cannot assess needed areas of development. This lack of consistency in incorporating technology in nursing programs results in missed experiences in using healthcare technology in clinical and lab settings. The consequences are missed opportunities to yield the benefits of using healthcare technologies, including personal, quality of care, and organizational benefits.

Lack of technology readiness has implications for decreased job satisfaction and increased turnovers (Boamah et al., 2017; Lin, 2017). Increased workload, diminished resources, and cost challenges are among the many stressors experienced by nurses in their work environments (Armmer, 2017; Steege & Rainbow, 2017). Novice nurses unhappy in the profession leave within the first year after graduation (Lockhart, 2020). Nationally, the average nurse turnover rate is 19.1 percent and is expected to increase, resulting in an 8% nursing vacancy rate. For 2022, the healthcare labor market will continue to grow, with 37.4% of hospitals polled predicting a labor force growth (Nursing Solutions Inc., 2022). This is, however, a decrease of 16% from prior forecasts, which may represent the uncertainty induced by COVID. Hospital turnover climbed by 1.7% over the last year to 19.5% (Nursing Solutions Inc., 2022). Nurse turnover is especially expensive at $40,038 per bedside Registered Nurse and ranges from $28,400 to $51,700 resulting in the average hospital losing $5.1m annually (Nursing Solutions Inc., 2022).

This research is essential to the discipline of nursing in three significant ways: (a) the research focus addresses the need to better prepare nursing students to utilize healthcare technologies in their professional practice; (b) the findings may advance knowledge of the factors that influence technology readiness of pre-licensure nursing students; and (c) the findings may impact changes in nursing school education to address the influencing factors in this study better and provide for meaningful opportunities to use healthcare technologies while in nursing school.

Purpose of the Study

The purpose of this study was to examine the effects of technology acceptance, attitudes, self-efficacy, and experience on technology readiness in pre-licensure nursing students. The findings of this study will increase our understanding of the factors that determine the technology readiness of pre-licensure nursing students and may expand nursing education efforts to address nursing students' acceptance, attitudes, self-efficacy, and experiences with healthcare technology while in nursing school. It is posited that technology acceptance, positive attitudes toward technology, self-efficacy, and increased experiences with technologies will all contribute significantly to nursing students' technology readiness. However, the degree to which they impact readiness must be better understood. Understanding nursing students' feelings and confidence with healthcare technology is critical because it enables the identification of barriers and gaps that can be used to generate strategies for improving training and access to technology while in nursing school to enhance safe nursing care.

Research Questions

The following research questions and hypotheses will guide this study:

1. What are the effects of pre-licensure nursing students' technology acceptance, attitudes toward technology, and self-efficacy on their healthcare technology readiness?

   H_1: Pre-licensure nursing student technology acceptance, attitudes, and self-efficacy will have effects on healthcare technology readiness.

2. What effect does technology experience have on technology acceptance, attitudes, and self-efficacy in pre-licensure nursing students?

   H_2: Technology experience will have an effect on technology acceptance, attitudes, and self-efficacy after controlling for age and education.

3. To what extent do technology acceptance, attitudes toward technology, and self-efficacy mediate the relationship between technology experience and technology readiness?

   H_3: Technology acceptance, attitudes toward technology, and self-efficacy mediate the relationship between technology experience and technology readiness.

The research questions were developed in alignment with the aims of this study, which are to determine the effects of the process of change feelings, such as acceptance, attitudes, and self-efficacy towards technology, and the effects of personal factors, such as technology experience, on student nurses' readiness to use technology. Research question one takes into account the behavioral side of technology readiness, where acceptance, attitudes, and self-efficacy represent feelings and beliefs that can fluctuate given their context, in this case, technology use. Furthermore, the level of technology experience one possesses has shown to be

an influencing factor in technology use behaviors; however, the amount of experience that makes a difference in acceptance, attitudes, and self-efficiency remains unknown (Bandura, 1977; Czaja et al., 2006b; Davis, 1989). Therefore, research question two will address the influence of technology experience on technology acceptance, attitudes, and self-efficacy. The purpose of the second research question was to understand what level of technology experience pre-licensure nursing students possess and how that influences their technology acceptance, attitudes, and self-efficacy, thus indirectly influencing technology readiness. Technology experience is examined separately from research question one because the experience alone has little influence on technology readiness without developing behaviors and beliefs (Davis, 1989; Fishbein & Ajzen, 1975). Consistent with the theorized link between experience and process of change feelings, technology acceptance, attitudes, and self-efficacy are hypothesized to mediate the relationship between technology experience and the outcome variable, technology readiness; thus, this is addressed in the third research question.

Knowing the effects of technology experience on acceptance, attitudes, and self-efficacy will inform what needs to be addressed in future curricula. For instance, if significant technology experience impacts all three factors positively, then opportunities for hands-on experiences using healthcare technologies in the learning environment should be available. Additionally, if the three factors have a positive effect on technology readiness, then curricula would be developed highlighting the ease of use and usefulness of technology (acceptance), developing positive attitudes toward technology and welcoming change (attitudes), and building confidence in use (self-efficacy).

Definitions

The theoretical definitions of the following concepts are followed by their operational definitions. The definitions were derived from recent literature.

Attitude toward technology is an individual's positive or negative evaluation of the introduction of technology (Kaminski, 2013). Attitudes toward technology will be operationalized in this study by the Pretest for Attitudes Toward Computers in Healthcare Assessment Scale (PATCH) v. 3 (Kaminski, 2013).

Healthcare technologies are the technologies used in healthcare settings by nurses, including electronic health records (EHR), computerized order entry systems, barcode medication administration, medication dispensing machines, and mobile technologies such as smartphones and wearable communication devices.

New graduate nurse/Novice nurse is an individual who has completed the required academic nursing courses and clinical training and has worked in the profession for less than one year.

Nursing informatics is a nursing specialty and is defined as the "integration of data, information, and knowledge to support patients, nurses, and other providers in their decision-making in all roles and settings. This support is accomplished through the use of information structures, information processes, and information technology" (Staggers & Thompson, 2002, p. 260).

Self-efficacy is defined in the context of technology usage as a user's belief in their capacity to carry out a course of action to accomplish a desired goal. Self-efficacy will be operationalized in this study by the Technology Self-Efficacy Scale (Kass, 2014).

Technology acceptance is an individual's perception that technology is useful and easy to use, and thus they are interested in using it (Davis, 1989). Technology acceptance will be

operationalized in this study by the modified Technology Acceptance Model (TAM) questionnaire (Lah et al., 2020). The modification by Lah et al. (2020) allows respondents to rate the strength of agreement with items regarding actual user experience rather than the likelihood of future use.

Technology experience is the cumulative experience of using various technologies, including personal, workplace, and healthcare-related technologies. Healthcare technology experience will be operationalized in this study by a modified version of the Technology and Computer Experience Questionnaire (Czaja et al., 2006a).

Technology literacy is the ability to develop critical thinking and skills in using, managing, and understanding technology in education and the workplace. Technology literacy is a skills-focused sub-component of technology readiness.

Technology readiness in healthcare is defined as the tendency of healthcare workers to adopt and effectively use new technologies to accomplish workplace goals. Technology readiness will be operationalized in this study by the Technology Readiness Index (TRI) 2.0.

Chapter Summary

Understanding nursing students' technology readiness is crucial because it has implications for their intention to use technologies after entering the profession (Strudwick, 2015). Technology readiness of nursing students is essential because lacking readiness has implications for decreased job satisfaction and increased nursing staff turnover (Lee & Kim, 2020). The factors influencing the technology readiness of nursing students must be thoroughly explored to avoid adverse outcomes. The benefits of technology readiness for new graduate nurses are profound; however, our understanding of how these factors interact to influence their readiness to use the technologies is limited. With a research-based strategy to address the needs

of the students, the nursing curriculum can be updated to be more congruent with the technology-laden healthcare environment.

Chapter 2: Review of the Literature

Introduction

This chapter presents the study's literature review and theoretical framework. The literature review is comprised of published studies and professional guidelines related to technology readiness to distinguish relationships and gaps. This review utilized citations from medicine, nursing, informatics, and information technology. Key search terms of "healthcare technology readiness," "technology readiness," "nursing technology readiness," and "health information technology preparation" were used using Boolean operators as necessary. An online search was conducted utilizing these terms in the following databases: Cumulated Index for Nursing and Allied Health (CINAHL), Academic Search Premier, ProQuest, Medline, and PubMed. The search inclusion criteria included peer-reviewed articles and empirical research in full text that included topics related to technology readiness and end-user adoption, acceptance, attitudes, and self-efficacy. End users included clinicians and providers, including nursing, nursing students, physicians, and allied health. Exclusion criteria for the search included articles unrelated to healthcare or focused on patients' use of technology.

Barriers and Challenges

Among healthcare professionals, novice nurses lack the healthcare technology competencies expected of them on the job due to inconsistencies in training while in nursing school despite robust evidence for improving proficiency, adoption, improved clinical outcomes, including quality and safe patient care, and job satisfaction (Boamah et al., 2017; Carayon et al., 2017; Lin, 2017; Strahan, 2017; Strudwick, 2015). The cause of the lack of technology readiness is from many barriers, including faculty discomfort with healthcare technologies, faculty not viewing technology literacy as a clinical skill, and funding limitations (Elewa & El Guindy,

2017, Kleib & Nagle, 2018; Net et al., 2021; Roney et al., 2017). Nurse managers, nurse educators, nursing directors, academic faculty, and deans ranked access to healthcare technology as the highest key factor for nurse graduates being more prepared (Wolters Kluwer Health, 2020). Nurse faculty reported that new nurse graduates were not proficient in using the EHR and other technologies in clinical settings (Miller et al., 2014; Shin et al., 2018). Nursing students self-reported inadequate preparation in using healthcare technologies (Mollart et al., 2021).

Nursing students require skills and expertise to properly utilize healthcare technology, which they may acquire through training in both classroom and clinical settings (Strahan, 2017). According to Kass (2014), prelicensure nursing students regard themselves as weak in applied technological abilities due to a lack of training opportunities in classroom, clinical, and lab settings. According to Elewa & El Guindy (2017), further resources and instruction are needed to assist nurses in developing some fundamental healthcare technology skills. They found that educators are the foundation of this initiative and must begin incorporating these systems and technology into the classroom to educate graduate and undergraduate students about healthcare technology. Critical competencies will not be established without opportunities for nursing students to practice clinical skills using healthcare technologies. Students must be able to display psychomotor abilities while also honing their communication and clinical judgment abilities. The lack of technology training in conjunction with the lack of technology practice impacts the students' readiness to utilize it once they enter professional practice as new graduate nurses (Mollart et al., 2021). A nursing curriculum that includes healthcare technology skills can better educate nursing students who will eventually use these technologies throughout their clinical rotations and when they enter the workforce as new graduate nurses. However, due to numerous

factors, technology training offerings in nursing schools are inconsistent when present or completely lacking (Mollart et al., 2021; Strahan, 2017; Wolters Kluwer Health, 2020).

Curriculum Initiatives

Informatics includes the application of information and technology to facilitate communication, knowledge management, error mitigation, and decision support. It emphasizes the importance of appreciating technologies that assist clinicians in making clinical decisions, preventing errors, and coordinating care. The Quality and Safety Education for Nurses Institute [QSEN] (2020) established nursing informatics as a pre-licensure program competency for providing quality and safe care. The competency includes using healthcare technologies in conjunction with information literacy skills in communicating, planning, and delivering patient care.

The Technology Informatics Guiding Educational Reform (TIGER) Informatics Competencies Collaborative advised that all nurses and nursing students exhibit proficiency and literacy in fundamental computer skills and information management (TIGER, 2010). TIGER competencies include this pedagogical method of teaching nursing informatics in pre-licensure programs (TIGER, 2010). TIGER requirements for graduating nursing student competencies include 1. Determine the nature and scope of the information required 2. Obtain necessary information efficiently and effectively 3. Analyze all health information critically to determine what information is pertinent and of value 4. Individually or as part of a group, use information technology effectively to complete a task-specific goal 5. Evaluate the result of the application of the health information. Informatics education includes applying digital technology to transform data and information into knowledge. This strong emphasis on using human-technology interaction enables users to interact with technology to effectively apply health information in

practice. Students must have hands-on experience with these technologies to learn. Future nurses will develop competence and proficiency in informatics if they have hands-on access to new and developing technologies and are trained using current technology, such as an EHR (Wolters Kluwer Health, 2020). Other studies have demonstrated that those with a higher level of education in a given field are more capable of learning and continuing to learn from experience (Kleib & Nagle, 2018; Kinnunen et al., 2019).

Despite these initiatives to bring quality informatics into the nursing curriculum, nursing students have reported that they received informatics instruction from faculty who are not knowledgeable about healthcare information technology (Forman et al., 2020). The sentiment among educators is that informatics is not a clinical skill (Kleib & Nagle, 2018). Barriers to incorporating technology in the curriculum include faculty discomfort with healthcare technologies, funding limitations, and the amount and variety of technologies that would need to be included in the curriculum (Elewa & El Guindy, 2017; Roney et al., 2017). This lack of acknowledgment of the importance of technology education in nursing programs leaves nursing students unprepared to utilize technology in their clinical rotations and when they enter the workforce.

Benefits of Technology

The benefits of being ready to use healthcare technology are apparent when nursing students recognize its usefulness in their work; thus, technology adoption is increased, and patient-safety benefits and efficiencies are leveraged (Habibi-Koolaee et al., 2015; Ifinedo, 2016; Kemp et al., 2019). Lack of readiness leads to negative attitudes toward technology and avoidance behaviors (Nes et al., 2021). Healthcare technologies' quality and patient safety functions include incorporating standard nursing terminology, supporting clinical documentation,

supporting standard protocols, communicating with clarity, notifying critical results, and supporting drug interaction checking and dispensing discrepancies (IOM, 2012). The Institute of Medicine (2012) recommended using various healthcare technologies to streamline nurses' workflows and suggested that these systems were critical components in improving patient safety. When used correctly and often, healthcare technologies can benefit patient care practices by providing workflow efficiencies, safety nets, and clinical decision support. Accurate medication and allergy lists are one example that can provide clinical decision support and initiate warnings in the system when entered and utilized to their fullest potential. Accurate medication and allergy lists are one example that, when entered and utilized to their fullest potential, can provide clinical decision support and initiate warnings in the system. Medication errors account for between 16 and 27% of all errors, and up to 4% cause patient harm (Carayon et al., 2017; Ferrah et al., 2017). Nurses can efficiently check the five medication administration rights by utilizing barcode medication administration (BCMA) systems within the EHR. Medication errors have been significantly reduced when BCMA is used (Zheng et al., 2021). The BCMA technology is just one of many functions of healthcare technologies that address patient safety concerns and provide nursing with an efficient means of completing their work.

Many studies have recognized the importance of technology adoption among healthcare professionals to leverage these benefits (Carayon et al., 2017; Van der Veen et al., 2018; Zheng et al., 2021). As a result of the lack of readiness, student nurses graduate and enter their first jobs learning several new technology systems while balancing perfecting other nursing skills (Lee & Kim, 2020; Ten Hoeve et al., 2018). In applications of cognitive load theory, novice nurses' initial professional experiences are met with confusion and stress when subjected to psychomotor and cognitive demands (Sewell et al., 2019). Frustrations that develop due to a lack of

technology readiness lead to workarounds, which affect patient safety as the technologies are misused (Alquwez et al., 2019; Strudwick, 2015; Van der Veen et al., 2018).

Technology readiness of nursing students is beneficial because lacking readiness has implications for decreased job satisfaction and increased turnovers once they enter the workforce (Boamah et al., 2017; Lin, 2017). Lee & Kim (2020) found that stressors within the contemporary healthcare environment, including technology advancements, have been linked to the frustrations of novice nurses and their intentions to leave the profession. Within the first year after graduation, 18% of newly graduated nurses will change jobs or careers (Lockhart, 2020). Within two years, an additional one-third of staff leave. Nurse retention is essential to the hospital industry because a significant nursing shortage is predicted (U.S. Bureau of Labor Statistics, 2021). According to the American Nurses Association (ANA), registered nurses will have the most employment opportunities in the United States through 2022 (Haddad et al., 2022). The U.S. Bureau of Labor Statistics (2021) forecasts that more than 275,000 extra nurses will be required from 2020 through 2030. From 2016 to 2026, employment prospects for nurses are anticipated to increase at a greater pace (9%) than for all other professions. The technology readiness of nursing students is an area that must be thoroughly explored to avoid these potential adverse outcomes.

Factors Influencing Nursing Students' Technology Readiness

Several factors influence nursing students' healthcare technology readiness, such as their acceptance of technology (Habibi-Koolae et al., 2015; Ifinedo, 2016; Rajkovic et al., 2018; Saleh et al., 2016; Strudwick, 2015), their attitudes toward technology (Cho et al., 2021; Fadel et al., 2020; Kemp et al., 2019; Rajkovic et al., 2018; Tubaishat, 2018), their self-efficacy with using the technology (Davis, 1989; Pan, 2020; Roney et al., 2017), and their experience using

healthcare technology while in the nursing program (Anderberg et al., 2019; Elewa & El Guindy, 2017; Van Houwelingen et al., 2017). However, previous studies investigated these factors in isolation, and there is a lack of understanding of how they work collectively to influence technology readiness.

Technology readiness is often described in relation to end-user technology acceptance (Kemp et al., 2019; Rajkovic et al., 2018; Saleh et al., 2016). However, the aforementioned studies did not consider the user's characteristics to affect their willingness to use technology. There was a focus on system-related dimensions of exposure to the technologies, usefulness, and ease of use. Lin et al.'s (2007) foundational work extended Davis's (1989) system factors of technology acceptance to include personal differences as distinguished in the Technology Readiness Index (TRI). The discoveries suggest that personality factors, system-specific aspects, and experiences play a significant role when embracing new technologies and must be further investigated.

User attitudes toward healthcare technologies significantly influence their perception and intention to use the system (Fadel et al., 2020). Initial opposition toward newly introduced electronic systems can lead to implementation failure or unintentional misuse of the system (Ifinedo, 2016). When resistance is present, a self-reinforcing loop of increasing resistance follows (Cho et al., 2021). Tubaishat's (2018) research on technology literacy found that rather than seeing technology as a means to provide more efficiencies, clinicians saw it as a barrier to their clinical workflows, which resulted in low utilization. Nurses with good computer literacy and adequate skills in general documentation tasks in an EHR were likelier to have positive attitudes toward computer use (Howe et al., 2018; Rajkovic et al., 2018). This correlation supports the likelihood that a positive experience will lead to positive attitudes toward

technology. While these results are beneficial in predicting readiness, they fail to consider other correlating factors, such as whether the user believes the technology is useful and easy to use (acceptance) and whether they feel confident in using the new technology (self-efficacy).

Self-efficacy is defined in technology usage as a user's belief in their capacity to carry out a course of action to accomplish a desired goal (Bandura, 1977; Saied, 2017). Bandura stressed that a person's belief in themselves varies across domains and that any measure of self-efficacy should be domain-specific rather than generalized. A study on interface design for nursing students' medication calculation mobile software, based on cognitive load theory, significantly improved their self-efficacy (McMullan, 2018). It is critical to have this confidence when confronted with technology that is unfamiliar and many advanced features, while balancing other cognitive demands while providing patient care such as clinical decision making. Positive experiences using technology can promote self-efficacy, making users more apt to utilize them to their fullest potential.

The importance of technology self-efficacy is recognized in academia, with several studies addressing technology competence as an essential skill of nursing faculty for teaching tools (Forman et al., 2020; Nes et al., 2021, Roney et al., 2017). Despite this expectation, faculty still struggle to incorporate innovative technology in their teaching (Shin et al., 2018; Roney et al., 2017). This feeling of inadequacy is also extended to a lack of healthcare-related technology use in clinical and lab settings as their feelings of inadequacy persist. Studies regarding self-efficacy among nursing students have primarily focused on using simulation-based technologies in nursing programs and their relation to teaching methods and learning objectives (Al Gharibi et al., 2021; Holland et al., 2017; Saied, 2017). Few studies investigated nursing students' self-efficacy with using healthcare technologies commonly used in nurses' professional practice.

Demographics of age and education level have been researched as antecedents of technology readiness. Age has been found to be negatively associated with technology readiness among healthcare workers, meaning that younger users adopt technology more readily (Kleib & Nagle, 2018; MacNevin et al., 2021); however, in Ifinedo's (2016) study of nurses' perceived usefulness of information systems, their formation of poor attitudes toward technology was not influenced by age. Education level is positively associated with technology readiness (Ifinedo, 2016; Kinnunen et al., 2019). Higher education attainment may imply more opportunities to use technologies in learning settings. The significance of these findings requires further exploration because all ages and education levels are becoming more familiar with technology in recent years.

Gaps in the Literature

A review of the literature found studies have investigated technology readiness from the standpoint of an experimental, interventional approach, including professional nurses, and after a specific type of healthcare technology, usually an EHR, was implemented (Alexander & Figlietti, 2017; Chirchur et al., 2021; Nguyen et al., 2017; Rajkovic et al., 2018). The interventions focused more on skills attainment rather than an approach to understanding the existing state of nurses' feelings and behaviors towards technologies in the current technology-laden landscape. This approach assumes that deficits exist without understanding the magnitude in which they occur.

Dixon's (1999) foundational work emphasizes the need to pay close attention to the behavioral side of technology. The behavioral side of technology includes understanding the users' needs and perceptions of the system. Although Dixon (1999) does not offer empirical evidence, the author provides historical literature as proof of the need to understand the human

side of information technology. The focus on technology acceptance as an outcome of an intervention does not consider actual readiness to use the system, which is different from acceptance. According to Fishbein and Ajzen (1975), readiness is a mental state or attitude associated with predispositions toward novel situations or innovations. Prior experiences influence acceptance and lead to the utilization of technology advancements. They emphasized the critical role of experiences in developing attitudes, belief systems, knowledge, and intention. Technology readiness goes beyond system-specific dimensions of acceptance and includes the perception of the technology, its value, the user's accumulated experience, and their "knowledge personality tendency" (Parasuraman & Colby, 2015).

Many studies of nursing students and technology use primarily focused on EHR acceptance and did not include the entire range of technologies nurses heavily interact with within their daily work (Howe et al., 2018; Nguyen et al., 2017; Rajkovic et al., 2018). Researchers have examined outcomes of students' perceptions through the use of the Academic EHR (AEHR), which is an adapted version of an EHR for use in learning settings; however, this approach does not consider other technologies (Baxter & Andrew, 2018; Chung & Cho, 2017; Keib et al., 2021). Despite this approach, nursing students reported that AEHR use for nursing documentation was insufficient (Chung & Cho, 2017; Kleib et al., 2021). The limited scope does not reflect the healthcare technology readiness of barcode medication administration, medication dispensing machines, and mobile technologies. Expanding the scope is essential as nurses work with a variety of technologies in their daily work outside of the EHR, and recent advances in technology have shifted toward mobile solutions (Cascio & Montealegre, 2016; Coyne, 2020; Eskandari et al., 2019; Pepito & Locsin, 2018; Raman, 2015; Risling, 2017).

Pharmacy and medical students' readiness for technology were studied heavily (Alizadeh & Ebrahimi, 2019; Jacobs et al., 2017; Jacobs et al., 2019; Karaca et al., 2021; MacNevin et al., 2021). Minimal research included nursing students as the focus of concern for the vast array of technologies used in practice from a comprehensive perspective. Most studies addressing the healthcare technology readiness of nursing students were conducted before 2014 (Caison et al., 2008; Kuo et al., 2013). More recent research with technology as the area of focus is critical to continually address as functionality has advanced significantly over the past few years, and technology systems used in healthcare have become more sophisticated (Cascio & Montealegre, 2016; Coyne, 2020; Eskandari et al., 2019; Pepito & Locsin, 2018; Risling, 2017). Additionally, several studies investigated nursing students' readiness to utilize educational technologies such as e-learning and virtual simulation modalities; however, these did not address technologies in regard to the tools that are used in clinical practice to take care of patients (Buabeng-Andoh, 2018; Coopasami et al., 2017; Li et al., 2018).

While researchers have investigated self-efficacy and technology use in healthcare, with the evolving technological advancements, previous and existing research on technology self-efficacy will become obsolete. The ubiquity of software environments, advancements in graphical user interfaces, and the proliferation of smart technology have rendered a large body of previous technology self-efficacy outdated (Cascio & Montealegre, 2016; Risling, 2017). With the advent of technological advancements, many innovative functionalities formerly associated with specific programs became standardized and accessible to most users. Computer training and usage are connected with an enhanced belief in the efficacy of computer use, which may lead to an increased drive to utilize technology. Self-efficacy has been considered the most helpful person-dimension for identifying the outcomes influenced by technology in the setting of

continual technological development (Pan, 2020). Bandura (1977) proposed that an appropriate measure of self-efficacy should be field-specific and assess skills across various scenarios with varying degrees of complexity within the domain. The importance of establishing self-efficacy in technology use is evident. The lack of attention to nursing students' self-efficacy with technology as patient care and communication tools in clinical practice and the need to address self-efficacy in relation to more modern technologies is essential. Self-efficacy is an essential antecedent of intention to use because voluntary use is associated with clinicians' perceived ability to successfully use healthcare technology (Tsai et al., 2019). As self-efficacy increases, intention and actual use may also increase, further motivating nurses to take advantage of technology's benefits.

In conclusion, new research in technology readiness is needed. The literature shows that the readiness of pre-licensure nursing students is beneficial and relevant because of the benefits of adoption behaviors, preparation to enter the workforce, improvement in clinical outcomes, and nurse job satisfaction and retention. Technology use has become ingrained in many aspects of nursing students' personal lives through computers and mobile technologies such as iPads, smartwatches, and smartphones. This everyday use may influence their stance on technology negatively or positively. Additionally, the technologies used in healthcare have expanded far beyond just the computer and EHR (Cascio & Montealegre, 2016; Coyne, 2020; Eskandari et al., 2019; Pepito & Locsin, 2018; Risling, 2017). Therefore, it is crucial to have a pulse on current technology acceptance, attitudes, and self-efficacy patterns to better address this in the curriculum. The study was needed because it took a comprehensive approach that examines the acceptance, attitudes, self-efficacy, and experience of pre-licensure nursing students on their healthcare technology readiness from the full array of healthcare technologies.

Theoretical Framework

The readiness to use technology is derived from several fields of study, including sociology, psychology, and information systems. This study aims to determine the effects of the process of change feelings, e.g., acceptance, attitudes, and self-efficacy towards technology, and personal factors, such as technology experience, on student nurses' readiness to use technology. To achieve these objectives, the theoretical underpinnings that guide this study are Davis's (1989) Technology Acceptance Model (TAM) and Bandura's (1977) Social Cognitive Theory (SCT).

Davis's (1989) TAM explains technology usage behaviors. In alignment with TAM, this study will examine the factors of technology acceptance, attitudes, and self-efficacy for their influence on technology readiness. The concepts are not personality traits but situation-specific constructs that foster behavioral change. TAM aims to explain, predict, and identify the key determinants of technology acceptance (Davis et al., 1989). Davis (1989) highlighted two determinants: (a) "perceived usefulness," defined as when people think that technology will help them accomplish their jobs more effectively, and (b) "perceived ease of use," defined as the degree to which people believe that a particular technology is intuitive to use. TAM assumes that when someone establishes a goal, they will be unrestricted in their execution. The model indicates that when users experience new technology, their perceptions of its utility and simplicity will influence their decisions about how and when to utilize it. With a realization of usefulness and ease of use, users will appreciate the technology through increased attitudes toward technology and an inclination to accept it.

TAM is grounded in Fishbein and Ajzen’s Theory of Reasoned Action (TRA) and is one of the most widely applied theories used to explain technology acceptance (Kemp et al., 2019;

Kowitlawakul et al., 2015; Lin, 2017; Strudwick, 2015; Tubaishat, 2018). According to Fishbein and Ajzen (1975), readiness is a mental state or attitude associated with predispositions toward novel situations or innovations. Prior experiences influence acceptance and lead to the utilization of technology advancements; thus, this study will examine technology experience while in the nursing program to understand its relationship to acceptance, attitudes, and self-efficacy. They emphasized the critical role of experiences in developing attitudes, belief systems, knowledge, and intention. Beyond system-specific dimensions of acceptance, technology readiness includes the perception of the technology, its value, the user's acquired experience, and their "knowledge personality tendency" (Parasuraman & Colby, 2015). Fishbein and Ajzen's (1975) TRA emphasizes behavioral intentions and propensity towards technology use, while Davis' TAM extends this theory to include system factors such as the utility of systems and ease of use. Davis (1989) expanded Fishbein and Ajzen's theory of reasoned behavior by employing established measuring scales to determine the factors that influence user adoption of technology from an information systems perspective rather than strictly a behavioral science one. TAM provides a theoretical framework to explain, predict, and identify factors on internal beliefs, attitudes, and intentions of technology end-users. Davis's (1989) notion of perceived usefulness and ease of use was another method of attitude analysis. Davis (1989) discovered that people prioritize utility over ease of use. In other words, if individuals saw technology as beneficial to their job, they were more receptive to adopting it, even if it was difficult to use.

Davis (1989) stressed the importance of self-efficacy in influencing users' behaviors even though it was not a formal concept in the model. Dixon (1999), Gong and Yan (2004), Igbaria and Iivari (1995), and Venkatesh and Davis (1996) support the effect of technology self-efficacy on feelings of readiness to use technology as well as actual usage patterns. When users felt they

had sufficient skill to execute tasks utilizing technology, they also believed technology was beneficial and enhanced their effectiveness and work performance. Additionally, users thought technology was easy to use when they believed it aided them in performing their jobs well.

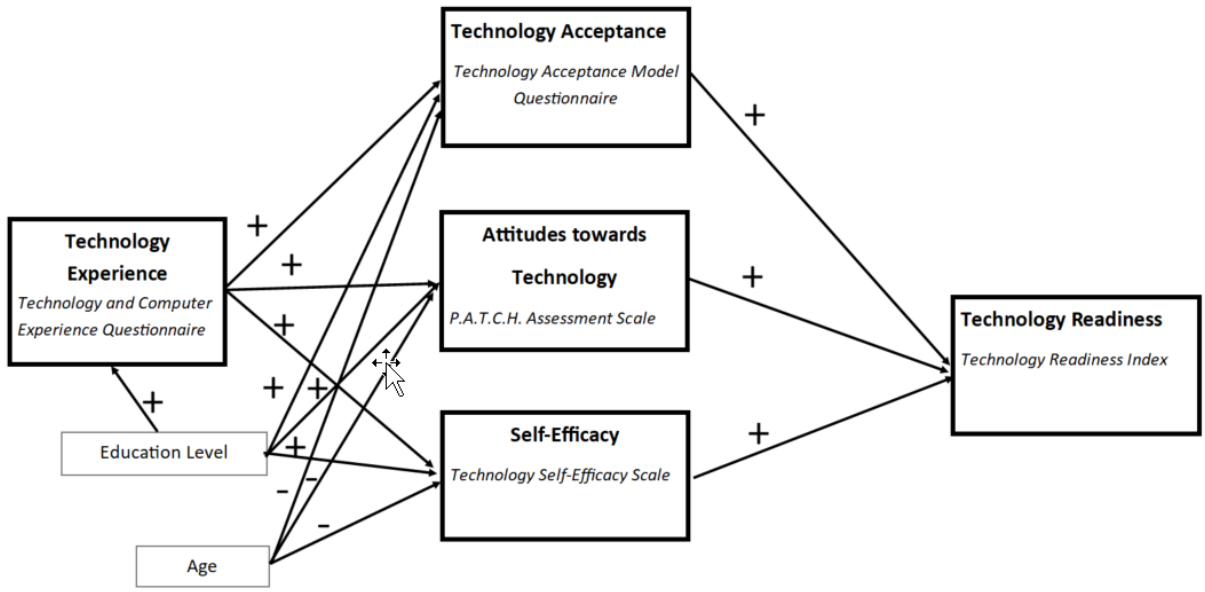
To further extend the concept of self-efficacy with technology readiness, Bandura's (1977) SCT also informs this study. Self-efficacy is not formally included in TAM but in studies that have extended the TAM theoretical framework as an external factor. Additionally, TAM considers that the primary variables in their models have only unidirectional causal linkages. In contrast, SCT posits that environmental circumstances, personal factors, and behaviors are all determined reciprocally (Bandura, 1977).

In alignment with SCT, personal factors in this study include the user's technology experience. Bandura (1977) emphasized *mastery experience* as a source of self-efficacy; Venkatesh and Davis (2000) reported that users' experience influenced the relationship between TAM behavioral components and intentions. SCT emphasizes the critical role of experiences in developing attitudes, belief systems, knowledge, and intention; thus, this study will examine technology experience to understand its relationship to acceptance, attitudes, and self-efficacy (Bandura, 1977). This study will examine technology experience from the perspective of cumulative experiences, including healthcare and other technologies utilized in personal and work environments. This approach is warranted because technology permeates almost every aspect of our lives. However, because technology continually advances, an overall experience baseline is captured to avoid assumptions of similar experiences (Davis, 1989; Hornbaek & Hertzum, 2017; Mlekus et al., 2020). Additionally, education level is a covariant in this study with a distinct theoretical linkage to technology experience and is represented in the study model

(Ifinedo, 2016; Kinnunen et al., 2019). Figure 1 presents a model of the study's concepts and their proposed interrelationships.

Figure 1

Technology Readiness Conceptual Model



Note. "+" indicates a positive relationship (i.e., increase in technology acceptance is associated with increased technology readiness). "-" indicates a negative relationship (i.e., increase in age is associated with a decrease in technology acceptance).

Chapter Summary

In conclusion, this review of the literature supports the benefits of technology readiness, the factors that influence technology readiness, as well as the gaps in knowledge related to the technology readiness of nursing students. Limitations in the studies related to healthcare technology readiness included (a) focus on EHR acceptance as opposed to the multitude of

healthcare technologies that nurses use daily, (b) gaps in investigating the behavioral side of technology readiness, (c) limited focus on variations of technology experience, and (d) several studies focusing on pharmacy and medical students' technology readiness with few nursing students as the population of interest. This study will take a more comprehensive approach to determine the influence of multiple predictive factors while also determining the extent of influence of mediating factors between technology experiences and technology readiness. The goal as a result of this innovative study is to provide evidence to advance knowledge of the factors that influence the technology readiness of pre-licensure nursing students, to make adjustments in nursing school education to allow for meaningful opportunities to use healthcare technologies and to adequately prepare nursing students to utilize healthcare technologies in their professional practice.

Chapter 3: Methodology

Introduction

This chapter describes the study's research methodology, including (a) research purpose and design, (b) sample and setting, (c) inclusion and exclusion criteria, (d) instrumentation, (e) data collection methods, (f) data analysis procedures, and (g) a conclusion.

Research Purpose and Design

The specific purpose of this study was to investigate the factors that influence technology acceptance, attitudes, self-efficacy, and experience on technology readiness in pre-licensure nursing students applying a comprehensive approach. This study examined the effects of (a) nursing student demographics; (b) nursing student personal factors (technology experience); (c) and nursing student process of change feelings (technology acceptance, attitudes toward technology, and technology self-efficacy) on student nurses' readiness to use technology. Additionally, this study examined the extent to which technology acceptance, attitudes toward technology, and technology self-efficacy mediate the relationship between technology experience and technology readiness.

This study used a descriptive, cross-sectional design. This type of design is appropriate due to the nature of the study's aims which are to describe the current state of the variables without manipulation. This study collected data from participants' subjective perceptions of their technology experience in the nursing program and their feelings towards healthcare technology use. Observations of nursing students' use of technology while in nursing school, when used, are not feasible due to varied environments of use, including clinical, lab, and classroom settings. Technology use is especially varied in clinical settings, where hospitals are not standard in providing access to their systems, and clinical faculty are inconsistent in incorporating

technology into the learning setting (Elewa & El Guindy, 2017; Forman et al., 2020; Kleib & Nagle, 2018; Roney et al., 2017). Additionally, the number of technologies used in these multiple settings is vast, thus, making the measurements of technology experiences complex and unpredictable. Self-report bias was a risk in this study; however, it yielded comprehensive data.

Sample

A convenience sample of final-term pre-licensure nursing students aged 18 years or older enrolled in four Southern Nevada Nursing schools was asked to answer items in an anonymous electronic survey. The students represent those in the last term of their final year of nursing school to capture participants with ample opportunities to experience healthcare technology.

Inclusion and Exclusion Criteria

The study inclusion criteria were participants who were:

1. Age 18 years or older;
2. Were currently enrolled in the pre-licensure Bachelor of Science in Nursing (BSN) program at the school of study;
3. Were currently enrolled in the last term of their final year of the accelerated BSN nursing program.

The study exclusion criteria included students who currently work as Licensed Practical Nurses (LPN) and use healthcare technology in their work settings; such students answered screening questions at the beginning of the survey to stop their participation.

Sample Size

For hypothesis one, a power analysis was conducted for multiple linear regression using G*Power software with three predictor variables and an estimated effect size of $f^2 = 0.18$ (Myers, 2010). A minimum of N = 65 is needed to achieve 0.8 power at 0.05 alpha level (see Appendix A). For hypothesis two, a similar power analysis showed that with an estimated effect size $f^2 = .31$ (Ruckdeschel, 2018), N = 63 would yield at least 0.96 power with one predictor variable and two covariates at 0.05 alpha level (see Appendix B). For hypothesis three, the power analysis showed that with an estimated effect size $f^2 = 0.18$ (Myers, 2010), N = 83 would yield at least 0.8 power at 0.05 alpha level (see Appendix C). Therefore, the target sample size for this study is 83.

Study Variables and Measurements

This study contained multiple independent and dependent variables depending on the research question addressed. Using the theories and outcomes of the review of the literature, factors that influence technology readiness were identified as key variables across multiple studies: (a) technology acceptance; (b) attitudes toward technology; (c) technology self-efficacy; (d) technology experience; and; (e) technology readiness.

Age and Education

Age and education level will be captured from a demographic questionnaire. Age is a continuous variable measured in years. Education level is a dichotomous variable capturing the highest education attained prior to entering nursing school, high school, or post-secondary degree.

Technology Acceptance

Technology acceptance was measured using the 12-item modified TAM Questionnaire, with a 7-point Likert scale, 1= strongly disagree, 7 = strongly agree, score range of 7-98 (Lah et

al., 2020). TAM is computed by a sum of the responses, with higher numbers indicating stronger technology acceptance. Cronbach's α coefficient of the modified TAM is 0.95. "Using this healthcare technology improves my job performance" (perceived usefulness) and "I have found healthcare technologies easy to use" (perceived ease of use) are representative questions on the TAM.

Attitudes Toward Technology

The 50-item Pretest for Attitudes Toward Computers in Healthcare (PATCH.) Assessment Scale v. 3 assessed the students' attitudes and used a 5-point Likert scale, 1 = agree strongly and 5 = disagree strongly, score range of 0-100 (Kaminski, 2013). A scoring tool applies weighted scores to the statements and summed higher numbers indicating more positive attitudes toward healthcare technologies. The PATCH has a Cronbach α score of 0.92 and an internal consistency score of 0.85. "I related well to technology and machines" is a representative question on the PATCH.

Technology Self-efficacy

The 5-item Technology Self-Efficacy Scale measured technology self-efficacy and used a 7-point Likert scale with 1 = strongly disagree and 7 = strongly agree, score range of 5-35 (Kass, 2014). Higher numbers indicate greater self-efficacy with using technology. Reliability for the scale was established by a Cronbach's α of .80. An example question is, "I feel confident in my ability to use new applications on my smartphone or tablet."

Technology Readiness

The 16-item Technology Readiness Index (TRI) 2.0 was used to measure nursing students' technology readiness (Parasuraman & Colby, 2015). The TRI 2.0 consists of 16 items measured on a 5-point Likert scale with 1 = strongly disagree and 5 = strongly agree, score with

computed scores ranging from 1-5, with a higher score indicating higher technology readiness. Reliability for the scale is established with an overall Cronbach's α of 0.70. Example questions include "New technologies are much more convenient to use" (optimism), "other people come to you for advice on new technologies" (innovativeness), and "It is embarrassing when you have trouble with technology while people are watching" (discomfort), and "the human touch is very important in the workplace" (insecurity).

Technology Experience

The second research question for this study examined the differences in technology acceptance, attitudes, and self-efficacy as a result of the amount of healthcare technology experience they attained while in nursing school, including clinical, lab, and classroom settings. The healthcare technology experience variable was captured through a modified version of the Computer and Technology Experience Questionnaire (Czaja et al., 2006a). It has a reported Cronbach's α of 0.83 (Van Houwelingen et al., 2013) and is known to have adequate reliability and validity (Czaja et al., 2006b; Horhota, 2008; Van Houwelingen et al., 2013; Vorrink et al., 2017). The original 31-item questionnaire contained mostly non-healthcare-related technologies. Therefore, an expert panel of 8 experienced nurses provided a list of healthcare technologies that nurses frequently use in the workplace to include in a modified version of this questionnaire. The modified version was kept at 31 items and included the same scoring scheme as the original Technology and Computer Experience Questionnaire. The 31 items are measured on a 5-point Likert scale with 1 = Not sure what it is and 5 = Used frequently. A frequency profile score was then calculated, with a minimum score of 0 (never used) and a maximum score of 3 (frequently used). Example technologies on the questionnaire are "Electronic Health Record" and

"Medication Dispensing Machine (Pyxis)." Table 1 summarizes the data collection instruments used in this study.

Table 1

Data Collection Instruments

Variables	Instruments	Author	# of Items	Reliability	Variable Type
Demographics	Demographic Questionnaire Age, Education, & Gender Initial screening		3		Categorical
Acceptance	Modified Technology Acceptance Model Questionnaire	(Lah et al., 2020)	12	Cronbach's alpha 0.95	Continuous
Attitudes	P.A.T.C.H. Assessment Scale (Pretest for Attitudes Toward Computers in Healthcare) v. 3	(Kaminski, 2013)	50	Cronbach's alpha 0.92	Continuous
Self-efficacy	Technology Self-efficacy Scale	(Kass, 2014)	5	Cronbach's alpha 0.80	Continuous
Technology Readiness	Technology Readiness Index (TRI) 2.0 Overall	(Parasuraman & Colby, 2015)	16	Cronbach's alpha 0.70	Continuous
Technology Experience	Technology and Computer Experience Questionnaire (modified for healthcare technologies)	Modified from (Czaja et al., 2006a)	31	0.83	Continuous

Data Collection Methods

Institutional Review Board approval was obtained from the University of Nevada Las Vegas (see Appendix D). Deans for four Southern Nevada nursing schools were emailed

requesting permission to send a recruitment email to the nursing students enrolled in the school through an email distribution list or listserv (see Appendix E). The Dean or liaison emailed the recruitment communication to a student email distribution list or listserv. The email communication informed students that their participation was strictly voluntary (see Appendix F). No one on the research team was an instructor for the students enrolled in courses from which the data was gathered. The electronic survey began with an introduction screen that provided the purpose of the study and obtained informed consent (see Appendix G). The informed consent included language of the voluntary nature of the study, the confidentiality of their responses, the risks and benefits of participation, and plans for disseminating the findings. Inclusion and exclusion criteria questions were then presented to the participant. The survey ended for the student if any response excluded them from the study. Demographic questions followed (see Appendix H), in addition to the modified TAM Questionnaire (see Appendix I), the PATCH assessment scale (see Appendix J), the Technology Self-Efficacy Scale (see Appendix K), the TRI 2.0 (see Appendix L), and the modified Technology and Computer Experience Profile (see Appendix M). Data was collected electronically using Qualtrics and then transferred to IBM Statistical Package for the Social Sciences (SPSS), Version 28 software for analysis. The questionnaire took approximately 20 minutes to complete.

Data Management Plan

Data was collected from Qualtrics® and saved on a secure Google server only accessible to the student researcher and principal investigator. Only the aggregated results were reported, and no personal identifiers were included in the analyzed results. Participants accessed a separate site at the end of the survey to enter their email address for the Apple iPad drawing so that it was not linked to the survey data.

Data Analysis

Each hypothesis was tested utilizing the statistical analysis as outlined in Table 2. Outliers, missing data, and numbers out of range were eliminated from the data. Author instructions were used to determine scores for each instrument. Following that, SPSS software version 28 was used to create descriptive statistics for each measure, and the assumptions for hierarchical multiple linear regression were evaluated. Cronbach's alpha reliability analyses were conducted to determine the reliability of the composite scores, and the assumptions for hierarchical multiple linear regression were tested. The data was plotted using scatterplots and histograms. To determine if there was multicollinearity among the independent variables, variance inflation factor (VIF) values were calculated (Menard, 2009).

Data for the first research question was analyzed using multiple linear regression analysis. The independent variables are technology acceptance, attitudes toward technology, and self-efficacy. The dependent variable is technology readiness as measured by scores on the TRI 2.0. Multiple regression is a technique used to explore how well a set of continuous variables can predict a particular outcome that is also continuous (Field, 2018). Multiple regression offers information on the overall model and the relative contributions of each of the model's variables. In this study, the hierarchical method of multiple linear regression analysis was utilized to see how well each of the independent variables explains the variance in healthcare technology readiness while controlling for the others. Controlling for age and education, technology acceptance, attitudes toward technology, and self-efficacy was added to the model. Technology readiness was the dependent variable entered into the model for the analysis of the first research question.

Data for the second research question was analyzed using a series of hierarchical multiple linear regression analyses, run once for each dependent variable. Age and education were added in the first step of the hierarchical regression modeling. In the second step, technology experience was added. This hierarchical multiple linear regression analysis was run three times, once for each of the dependent variables of technology acceptance, attitudes toward technology, and self-efficacy.

For the third research question, mediation was examined based on the indirect and direct effects using bootstrapping with percentile-based confidence intervals using the PROCESS extension in SPSS version 28. Baron and Kenny (1986) indicate that a variable can function as a mediator in direct or indirect causal sequences if the regression analyses are statistically significant following certain conditions. Therefore, mediation was tested through three regression analyses, first with the independent variable (technology experience) predicting the dependent variable (technology readiness); next, with the independent variable predicting the mediators (technology acceptance, attitudes, and self-efficacy), which was completed with the analysis of research question two. Finally, with the independent variable (technology experience) and mediators (technology acceptance, attitudes, and self-efficacy) predicting the dependent variable (technology readiness), with technology experience and mediators entered as predictors. With this approach, when the mediators are added to the equation, if the significance of the independent variable of experience reduces significantly, then it would indicate mediation. This would mean rather than a direct causal relationship between the independent variable and the dependent variable, the independent variable influences the mediator variables, which in turn influences the dependent variable. Therefore, the mediator variables clarify the nature of the relationship between the independent and dependent variables. Results were analyzed for

complete or partial mediation. Table 2 provides an overview of the hypotheses, variables, and analyses for each.

Table 2

Data Analysis Table

Hypothesis	H_1: Pre-licensure nursing student technology acceptance, attitudes, and self-efficacy will have effects on healthcare technology readiness.	H_2: Technology experience will have an effect on technology acceptance, attitudes, and self-efficacy after controlling for age and education.	H_3: Technology acceptance, attitudes towards technology, and self-efficacy do mediate the relationship between technology experience and technology readiness.
Independent Variables	1.Technology Acceptance 2. Attitudes Towards Technology 3. Technology Self-Efficacy	Technology Experience	Technology Experience
Dependent Variable	Technology Readiness	1. Technology Acceptance 2. Attitudes Towards Technology 3. Technology Self-Efficacy	Technology Readiness
Effect			1.Technology Acceptance 2.Attitudes Towards Technology 3.Technology Self-Efficacy
Statistical Test	Hierarchical multiple linear regression	Hierarchical multiple linear regression	Mediation analysis
Power Analysis	H^1: N = 65 needed at a power level of 0.8 and alpha=0.05; or H^2: N = 63 needed at a power level of 0.96 and alpha=0.05; or H^3: N = 83 needed at a power level of 0.8 and alpha=0.05		

Chapter Summary

The purpose of this study was to examine the effects of technology acceptance, attitudes, self-efficacy, and experience on technology readiness in pre-licensure nursing students through a comprehensive approach. Hierarchical multiple linear regression analysis was a useful statistical method because it permitted analysis of the prediction of an outcome variable from a set of predictor variables utilizing a literature-informed method of variable selection and input. Furthermore, multiple regression analysis is similar to the theoretical models that underpin this study in that it seeks to determine the influence of predictor variables on a dependent variable, whereas the TAM and SCT address the dynamic influence of many circumstances on individual behavior (Bandura, 1977; Davis, 1989). Hierarchical multiple regression analysis aided the study's goal by offering significant data analyses. Mediation analysis regarding the direction and strength of the mediating effects of acceptance, attitudes, and self-efficacy was used for research question three. This allowed for a better understanding of technology experience, and whether it had reduced or had no influence on technology readiness after technology acceptance, attitudes, and self-efficacy were controlled.

Chapter 4: Results

Introduction

In this chapter, the results of the data analyses, including the demographic characteristics of the sample and the analysis of each hypothesis, are presented in narrative and statistical format. At the end of the chapter is a summary of the results.

Demographic Characteristics

Prior to running the hypothesis tests, summary statistics were calculated and presented for the variables of age, education, technology acceptance, attitudes toward technology, technology readiness, technology experience, and technology self-efficacy. Frequencies and percentages were calculated for the categorical variables, while means and standard deviations were calculated for the continuous/ scale variables. The study invitation yielded 110 responses. However, 19 respondents failed to complete the surveys in their entirety and were omitted from the analysis, leaving a sample size of $N = 91$. Among the 91 participants, the most frequently observed education category was post-secondary (a degree obtained post high school) (n = 55, 60.44%). The most frequently observed age category was 26-35 (n = 43, 47.25%). Females represented 71.4% of the sample (n = 65). Frequencies and percentages are presented in Table 3.

Table 3

Demographic Characteristics of Sample

Variable	*n*	*%*
Education		
Post-secondary (a degree obtained post high school)	55	60.44
High school	35	38.46
Missing	1	1.10
Age		
18-25	35	38.46
26-35	43	47.25
36-45	11	12.09
46-55	2	2.20
Missing	0	0.00
Gender		
Female	65	71.40
Male	25	27.5
Non-binary	0	0.00
Prefer not to say	1	1.1

Data Analysis

Following the completion of the survey, the data was then downloaded into SPSS version 28 for analysis. To prepare for analysis, any missing data and outliers present were identified and subsequently removed from the analysis. Additionally, composite scores were calculated for the variables of technology experience, technology self-acceptance, attitudes toward technology, technology self-efficacy, technology readiness, and technology experience according to each instrumentation's instructions. Categorical variables were dummy coded for analysis. Before hypothesis testing, summary statistics were calculated and presented for the demographic information and the composite score variables of interest, Cronbach's alpha reliability analyses were conducted to determine the reliability of the composite scores, and the assumptions for hierarchical multiple linear regression were tested.

Descriptive Statistics

Additional means and standard deviations were conducted for the variables of interest. The scores for technology acceptance ranged from 7-98, in which higher numbers indicated more technology acceptance. The observations for technology acceptance had a mean of 71.19 (*SD* = 10.72). This suggests that participants had fairly high levels of technology acceptance. According to instrument instruction, scores for attitudes toward technology ranged from 0-100, where higher numbers indicated more positive attitudes toward healthcare technologies. The observations for attitudes toward technology had a mean of 76.73 (*SD* = 12.79), suggesting that participants felt favorably towards healthcare technology. Scores for technology self-efficacy ranged from 5-35, where higher numbers indicate greater self-efficacy. The observations for technology self-efficacy had a mean of 30.54 (*SD* = 4.31), indicating that participants had high levels of technology self-efficacy. The observations for technology experience had a mean of

2.21 (*SD* = 0.44). The scores for technology experience range from 0-3, where higher scores indicate more experience with technology. The results suggest that participants, on average, use technology occasionally. Finally, scores for technology readiness ranged from 1-5, in which higher scores reflect "technology ready," while lower scores suggest a "non-technology ready" orientation. The observations for technology readiness had a mean of 3.35 (*SD* = 0.65). This suggests that, on average, participants were moderately technology ready. The descriptive statistics can be found in Table 4.

Table 4

Descriptive Statistics Table for Variables

Variable	*M*	*SD*	*n*
Technology Acceptance	71.19	10.72	90
Attitudes Towards Technology	76.73	12.79	86
Technology Self-efficacy	30.54	4.31	85
Technology Experience	2.21	0.44	88
Technology Readiness	3.35	0.65	89

Reliability Analysis

A series of Cronbach's alpha reliability analyses were conducted for the composite scores of technology acceptance, attitudes toward technology, technology self-efficacy, technology experience, and technology readiness. The Cronbach's alpha coefficient was evaluated using the guidelines suggested by George and Mallery (2018), where > .9 excellent, > .8 good, > .7

acceptable, > .6 questionable, > .5 poor, and ≤ .5 unacceptable. The results of each analysis had an alpha coefficient of .82 or larger, indicating good and excellent reliability. Table 5 presents the results of each reliability analysis.

Table 5

Cronbach's Alpha Reliability Analyses

Scale	No. of Items	α	Lower Bound	Upper Bound
Technology Acceptance	12	.95	.93	.96
Attitudes Towards Technology	50	.93	.91	.95
Technology Self-efficacy	5	.82	.77	.87
Technology Readiness	16	.87	.83	.90
Technology Experience	31	.89	.87	.92

Research Questions and Hypotheses

The purpose of this quantitative non-experimental design was to investigate the factors that influence technology acceptance, attitudes, self-efficacy, and experience on technology readiness in pre-licensure nursing students using a comprehensive approach. To accomplish this, prelicensure student nurses were asked to complete an online survey measuring (a) nursing student demographics; (b) nursing student personal factors (technology experience); (c) and nursing student process of change feelings (technology acceptance, attitudes toward technology, and technology self-efficacy). To answer the three research questions, a series of hierarchical

multiple linear regressions and mediation analyses were conducted and presented within this chapter.

Research Question 1

RQ1: What are the effects of pre-licensure nursing students' technology acceptance, attitudes toward technology, and self-efficacy on their healthcare technology readiness?

H_1: Pre-licensure nursing student technology acceptance, attitudes, and self-efficacy will influence healthcare technology readiness.

A hierarchical multiple linear regression analysis was conducted to assess whether technology acceptance, attitudes toward technology, and technology self-efficacy predicted technology readiness while controlling for age and education. The first step of the model was run between age and education on technology readiness, while the second step of the model added the variables of attitudes toward technology, technology acceptance, and technology self-efficacy. Prior to the hypothesis test, the assumptions of normality, homoscedasticity, multicollinearity, and lack of outliers were assessed. Normality was assumed due the quantiles of the residuals not strongly deviating from the theoretical quantiles in the P-P scatterplot as seen in Figure 2 (DeCarlo, 1997). Homoscedasticity was evaluated by plotting the residuals against the predicted values (Bates et al., 2014; Field, 2018; Osborne & Walters, 2002).The assumption of homoscedasticity for the regression model predicting technology readiness was met as the points appear randomly distributed with a mean of zero with no apparent curvature (Figure 3). Variance Inflation Factors (VIFs) were calculated to detect the presence of multicollinearity between predictors and revealed VIF values less than 10 (range 1.05 to 3.0). Cook's distances revealed

there were no outliers present in the dataset as there were no values over the 50th percentile (Cook, 1977).

Figure 2

P-P Scatterplot for Normality of the Residuals for the Regression Model Predicting Technology Readiness

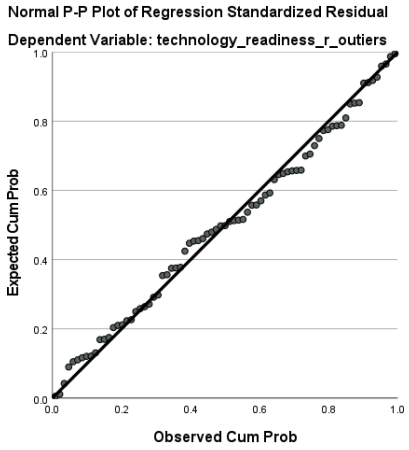
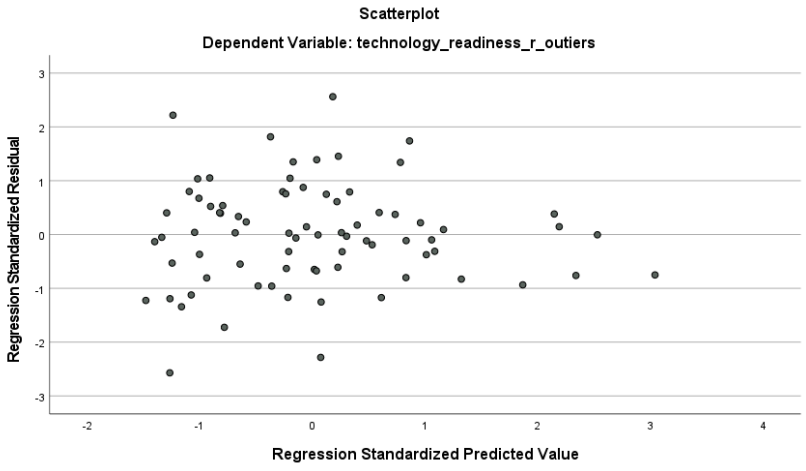


Figure 3

Residuals Scatterplot Testing Homoscedasticity for the Regression Model Predicting Technology Readiness



Results for RQ1

The results of the first step of the hierarchical multiple linear regression model were not significant, $R^2 = .05$, $F\,(4,86) = 1.11$, $p = .357$, indicating the levels of age and education did not explain a significant proportion of variation in technology readiness. Since the overall model was not significant, the individual predictors were not examined further.

For the second step of the model, the variables of technology acceptance, attitudes toward technology, and technology self-efficacy were added as predictor variables. The results of the second step of the hierarchical multiple linear regression model were significant, $R^2 = .68$, $\Delta R^2 = .63$, $F\,(7,72) = 21.73$, $p < .001$, indicating that approximately 63.00% of the variance in technology readiness is explainable technology acceptance, attitudes toward technology, and technology self-efficacy collectively, while controlling for age and education. Specifically, technology acceptance significantly predicted technology readiness, $B = 0.02$, $t\,(72) = 2.78$, $p = .007$. Additionally, attitudes toward technology significantly predicted technology readiness, $B = 0.02$, $t\,(72) = 3.07$, $p = .003$. Finally, technology self-efficacy significantly predicted technology readiness, $B = 0.05$, $t\,(72) = 3.67$, $p < .001$. The hypothesis was accepted as technology acceptance, attitudes toward technology, and technology self-efficacy had a significant influence on technology readiness. Table 6 summarizes the results of the regression model.

Table 6

Hierarchical Multiple Linear Regression Analysis Results for Technology Readiness

	Model 1			Model 2		
Variable	*B*	*SE B*	β	*B*	*SE B*	β
Age						
18-25	-0.13	0.16	-0.10	0.02	0.10	0.02
36-45	-0.23	0.22	-0.11	0.005	0.13	0.003
46-55	-0.48	0.47	-0.11	-0.16	0.27	-0.04
Education						
Post-secondary	0.18	0.15	0.14	-0.04	0.09	-0.03
Technology Acceptance				0.02**	0.005	0.26
Attitudes Toward Technology				0.02**	0.006	0.36
Technology Self-efficacy				0.05***	0.01	0.34
R^2		.05			.68	
ΔR^2		.05			.63	
F for change in R^2		1.11			21.73***	

Note: Age 26-35 was reference category. Education High School was reference category.

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

Research Question 2

RQ2: What effect does technology experience have on technology acceptance, attitudes, and self-efficacy in pre-licensure nursing students?

H_2: Technology experience will influence technology acceptance, attitudes, and self-efficacy after controlling for age and education.

To answer the second research question, three separate hierarchical linear regression analyses were conducted to assess whether technology experience significantly predicted

technology acceptance, technology self-efficacy, and attitudes toward technology, respectively, while controlling for age and education. The first step of the model looked at whether age and education predicted the dependent variable, while the second step introduced technology experience as an independent variable. Prior to the hypothesis test, the assumptions of normality, homoscedasticity, multicollinearity, and lack of outliers were assessed for the three separate hierarchical linear regression tests. Normality was assumed due to the quantiles of the residuals not strongly deviating from the theoretical quantiles in the P-P scatterplots (DeCarlo, 1997). Homoscedasticity was evaluated by plotting the residuals against the predicted values (Bates et al., 2014; Field, 2018; Osborne & Walters, 2002). The assumption of homoscedasticity was met as the points appear randomly distributed with a mean of zero with no apparent curvature. Variance Inflation Factors (VIFs) were calculated to detect the presence of multicollinearity between predictors and revealed VIF values less than 10 for all analyses. Cook's distances revealed there was one outlier in the dataset for the regression analyses on technology acceptance and two outliers for technology self-efficacy. These outliers were removed from the analysis. Removal of outliers is a standard practice (Hinkle et al., 2003). The multivariate outliers represented values at the extreme ends of the dataset, possibly due to random responding and not representative of true values from natural variation in the population.

Results for RQ2: Technology Acceptance

The results of the first step of the hierarchical linear regression model were not significant, $R^2 = .04$, $F\,(4,82) = 0.82$, $p = .517$, indicating the levels of age and education did not explain a significant proportion of variation in technology acceptance. Since the overall model was not significant, the individual predictors were not examined further.

The results of the second step of the hierarchical linear regression model were significant, $R^2 = .17$, $\Delta R^2 = .13$, $F\ (5,80) = 3.18$, $p = <.001$, indicating that approximately 13.00% of the variance in technology acceptance is explainable by technology experience when controlling for age and education. Specifically, technology experience significantly predicted technology acceptance, $B = 8.56$, $t\ (80) = 3.51$, $p < .001$. Table 7 summarizes the results of the regression model.

Table 7

Hierarchical Multiple Linear Regression Analysis Results for Technology Experience, Age, and Education Predicting Technology Acceptance

	Model 1			Model 2		
Variable	*B*	*SE B*	β	*B*	*SE B*	β
Age						
18-25	-0.39	2.49	-0.02	0.54	2.38	0.03
36-45	1.02	3.60	0.03	2.54	3.44	0.08
46-55	-6.02	7.43	-0.09	-4.47	7.05	-0.07
Education						
Post-secondary	3.31	2.36	0.16	2.33	2.26	0.11
Technology Experience				8.56***	2.44	0.37
R^2		.04			.17	
ΔR^2		.04			.13	
F for change in R^2		0.82			3.18***	

Note: Age 26-35 was reference category. Education High School was reference category.

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

Results for RQ2: Attitudes Toward Technology

The results of the first step hierarchical multiple linear regression model were not significant, $R^2 = .07$, $F\,(4,81) = 1.58$, $p = .186$, indicating the levels of age and education did not explain a significant proportion of variation in attitudes toward technology. Since the overall model was not significant, the individual predictors were not examined further.

The results of the second step of the hierarchical linear regression model were significant, $R^2 = .19$, $\Delta R^2 = .12$, $F\,(5,75) = 3.63$, $p = .005$, indicating that approximately 12% of the variance in attitudes toward technology was explainable by technology experience when controlling for age and education. Specifically, technology experience significantly predicted attitudes toward technology, $B = 10.08$, $t\,(75) = 3.16$, $p = .001$. Table 8 summarizes the results of the regression model.

Table 8

Hierarchical Multiple Linear Regression Analysis Results for Technology Experience, Age, and Education Predicting Attitudes Toward Technology

	Model 1			Model 2		
Variable	*B*	*SE B*	β	*B*	*SE B*	β
Age						
18-25	-2.15	3.17	-0.08	-1.16	3.04	-0.04
36-45	-5.73	4.28	-0.15	-3.75	4.15	-0.10
46-55	6.52	12.09	-0.10	-7.02	8.73	-0.08
Education						
Post-secondary	0.72	3.90	0.02	4.18	2.83	0.16
Technology Experience				10.08***	3.02	0.35
R^2		.07			.19	
ΔR^2		.07			.12	
F for change in R^2		1.58			3.63**	

Note: Age 26-35 was reference category. Education High School was reference category.

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

Results for RQ2: Technology Self-Efficacy

The results of the first step of the hierarchical multiple linear regression model were not significant, $R^2 = .05$, $F\,(4,76) = 1.02$, $p = .403$, indicating age and education did not explain a significant proportion of variation in technology self-efficacy. Since the overall model was not significant, the individual predictors were not examined further.

The results of the second step of the hierarchical multiple linear regression model were not significant, $R^2 = .09$, $\Delta R^2 = .04$, $F\,(5,75) = 1.55$, $p = .186$, indicating technology experience, age, and education did not explain a significant proportion of variation in technology self-efficacy. Since the overall model was not significant, the individual predictors were not examined further. Table 9 summarizes the results of the regression model.

Table 9

Hierarchical Multiple Linear Regression Analysis Results for Technology Experience, Age, and Education Predicting Technology Self-efficacy

	Model 1			Model 2		
Variable	*B*	*SE B*	β	*B*	*SE B*	β
Age						
18-25	-0.58	0.98	-0.07	-0.19	0.98	-0.10
36-45	-2.50	1.32	-0.22	-2.07	1.33	-0.17
46-55	-2.37	2.81	-0.10	-2.05	2.79	-0.07
Education						
Post-secondary	0.16	0.93	0.02	0.29	0.93	0.05
Technology Experience				1.97	1.04	0.14
R^2		.05			.09	
ΔR^2		.05			.04	
F for change in R^2		1.02			1.55	

Note: Age 26-35 was reference category. Education High School was reference category.

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

Summary of Results for RQ2

The hypothesis for research question two was partially accepted. Specifically, technology experience significantly predicted technology acceptance, $B = 8.56$, $t\ (80) = 3.51$, $p < .001$. Additionally, technology experience significantly predicted attitudes toward technology, $B = 10.08$, $t\ (75) = 3.16$, $p = .001$. However, the results for technology experience predicting technology self-efficacy were not accepted; therefore, this part of the hypothesis was rejected.

Research Question 3

RQ3: To what extent do technology acceptance, attitudes toward technology, and self-efficacy mediate the relationship between technology experience and technology readiness?

H_3: Technology acceptance, attitudes toward technology, and self-efficacy do mediate the relationship between technology experience and technology readiness.

Three causal mediation analyses were conducted to assess if technology acceptance, attitudes toward technology, and technology self-efficacy mediated the relationship between technology experience and technology readiness. Prior to the hypothesis test, the assumptions of normality, homoscedasticity, multicollinearity, and lack of outliers were assessed for the three mediation analyses. Normality was assumed due the quantiles of the residuals not strongly deviating from the theoretical quantiles in the P-P scatterplot (DeCarlo, 1997). Homoscedasticity was evaluated by plotting the residuals against the predicted values (Bates et al., 2014; Field, 2018; Osborne & Walters, 2002).The assumption of homoscedasticity for the three mediation analyses was met as the points appear randomly distributed with a mean of zero with no apparent curvature. Variance Inflation Factors (VIFs) were calculated to detect the presence of multicollinearity and revealed VIF values less than 10 for all analyses. Cook's distances revealed there was one outlier the dataset for the regression analyses on attitudes towards technology and was removed from the analysis. This outlier was removed from the analysis. Removal of outliers is a standard practice (Hinkle et al., 2003). The multivariate outliers represented values at the extreme ends of the dataset, possibly due to random responding and not representative of true values from natural variation in the population.

Following Hayes' (2013) Macro Process via bootstrapping method, a mediator has mediational effect when (1) the indirect effect of technology experience on technology readiness via the mediators and (2) the bias-corrected 95% confidence interval (CI) around the indirect effect from the bootstrap resamples. The indirect effect was considered statistically significant if its bias-corrected 95% confidence interval did not include zero.

Results for RQ3: Technology Acceptance

Mediation was examined based on the indirect and direct effects using bootstrapping (N = 100) with percentile-based confidence intervals using the PROCESS extension in SPSS version 28. The results are based on an alpha of .05. The regression model results are presented in Table 10 and Table 11. The mediation model diagram for technology acceptance can be seen in Figure 4.

Table 10

Results for the Regression on Technology Readiness for Technology Acceptance

Variable	*B*	*SE*	95% CI	*t*	*p*
(Intercept)	3.38	0.05	[3.28, 3.48]	67.20	< .001
Technology Experience	0.26	0.12	[0.01, 0.51]	2.10	.039
Technology Acceptance	0.03	0.005	[0.02, 0.04]	6.86	< .001

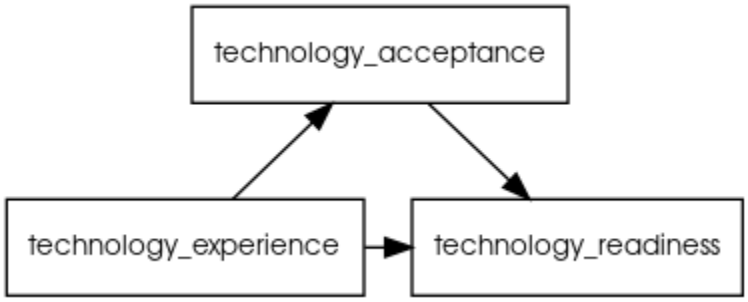
Table 11

Results for the Regression on Technology Acceptance

Variable	*B*	*SE*	95% CI	*t*	*p*
(Intercept)	-8.12×10^{-15}	1.09	[-2.18, 2.18]	-0.00	1.000
Technology Experience	9.61	2.48	[4.67, 14.55]	3.97	<.001

Figure 4

Node Diagram for the Mediation Analysis of Technology Acceptance



Results. The average direct effect was significant, $B = 0.26$, $p = .039$. This indicates that technology experience significantly predicts technology readiness. The average indirect effect of technology experience on technology readiness through technology acceptance was significant, $B = 0.33$, 95% CI [0.15, 0.56]. This suggests that there was a mediating effect of technology acceptance on the effect of technology experience and technology readiness.

Results for RQ3: Attitudes Toward Technology

The mediation results for attitudes toward technology are based on an alpha of .05. The regression model results are presented in Table 12 and Table 13. The mediation model diagram can be seen in Figure 5.

Table 12

Results for the Regression on Technology Readiness for Attitudes Toward Technology

Variable	*B*	*SE*	95% CI	*t*	*p*
(Intercept)	3.38	0.04	[3.30, 3.46]	81.32	< .001
Technology experience	0.24	0.10	[0.03, 0.44]	2.28	.025
Attitudes Toward Technology	0.04	0.004	[0.03, 0.04]	10.50	.001

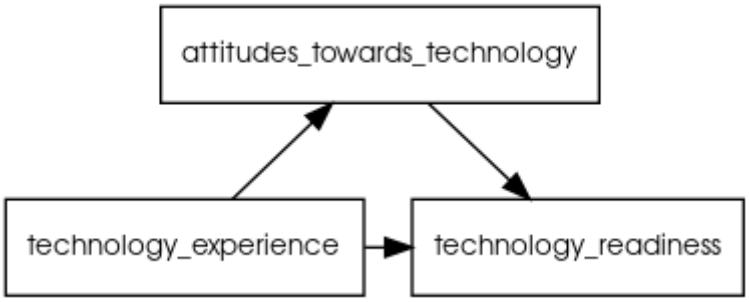
Table 13

Results for the Regression on Attitudes Towards Technology

Variable	*B*	*SE*	95% CI	*t*	*p*
(Intercept)	6.35×10^{-15}	1.33	[-2.64, 2.64]	0.00	1.000
Technology experience	10.22	3.09	[4.07, 16.37]	3.31	.001

Figure 5

Node Diagram for the Mediation Analysis of Attitudes Toward Technology



Results. The average direct effect was significant, $B = 0.24$, $t = 2.28$, $p = .025$. This indicates that technology experience significantly predicted technology readiness. The average indirect effect of technology experience on technology readiness through attitudes toward technology was significant, $B = 0.38$, 95% CI [0.18, 0.75]. This suggests that there was a mediating effect of attitudes toward technology on the effect of technology experience and technology readiness.

Results for RQ3: Technology Self-efficacy

Results. The mediation results for technology self-efficacy are based on an alpha of .05. The regression model results are presented in Table 14 and Table 15. The mediation model diagram can be seen in Figure 6.

Table 14

Results for the Regression on Technology Readiness for Technology Self-efficacy

Variable	*B*	*SE*	95% CI	*t*	*p*
(Intercept)	3.39	0.05	[3.29, 3.50]	67.27	< .001
Technology experience	0.39	0.12	[0.15, 0.64]	3.21	.002
Technology self-efficacy	0.09	0.01	[0.07, 0.11]	7.46	< .001

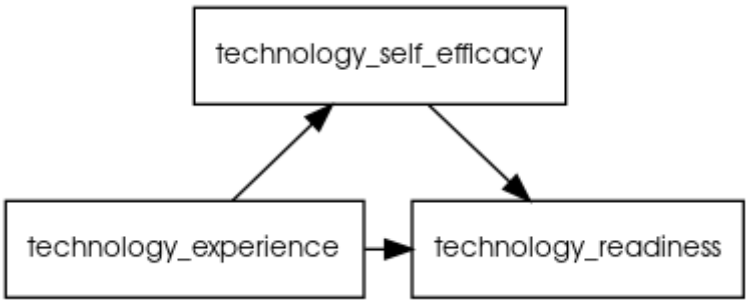
Table 15

Results for the Regression on Technology Self-efficacy

Variable	*B*	*SE*	95% CI	*t*	*p*
(Intercept)	1.13×10^{-15}	0.47	[-0.94, 0.94]	0.00	1.000
Technology experience	2.12	1.13	[-0.13, 4.36]	1.88	.064

Figure 6

Node Diagram for the Mediation Analysis for Technology Self-efficacy



Results. The average direct effect was significant, $B = 0.39$, $p = .002$. This indicates that technology experience significantly predicted technology readiness. The average indirect effect of technology experience on technology readiness through technology self-efficacy was not significant, $B = 0.19$, 95% CI [-0.06, 0.47]. Therefore, there was not a mediating effect of technology self-efficacy on the relationship between technology experience and technology readiness.

Summary of Results for RQ3

The path analysis revealed in each of the analyses of technology acceptance, attitudes toward technology, and technology self-efficacy, the direct effects were significant, indicating that technology experience significantly predicted technology readiness. Additionally, the indirect effect of technology experience on technology readiness through technology acceptance was significant, as was through attitudes toward technology; therefore, mediation was found, and this portion of the hypothesis was accepted. The indirect effect of technology experience on technology readiness through technology self-efficacy was not significant; therefore, this portion of the hypothesis was rejected.

Chapter Summary

Overall, the purpose of this quantitative non-experimental design was to investigate the factors that influence technology acceptance, attitudes, self-efficacy, and experience on technology readiness in pre-licensure nursing students. To accomplish this, student nurses were asked to complete an online survey measuring their ability to use and attitudes toward healthcare-related technology. Following the completion of the survey, the data was then downloaded into SPSS version 28 for analysis. Prior to hypothesis testing, summary statistics were calculated and presented for the demographic information, as well as the composite score

variables of interest, and Cronbach's alpha reliability analyses were conducted to determine the reliability of the composite scores. To answer the first research question, a hierarchical multiple linear regression was conducted to determine if attitudes, self-efficacy, and acceptance of technology predicted technology readiness while controlling for age and education level. The results of the regression were significant, indicating that the variables collectively predicted technology readiness. Specifically, technology acceptance, technology self-efficacy, and attitudes toward technology significantly positively predicted technology readiness. To answer the second research question, three separate hierarchical multiple linear regressions were conducted to determine if technology experience predicted technology acceptance, self-efficacy, and attitudes, respectively. The results of the regressions indicated that technology experience significantly predicted both technology acceptance and attitudes toward technology. Finally, to answer the third research question, three separate mediation analyses were conducted to determine if there was a mediating effect of either technology acceptance, self-efficacy, or attitudes toward technology in the relationship between technology experience and technology readiness. The results of each analysis indicated that there was a significant direct relationship of technology experience on technology readiness. The results also indicated that there was a mediating effect of attitudes toward technology and technology acceptance on the direct relationship found. This is what is known as a significant indirect effect. The implication of these results will be further explored in the next chapter.

Chapter 5: Discussion

Introduction

The purpose of this study was to investigate the factors that influence technology acceptance, attitudes, self-efficacy, and experience on technology readiness in pre-licensure nursing students using a comprehensive approach. To accomplish this, student nurses were asked to complete an online survey measuring these concepts. The quantitative non-experimental study design answered three research questions with the variables of technology acceptance, attitudes, self-efficacy, and experience on technology readiness. This chapter presents an interpretation of the study findings, a discussion of how the findings relate to current literature, as well as strengths, limitations of the study, and implications for nursing and future research.

Interpretation of the Findings

Sample

Among the 91 participants, the most frequently observed category of age was 26-35 (n = 43, 47.25%). This does not align with national statistics, where 75.8% of Prelicensure BSN students reported in the Biennial Survey of Schools of Nursing are under the age of 25 (National League for Nursing [NLN], 2020b). However, the report fails to delineate whether the schools have accelerated vs. non-accelerated programs. In this study, three of the four nursing schools have accelerated BSN programs. Accelerated BSN programs are for students who have completed some or all of their undergraduate education, thus making it possible to complete a traditional 4-year degree in 12-18 months years (American Association of Colleges of Nursing [AACN, 2019). Students enrolled in accelerated BSN programs are not entering immediately out

of high school, may have obtained a post-secondary degree in another field, and start nursing school in their "mid to late twenties" (AACN, 2019).

The most frequently observed category of education level was post-secondary (a degree obtained post high school) (n = 55, 60.44%). This demographic aligns with the aforementioned characteristics of students entering accelerated nursing programs comprising those with a previous degree. According to AACN (2021), there were 318 accelerated BSN programs in the United States, with 27 new accelerated BSN programs in the planning stages. The demographic characteristics are representative of pre-licensure BSN students in the United States.

Males represented 27.5% of the sample, above the national average of 13% (NLN, 2020a). The NLN also reported 87% of nursing students as female, where females represented 71.4% of the sample in this study. These demographics may indicate the movement towards more diversity in programs.

Research Question 1

Research question one examined the effects of pre-licensure nursing students' technology acceptance, attitudes toward technology, and self-efficacy on their healthcare technology readiness. The results of the first step of the hierarchical multiple linear regression model were not significant, indicating the levels of age and education did not explain a significant proportion of variation in technology readiness; thus, the individual predictors were not examined further.

The results of the second step of the hierarchical multiple linear regression model were significant, $R^2 = .68$, $\Delta R^2 = .63$, $F\,(7,72) = 21.73$, $p < .001$, indicating that approximately 63.00% of the variance in technology readiness is explainable by age, education, technology acceptance, attitudes toward technology, and technology self-efficacy collectively. The R-squared value for the first step of the model was .05, indicating that the amount of variance explainable by the

predictor variables increased by .63 units when the predictors of attitudes, acceptance, and self-efficacy were added to the model. Specifically, technology acceptance significantly predicted technology readiness, $B = 0.02$, $t\ (72) = 2.78$, $p = .007$. This indicates that a one-unit increase in technology acceptance will increase the value of technology readiness by 0.02 units. Additionally, attitudes toward technology significantly predicted technology readiness, $B = 0.02$, $t\ (72) = 3.07$, $p = .003$. This suggests that for every one-unit increase in attitudes toward technology, the value of technology readiness will increase by 0.02 units. Finally, technology self-efficacy significantly predicted technology readiness, $B = 0.05$, $t\ (72) = 3.67$, $p < .001$. This indicates that a one-unit increase in technology self-efficacy will increase the value of technology readiness by 0.05 units.

The results suggest that technology readiness increases as there is more technology acceptance, positive attitudes toward technology, and increased technology self-efficacy. Research question one considers the behavioral side of technology readiness, where acceptance, attitudes, and self-efficacy represent feelings and beliefs that can fluctuate given their context, in this case, healthcare technology use.

Research Question 2

Research question two examined the effect of technology experience on technology acceptance, attitudes, and self-efficacy in pre-licensure nursing students while controlling for age and education. This was accomplished by running three separate hierarchical multiple linear regression analyses. Because the results of the first steps of each model were not significant in any of the series of hierarchical multiple linear regression analyses, this indicated that age and education did not explain a significant proportion of variation in technology acceptance, attitudes, and self-efficacy.

When technology acceptance was introduced in the second step, the results were significant, indicating that approximately 13.00% of the variance in technology acceptance is explainable by technology experience, age, and education collectively. The R-squared value for the first step of the model was .04, indicating that the variance explainable by the model increased by .13 units when technology experience was added to the model. Specifically, technology experience significantly predicted technology acceptance and indicated a one-unit increase in technology experience will increase the value of technology acceptance by 8.56 units. The results suggest that with more experience using technologies, prelicensure nursing students demonstrate more acceptance of technologies. The literature supports that technology experiences influence acceptance and lead to increased utilization. They emphasized the critical role of experiences in the development of attitudes, belief systems, knowledge, and intention (Fishbein and Ajzen, 1975). These results are promising in developing novice nurses who recognize technologies' usefulness and ease of use through this increased experience, which influences their inclinations to use them in their professional practice.

When attitudes towards technology was introduced in the second step of the hierarchical multiple linear regression model, it was significant, indicating that approximately 12% of the variance in attitudes toward was explainable by technology experience, age, and education collectively. The R-squared value for the first step of the model was .07, indicating that the variance explainable by the model increased by .12 units when technology acceptance was added to the model. Specifically, technology experience significantly predicted attitudes toward technology. This indicates that a one-unit increase in technology experience will increase the value of attitudes toward technology by 10.08 units. These findings suggest that positive attitudes toward technologies will develop the more they are utilized in nursing programs. This is

important as novice nurses learn to embrace and champion the healthcare technologies they are using in their first nursing positions after graduation, as well as championing the use of the technologies to provide the patient safety nets and efficiencies that they promise.

When self-efficacy was added to the second step of the hierarchical multiple linear regression model, it was not significant, which indicates that technology experience, age, and education did not explain a significant proportion of variation in technology self-efficacy. Therefore, this suggests that the amount of technology experience one possesses does not impact technology self-efficacy. This result is not surprising, given that technology is embedded in many aspects of students' lives. Therefore, they may see it as intuitive to use whether or not they have been exposed to a new healthcare technology previously; thus, their confidence already exists.

Research Question 3

Research question three examined to what extent technology acceptance, attitudes toward technology, and self-efficacy mediate the relationship between technology experience and technology readiness by conducting three causal mediation analyses using PROCESS. For technology acceptance, the direct effect analysis was significant and indicated that every one-unit increase in technology experience resulted in an increase in technology readiness by 0.26 units. The average indirect effect of technology experience on technology readiness through technology acceptance was significant and suggests that there was a mediating effect of technology acceptance on the effect of technology experience and technology readiness. Specifically, the addition of technology acceptance into the model increased technology readiness by 0.33 units.

For attitudes toward technology, the direct effect was significant; every one-unit increase in technology experience resulted in an increase in technology readiness by 0.24 units. The indirect was also significant, and there was a mediating effect of attitudes toward technology on the effect of technology experience and technology readiness. This suggests that when attitudes toward technology is added to the model, technology readiness increases by 0.38 points. For technology self-efficacy, the direct effect analysis indicates that technology experience significantly predicted technology readiness. Specifically, every one-unit increase in technology experience resulted in an increase in technology readiness by 0.19 units. The average indirect effect of technology experience on technology readiness through technology self-efficacy was not significant; therefore, there was not a mediating effect of technology self-efficacy on the relationship between technology experience and technology readiness.

The mediation analyses results are significant because they tell us that technology experience alone, while it does have a direct effect on technology readiness, the introduction of technology acceptance and attitudes towards technology further predicted an increase in technology readiness. Therefore, further developing these process of change feelings of acceptance and attitudes should be of focus in nursing school curricula, clinical, and simulation experiences to further enhance their readiness to use technologies before entering the workforce. Curricula should identify objectives and outcomes that specify achievement of technology acceptance and positive attitudes towards the technology to hold students and faculty accountable to the learning goals.

Nursing Practice and Education Implications

The study findings have considerable implications for nursing practice and nursing education because the frequency of technology experiences, a majority of those assessed being

healthcare-related technologies, significantly influenced technology acceptance and attitudes toward technology of prelicensure nursing students in the last term of their nursing programs and that technology acceptance and attitudes had a mediating effect of technology experience on technology readiness. This tells us that the more opportunities nursing students have to interact with and utilize healthcare technologies, the more likely they will accept these technologies as useful and easy to use in their nursing workflows, providing efficiencies and patient safety nets for quality nursing care. Nurses are often the main drivers in healthcare technology training and implementation and are frequently called upon to participate in decision-making and development evaluation (Alexander & Figlietti, 2017; Chirchur et al., 2021). Nurses who develop positive attitudes toward technology are likely to champion use for new-hire nurses and the existing staff. Studies support that nurses with good computer literacy and adequate skills in general technology-related tasks were more likely to have positive attitudes toward computer use (Howe et al., 2018; Rajkovic et al., 2018). This connection supports the likelihood that a positive experience will lead to positive attitudes toward technology. Users with positive attitudes toward technology are often early adopters of new technologies and will advocate broad-use among their colleagues. These users see the value in safety nets that some technologies provide, including medication allergy or contraindication alerts and clinical reminders. Thus, providing the technology experience while in nursing school enhances users' likelihood of seeking involvement in testing, optimization, and maintenance activities that will further perpetuate utilization and competency.

The TAM, one of the theoretical frameworks supporting this study, indicates that when users experience new technology, their perceptions of its utility and simplicity will influence their decisions about how and when to utilize it (Davis et al., 1989). Two determinants of

technology acceptance in the TAM are perceived usefulness and ease of use. Healthcare technology users want to view their systems as a utility that enhances productivity and efficiency in their jobs. Perceived usefulness, as it relates to the TAM, is the degree to which a person sees a system enhancing their productivity and job performance (Kemp et al., 2019). Many researchers have found that when nurses express high perceptions of usefulness and recognize the advantages of the technology, they have a positive perception, making them engaged learners and users (Infinedo, 2016; Rajkovic et al., 2018). The more users perceive a system to be useful, the more they will see it as easy to use and increasingly utilize it. With nurses recognizing the usefulness of technology in their work, technology adoption will be increased, and thus the patient-safety mechanisms, quality of care, and efficiencies will be leveraged. As nursing students realize healthcare technology's usefulness and ease of use, they will appreciate it through increased attitudes toward technology and an inclination to accept it. The findings of this study demonstrate that through increased technology experience and engagement, nursing students will find value in technology as a supportive tool in clinical experiences and their daily work after they enter professional practice.

Technology ease of use includes the elements of ease of access, navigability, and task efficiency. System response time, documentation time, and the availability and timeliness of data are components that are the output of a well-designed system and are of great importance to users (Nguyen et al., 2017; Vaughn et al., 2019). Nurses reported being less likely to accept healthcare technologies when ease of use was low. The usability elements were specifically related to intuitive task completion, the ability to correct mistakes, and meaningful and actionable clinical decision support. The findings of this study indicate that the more frequently nurses experienced healthcare technologies, they recognized the usability of the technologies,

and thus acceptance increased. Healthcare technology developers should continue to aim for intuitive, useful, and flexible designs that match nurses' workflow needs so that their acceptance of technology is firmly established.

Challenges in healthcare, such as increased workload, diminished resources, and cost challenges, have contributed to poor adoption of technology, which leads to poor attitudes, decreased job satisfaction, and increased turnover (Armmer, 2017; Howe et al., 2018; Steege & Rainbow, 2017). Nationally, the average nurse turnover rate is 19.1 percent and is expected to increase, resulting in an 8% nursing vacancy rate. Nurse retention is essential to the hospital industry because a significant nursing shortage in 2024 has been predicted (U.S. Bureau of Labor Statistics, 2021). Nurse turnover is exceptionally costly at $40,038 per bedside Registered Nurse and ranges from $28,400 to $51,700 resulting in the average hospital losing $5.1m per year (Nursing Solutions Inc., 2022). If providing technology experiences in nursing programs increases nursing students' acceptance and attitudes toward the technologies, this can imply a more satisfied new graduate nurse entering the workforce.

The need to include healthcare technology training in nursing education has been discussed extensively in the literature (Mollart et al., 2021; Nes et al., 2021; Strahan, 2017; Wolters Kluwer Health, 2020). The study findings indicate that technology acceptance and attitudes increased with more frequent technology use. With this positive impact, opportunities for hands-on experiences using healthcare technologies in the learning environment should be a priority of nursing schools. This includes several technologies outlined in the modified Technology Experience Questionnaire, such as the EHR, medication dispensing machine, and patient-controlled analgesia pump. QSEN (2020), a national advisory board, supports informatics competencies for nursing programs with three features: basic computer skills, informatics

knowledge, and informatics skills (QSEN, 2020). Pre-licensure nursing programs have responded to these competencies by incorporating an informatics course or embedded informatics principles in didactic courses (Belchez, 2019). Incorporating hands-on lab and clinical-based experiences utilizing health information technologies should be included in this curriculum due to the findings from this study. Restrictive access to some technologies in hospitals and other healthcare settings as been noted to threaten nursing students' clinical learning and the development of informatics competencies (Hansbrough et al., 2020). Healthcare organizations hosting clinical nursing students should provide students with the necessary access and training to ensure the use of these systems.

Technology use has become ingrained in many aspects of nursing students' personal lives through computers and mobile technologies such as iPads, smartwatches, and smartphones. This everyday use may influence their stance on technology negatively or positively. Additionally, the technologies used in healthcare have expanded far beyond just the computer and EHR (Cascio & Montealegre, 2016; Coyne, 2022; Eskandari et al., 2019; Pepito & Locsin, 2018; Risling, 2017). The results of this study indicated that technology acceptance and attitudes of nursing students influenced their readiness to use the technologies. Therefore, it is crucial to have nursing school curricula with learning objectives that address the development of ease of use and usefulness of technology (acceptance), developing positive attitudes toward technology, and welcoming change (attitudes), so that students establish this readiness when they enter their first nursing positions post-graduation.

Nursing graduates must be prepared to integrate new technologies easily into nursing practice, and this education should begin early. Nursing students should be exposed to healthcare technologies by adding nursing technology courses in pre-licensure programs. Raising

technology acceptance and attitudes early in the curriculum could raise the likelihood that students will be able to use healthcare technologies effectively. Exercises that enable students to think more fluidly and seize every opportunity to adapt to an ever-changing technology-laden environment will likely be effective in this situation. This paves the way for a more stringent admissions procedure for pre-licensure nursing programs to establish a candidate's level of adaptability. A general understanding of technology or healthcare technology may not be sufficient for effectively using healthcare technology tools.

Strengths and Limitations

There were several strengths identified with this study. This study recruited pre-licensure nursing students enrolled in the last term of nursing school from four different nursing schools rather than all from the same school. This allowed the ability to reach the target sample size of $N = 83$ (actual 91). Additionally, the study procedures included deans of nursing schools emailing the students requesting their participation, which limited any direct recruitment from the student researcher.

There were limitations identified within this study. Demographically, the sample was atypical of the nursing student population because it (a) recruited nursing students from one area of the country, southern Nevada, and (b) did not differentiate whether the students were enrolled in an accelerated vs. traditional nursing program. It is possible this could affect the generalizability of the findings. Self-report bias was a risk in this study; however, it was not feasible to capture observations of actual technology use due to varied environments of use, including clinical, lab, and classroom settings. Technology use is especially varied in clinical settings, where hospitals are not standard in providing access to their systems, and clinical faculty are inconsistent in incorporating technology into the learning setting (Elewa & El

Guindy, 2017; Forman et al., 2020; Kleib & Nagle, 2018; Roney et al., 2017). Additionally, the number of technologies used in these multiple settings is vast, thus, making the measurements of technology experiences complex and unpredictable.

Some students in this study were impacted by limited on-site clinical opportunities due to the COVID-19 pandemic early in their programs. In some cases, this meant substituting some clinical hours with virtual simulation software cases, such as i-Human. This may have limited opportunities for nursing students to experience healthcare technology in the clinical setting, which could impact the study results' generalizability.

The recruitment strategy in this study involved emailing electronic surveys requesting participation. The survey length was a total of 117 items, the length of which may have contributed to the failure of 19 respondents to complete the survey in its entirety. Shorter versions of the Technology Acceptance Questionnaire and the P.A.T.C.H. are available and might have increased student completion.

Recommendations for Future Research

This study explored whether technology acceptance, positive attitudes toward technology, self-efficacy, and increased experiences with technologies contributed significantly to nursing students' technology readiness. Suggestions for future research include using schools of nursing from different parts of the United States and differentiating whether students were enrolled in accelerated vs. traditional nursing programs as this may impact the results. The rate at which a program accelerates may impact opportunities and time to utilize healthcare technologies in school. Future studies should also include the ability to observe and document the specific healthcare technologies used, when in the program they were used, and how much use for a more accurate depiction of technology experience rather than self-reported use.

Another recommendation for future research includes determining effective healthcare technology education delivery methods and the optimal amount of time dedicated to hands-on experiences. For example, virtual reality systems have recently been introduced in nursing education and could provide a simulated experience of technology use (Chen et al., 2020; Choi et al., 2022). Also, a determination of whether healthcare technology education should have dedicated hours applied to it through a clinical lab experience for selected courses and if it should be tracked similarly to a nursing fundamentals skill.

Technology is ever-changing as newer concepts of artificial intelligence, machine-learning, and interoperability become of focus in healthcare information systems. This requires having a constant pulse on how users' behaviors and feelings change in response to new implementations of these technologies in the healthcare setting. Bridging the gap between nursing education and the technology-laden healthcare environment is essential, and effective technology training should be incorporated in nursing programs.

Conclusion

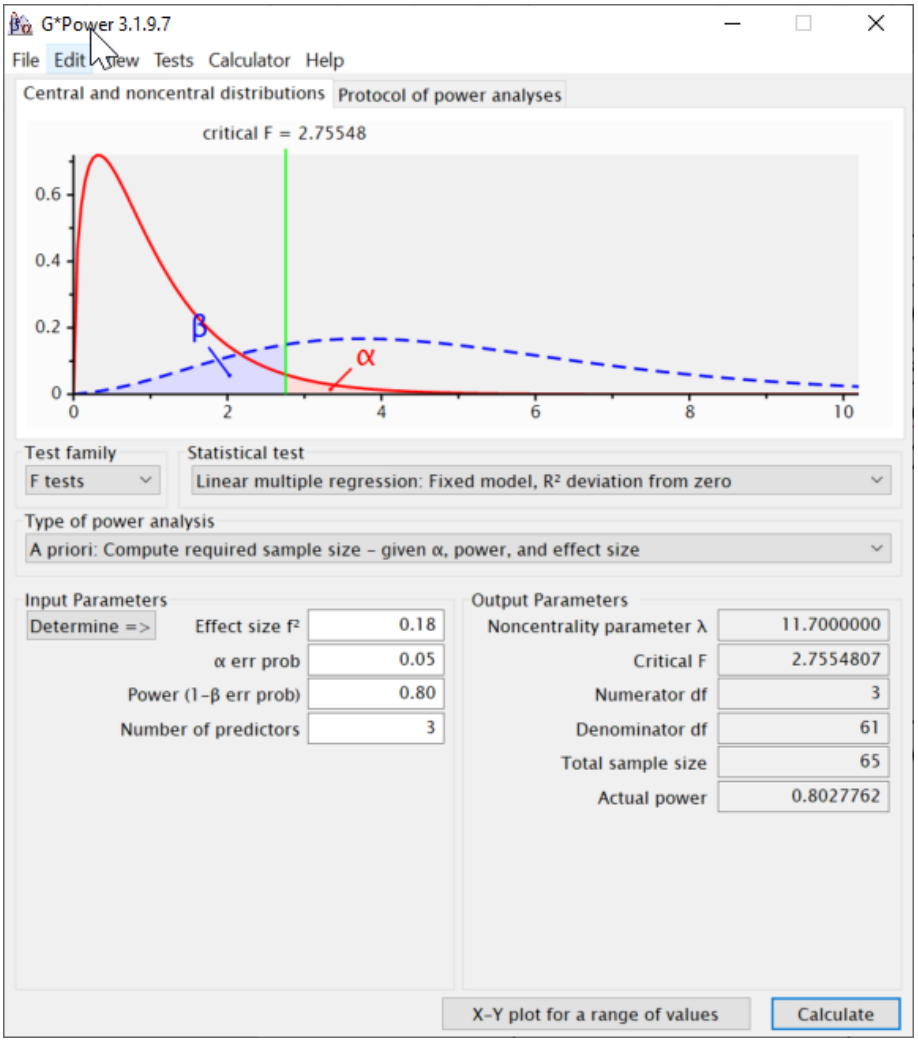
This quantitative non-experimental design aimed to investigate the factors that influence technology acceptance, attitudes, self-efficacy, and experience on technology readiness in pre-licensure nursing students using a comprehensive approach. This study was unique because it determined the influence of multiple predictive factors and the extent of influence of mediating factors between technology experiences and technology readiness while including a vast array of healthcare-related technologies recommended by nurse experts. As a result of this study, it is evident that personal factors, such as technology experience, influence pre-licensure nursing students' technology readiness and are further influenced by process of change feelings, such as technology acceptance and attitudes. Employers have reported that nursing students are entering

the workforce unprepared to use healthcare technologies, putting patients at risk as safety-nets are underutilized and quality of care is lacking. Nursing schools are responsible for preparing competent nurse graduates to deliver safe care; therefore, it is vital that healthcare technology education is included in nursing education.

This study demonstrated that hands-on technology experiences influence how nursing students feel towards them, thus predicting their readiness to use the technologies before graduating from school. The results suggest that nursing programs should establish curricula emphasizing the importance of these tools and invest in training and resources to provide for more hands-on experiences. The delivery method of such technology education should be further explored in future research with the aim of establishing successful, technology-ready nurse graduates.

Appendix A

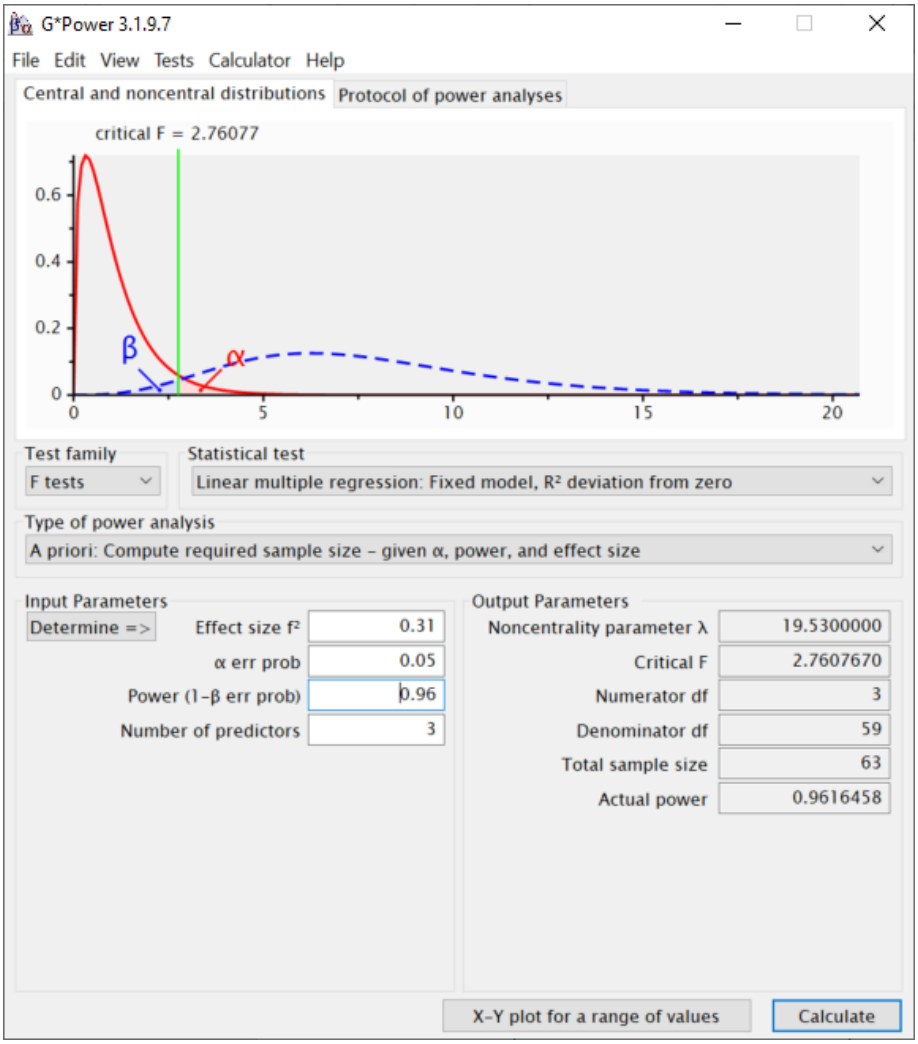
Figure 7. Sample Size Power Analysis for H^1 Using G*Power



Note. G*Power 3 Statistical Software for Sample Analysis (Faul et al., 2007).

Appendix B

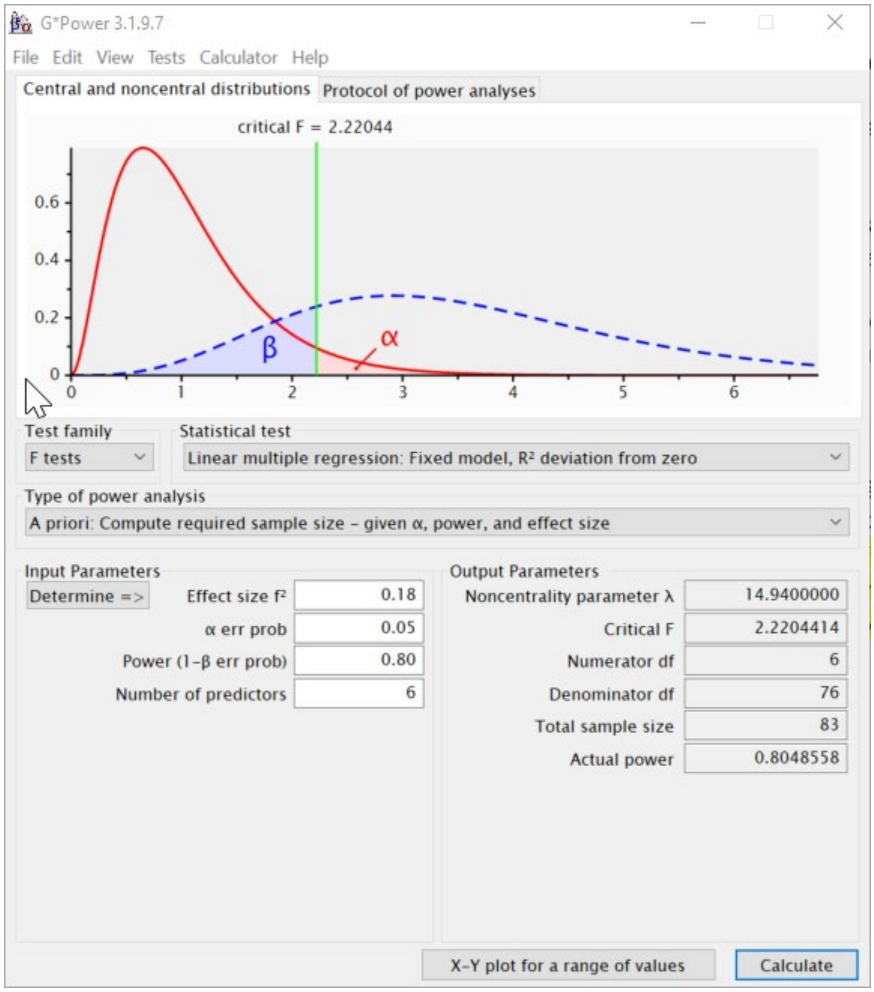
Figure 8. Sample Size Power Analysis for H^2 Using G*Power



Note. G*Power 3 Statistical Software for Sample Analysis (Faul et al., 2007).

Appendix C

Figure 9. Sample Size Power Analysis for H^3 Using G*Power



Note. G*Power 3 Statistical Software for Sample Analysis (Faul et al., 2007).

Appendix D

IRB Approval Letter

ORI-HS, Exempt Review
Exempt Notice

DATE: November 9, 2022

TO: Karyn Holt
FROM: Office of Research Integrity – Human Subjects

PROTOCOL TITLE: UNLV-2022-494 RELATIONSHIPS BETWEEN HEALTHCARE TECHNOLOGY EXPERIENCE, ACCEPTANCE, ATTITUDES, SELF-EFFICACY AND READINESS IN PRE-LICENSURE NURSING STUDENTS
SUBMISSION TYPE: Initial

ACTION: Exempt
REVIEW DATE: November 9, 2022
REVIEW TYPE: EXEMPT
REVIEW CATEGORY: Category 2.(i). Research that only includes interactions involving educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures, or observation of public behavior (including visual or auditory recording).
The information obtained is recorded by the investigator in such a manner that the identity of the human subjects cannot readily be ascertained, directly or through identifiers linked to the subjects.

This memorandum is notification that the protocol referenced above has been reviewed as indicated in Federal regulatory statutes 45 CFR 46 and deemed exempt under category 2(i) as noted in the Review Category.

PLEASE NOTE:

- **Prior to the start of your study, please list the PI on the recruitment materials. After including the PI on the recruitment material then you can start your study.**

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

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

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

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

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

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

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

Office of Research Integrity – Human Subjects
4505 Maryland Parkway . Box 451047 . Las Vegas, Nevada 89154-1047
(702) 895-2794 . FAX: (702) 895-0805 . IRB@unlv.edu

Appendix E

Request for Approval to Deans

Dear Dean,

My name is Emily Boyce and I am a Ph.D. candidate from the University of Nevada, Las Vegas. I am contacting you to share with you my dissertation topic and request your approval to recruit your pre-licensure BSN students in a UNLV IRB approved research study comprised of a 20-25 minute electronic survey to investigate the predictors of healthcare technology readiness.

This study's target population is final term (session/semester) pre-licensure BSN students from Arizona College, Chamberlain University, Nevada State College, Roseman University, Touro University, and UNLV.

The purpose of my study is examine the factors that predict healthcare technology readiness in final term pre-licensure nursing students.

I am requesting the attached "Recruitment Letter" is sent to your graduating students via listserv or email in January.

After reading through the materials, and if you agree in my engaging with your students to participate in this survey, could you please indicate your approval via email AND provide a designee contact email so that I may request they send the recruitment emails in January?

Thank you for considering this opportunity to contribute to this research.

Sincerely,

Emily Boyce MSN, RN-BC, NE-BC, Ph.D.(c) – Student Investigator

Karyn Holt Ph.D., RN, ANEF, CNM – Principal Investigator
Professor, UNLV School of Nursing
Karyn.holt@unlv.edu
Attached: Recruitment email, Survey questions, and IRB approval letter.

Details: This study will examine the factors that predict healthcare technology readiness in final term pre-licensure nursing students. Five Southern Nevada nursing schools have been identified as the sample population in order to achieve generalizable results; however, the results will not identify individual schools in publication or presentation through any comparison. Schools will be identified as University A, University B, etc.

The initial recruitment email is planned to be sent on Tuesday, January 10 with a reminder email sent the following week, Tuesday, January 17. I would like to work directly with your designee who will send the recruitment emails to the nursing student listserv/distribution list. Screening questions in the survey will determine the student's eligibility and their consent to participate.

Those students completing the survey will have the opportunity to enter a drawing for an Apple iPad.

Appendix F

Recruitment Email to Students

Dear BSN Nursing Students:

I am contacting you today to invite you to participate in a research study of last term nursing students. The purpose of the study is to examine the factors that predict healthcare technology readiness in pre-licensure nursing students. Technology readiness is defined as the tendency of healthcare workers to adopt and effectively use new healthcare technologies to accomplish goals in their workplace. This is voluntary and you are not required to participate and not participating will not affect your academic status at the school in which are enrolled.

Participants of this study will be entered into a drawing to win an Apple iPad.

To be eligible to participate, you must be enrolled in the final-term of your pre-licensure BSN nursing program and be age 18 years or older. Nursing students who currently work as Licensed Practical/Vocational Nurses (LPN/LVN) are not eligible to participate.

If you choose to participate, you will be asked to complete a brief demographic form and an electronic survey. Your involvement with the study should take no more than 20-25 minutes of your time. Confidentiality will be strictly maintained, and no personally identifying information will be collected or reported. Your participation in the research is completely voluntary and you may change your mind at any time, and you have the right to withdraw. Please click the link to access the survey.

Hyperlink to survey

To find out more about this study, you may contact me directly at boycee1@unlv.nevada.edu.

Thank you for considering this opportunity.

Sincerely,

Emily Boyce MSN, RN-BC, NE-BC, PhD(c)

Appendix G

Informed Consent

EXEMPT RESEARCH STUDY
INFORMATION SHEET

Department of Graduate Nursing

Title of Study: ***RELATIONSHIPS BETWEEN HEALTHCARE TECHNOLOGY EXPERIENCE, ACCEPTANCE, ATTITUDES, SELF-EFFICACY AND READINESS IN PRE-LICENSURE NURSING STUDENTS***

INVESTIGATOR(S) AND CONTACT PHONE NUMBER:

Student Investigator (SI)	**Principal Investigator (PI)**
Emily L. Boyce MSN, RN-BC, NE-BC Ph.D. Candidate School of Nursing University of Nevada, Las Vegas 1075 Sonoran Hope Ct Henderson, NV 89062 702-439-0989 boycee1@unlv.nevada.edu	Karyn Holt Ph.D., RN, ANEF, CNM Professor School of Nursing University of Nevada, Las Vegas 4505 S. Maryland Parkway Box 453018 Las Vegas, NV 89154-3018 702-895-3360 karyn.holt@unlv.edu

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The purpose of the study is to examine the factors that predict healthcare technology readiness in pre-licensure nursing students. Technology readiness is defined as the tendency of healthcare workers to adopt and effectively use new healthcare technologies to accomplish goals in their workplace.

You are being asked to participate in the study because you meet the following criteria: You are a student currently enrolled in the last term of a prelicensure BSN nursing program. The students represent those in their final term of nursing school to capture participants who have had opportunities to use healthcare technology.

If you volunteer to participate in this study, you will be asked to do the following: You will be asked to take an electronic survey. You will be asked to agree to the informed consent, and then

will be presented with screening questions. Answers to the screening questions may exclude you from the study, and the survey will end. Next, three (3) demographic questions followed by questions related to your experience, acceptance, attitudes, self-efficacy, and readiness related to the use of healthcare technology. The survey will end as will your participation in this study. Lastly, you will click on a link that will take you to a separate survey to enter your email address and indicate if you want to be included in the Apple iPad drawing and/or receive results of the study, and to be sent a copy of the informed consent. If you are the winner of the Apple iPad, I will notify you via email to schedule delivery.

This study includes only minimal risks. The study will take 20-25 minutes of your time. You *will not* be compensated for your time.

For questions regarding the rights of research subjects, any complaints or comments regarding the manner in which the study is being conducted you may contact **the UNLV Office of Research Integrity – Human Subjects at 702-895-0020, or via email at IRB@unlv.edu.**

Your participation in this study is voluntary. You may withdraw at any time. You are encouraged to ask questions about this study at the beginning or any time during the research study.

Participant Consent:

☐ I have read the above information and agree to participate in this study. I have been able to ask any questions I have about the research study. I am at least 18 years of age.

☐ I do NOT agree to participate in the research study.

A copy of the informed consent will be sent to the email that you type at the end of the survey.

After completing the informed consent, you will be redirected to three demographic questions followed by the modified Technology Acceptance Model Questionnaire, the Pretest for Attitudes Toward Computers in Healthcare assessment scale, the Technology Self-Efficacy Scale, the modified Technology Readiness Index, and the Healthcare Technology Experience Questionnaire.

Appendix H

Screening and Demographic Questionnaire

Are you currently enrolled in the last term (i.e. semester, session) of a BSN pre-licensure nursing program?

- Yes
- No

Are you at least 18 years of age?

- Yes
- No

Are you currently working as Licensed Practical/Vocational Nurses (LPN/LVN)?

- Yes
- No

What is your age range?

- 18-25
- 26-35
- 36-45
- 46-55
- Over 55

Gender:

- Male
- Female
- Non-Binary
- Prefer not to say

What is your highest education attained prior to entering nursing school?

- high school
- post-secondary degree

Appendix I

Modified Technology Acceptance Model Questionnaire

(Lah et al., 2020)

The Technology Acceptance Model (TAM) is designed to give you an opportunity to rate this product's usefulness and easy-of-use. To as great an extent as possible, think about all of the tasks that you do with technology while you answer these questions.

Please read each statement and indicate how strongly you agree or disagree with the statement. Please read the statements carefully, but don't spend a lot of time on each item – your first impression is fine.

Please indicate the extent to which you agree with the following statements where 1 = Extremely disagree and 7 = Extremely agree.

	Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree
1. Using technology in my job enables me to accomplish tasks more quickly.							
2. Using technology improves my job performance.							
3. Using technology increases my productivity.							
4. Using technology enhances my effectiveness.							
5. Using technology makes it easier to do my job.							
6. I have found technology useful.							

7. Learning to operate technology is easy for me.							
8. I found it easy to get technology to do what I want it to do.							
9. My interaction with technology has been clear and understandable.							
10. I found technology to be flexible to interact with.							
11. It was easy for me to become skillful at using technology.							
12. I found technology easy to use.							

Appendix J

Pretest for Attitudes Toward Computers in Healthcare Assessment Scale (PATCH) v. 3

(Kaminski, 2013)

Directions: Each indicator is to be rated using a five-point Likert scale. Choose the response that best reflects your attitude for each statement.

	Agree strongly	Agree	Not certain	Disagree	Strongly Disagree
1. The computer is a powerful enabling tool.					
2. In healthcare, computers could save a lot of paperwork.					
3. Machines and I don't mix.					
4. I feel I am a skilled typist.					
5. I feel alarmed when I think of using a computer					
6. I have excellent finger dexterity					
7. I regularly use a computer at home.					
8. I would love to be a proficient user of computers.					
9. Bedside computers will irritate patients.					
10. I will never feel relaxed about using a computer.					
11. Computers can help me to be creative.					

12. I would enjoy learning course work using a computer program.					
13. Computers are frustrating to use.					
14. Listening to people using computer jargon intimidates me.					
15. Computers will someday put health professionals out of a job.					
16. I am in control when I use a computer.					
17. I relate well to technology and machines.					
18. I feel confident that I can master using a computer.					
19. 9. I can let my creativity flow when writing using a computer.					
20. . Computers in healthcare will create more work for nurses.					
21. Computers can be great problem-solving tools.					
22. Computers are too complicated for me to learn well.					
23. Computers are impersonal and dehumanizing.					
24. The future promise of computers in healthcare excites me.					

25. I feel restless and confused when I think of using a computer.					
26. I don't intend to own a home computer					
27. I feel a computer course in nursing is totally unnecessary.					
28. People who like computers are introverted and antisocial.					
29. I know more about computers than most faculty or administrators do.					
30. Working with computers is boring and tedious.					
31. I can easily master the content of a computer lesson.					
32. I feel ambivalent about computers and technology.					
33. Computers are everywhere, it is natural for them to used in healthcare.					
34. I like to use the Internet to research health and nursing information.					
35. It takes longer to chart on the computer than on paper.					
36. I enjoy using technology to communicate with colleagues (email, etc.)					

37. Computers help me to keep up to date with nursing issues, knowledge, research.					
38. Computers are just another object that takes me away from my patients.					
39. I resent the thought of having to use computers in my nursing practice.					
40. Using technology in practice interferes with my ability to be caring to my patients.					
41. Patients should not look for health and illness information on the Internet.					
42. Social media tools enrich health care professional communication and collaboration.					
43. I use health care apps on my cellphone or SMART phone.					
44. Nursing related online groups, forums, and email discussion lists are a waste of time.					
45. Electronic charting restricts how nurses record patient care.					
46. Personalized Electronic Health Records streamline access to information and					

interdisciplinary communication about patients.					
47. Online support groups are a waste of time and have no value for patients.					
48. Computers are great tools for patient education.					
49. Handwritten charting is much more complete than electronic documentation					
50. Nurses should be involved in the planning of national Electronic Health Records.					

Appendix K

Technology Self-Efficacy Scale

(Kass, 2014)

Directions: Read each statement and rate each item on a 7-point scale from “Strongly disagree” to “Strongly agree.”

Please indicate how confident you are in your ability to use each of the following technologies.

	Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree
1. I feel confident in my ability to use social media to have meaningful interactions.							
2. I feel confident in my ability to use technology for entertainment.							
3. I feel confident in my ability to use Internet tools to conduct research and find trustworthy articles on a topic.							
4. I feel confident in my ability to use technology to create an engaging presentation.							
5. I feel confident in my ability to use new applications on my smartphone or tablet.							

Appendix L

Technology Readiness Index 2.0

(Parasuraman & Colby, 2015)

These questions comprise the Technology Readiness Index 2.0 which is copyrighted by A. Parasuraman and Rockbridge Associates, Inc., 2014. This scale may be duplicated only with written permission from the authors."

We are interested in your views on how technology influences your life. Please indicate how much you agree with the following statements.

Please indicate the extent to which you agree with the following statements where 1 = Strongly disagree and 5 = Strongly agree.

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1. New technologies contribute to a better quality of life.					
2. Technology gives me more freedom of mobility.					
3. Technology gives people more control over their daily lives.					
4. Technology makes me more productive in my personal life.					
5. Other people come to me for advice on new technologies.					
6. In general, I am among the first in my circle of friends to acquire new technology when it appears.					
7. I can usually figure out new high-tech products and services without help from others.					
8. I keep up with the latest technological developments in my areas of interest.					

9. When I get technical support from a provider of a high-tech product or service, I sometimes feel as if I am being taken advantage of by someone who knows more than I do.					
10. Technical support lines are not helpful because they don't explain things in terms I understand.					
11. Sometimes, I think that technology systems are not designed for use by ordinary people.					
12. There is no such thing as a manual for a high-tech product or service that's written in plain language.					
13. People are too dependent on technology to do things for them.					
14. Too much technology distracts people to a point that is harmful.					
15. Technology lowers the quality of relationships by reducing personal interaction.					
16. I do not feel confident doing business with a place that can only be reached online.					

Appendix M

Modified Technology and Computer Experience Profile

The purpose of this set of questions is to assess your familiarity and experience with technology. Please indicate your choice of response by marking one response.

1. Within the last year, please indicate how much you have used any of the technologies listed

	Not sure what it is	Not used	Used once	Used occasionally	Used frequently
Healthcare Technologies					
1. Blood pressure monitor					
2. Digital Thermometer					
3. Electronic Health Record					
4. Medication Dispensing Machine (ex. Pyxis)					
5. Call light system					
6. Central supply scanning					
7. Blood sugar machine/Glucometer					
8. Telemetry monitor					
9. Ventilator					
10. Pulse Ox					
11. IV Pump					
12. PCA (Patient Controlled Analgesia)					
13. IV Pump					
14. Beds (alarms and positioning)					
15. Weight Scale					
16. Bladder Scanner					
17. Telehealth Software					
18. Push-to-talk wearable communication devices (Vocera)					
19. Specimen collection printer					
Other Technologies					
20. Desktop/Laptop Computer					
21. Tablet Computer (iPad, Touchpad)					
22. Smartphone					

23. Fax Machine					
24. Copier					
25. Online calendar scheduling					
26. Group text chat					
27. Fax Machine					
28. Social Networking (Instagram, Facebook)					
29. Productivity Software (Excel, PowerPoint, Word)					
30. Email					
31. Video Conferencing					

Appendix N

Permission to Use the Modified Technology Acceptance Questionnaire

From: James Lewis <drjimnfl@gmail.com>
Sent: Thursday, August 25, 2022 8:02 PM
To: Emily Boyce <boycee1@unlv.nevada.edu>
Subject: Re: modified technology acceptance model questionnaire - permission

Yes. You have permission to use any of my published standardized questionnaires as needed for your research. Good luck!

Jim Lewis

On Thu, Aug 25, 2022 at 12:31 PM Emily Boyce <boycee1@unlv.nevada.edu> wrote:

> Dr. Lewis,
> My name is Emily Boyce. I am a PhD student at University if Nevada, Las Vegas. I am writing to request written permission to use your modified technology acceptance model questionnaire in my research study. Thank you in advance for your reply.
>
> Sincerely,
> Emily Boyce MSN, RN-BC, NE-BC, PhD(c)

Appendix O

Permission to Use P.A.T.C.H. Assessment Scale v.3

From: June Kaminski <june@nursing-informatics.com>
Sent: Tuesday, July 19, 2022 1:48 PM
To: Emily Boyce <boycee1@unlv.nevada.edu>
Subject: Re: Requesting permission to use P.A.T.C.H. scale
Importance: High

Hello Emily,

You have my permission to use the PATCH in your research.

Good luck with your studies. I would love to read your final work.

All the best,

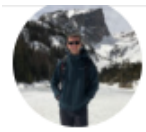
June
June Kaminski RN MSN PhD(c)
Nursing Informatics.com
https://www.nursing-informatics.com
Editor in Chief
Canadian Journal of Nursing Informatics
https://cnji.net
Editor in Chief
Online Journal of Nursing Informatics
https://www.himss.org/ojni

On 2022-07-18 14:52, Emily Boyce wrote:

> Good afternoon,
> My name is Emily Boyce. I am a PhD student at University if Nevada, Las Vegas. I am writing to request written permission to use your P.A.T.C.H. Scale in my research study. Thank you in advance for your reply!
>
> Sincerely,
> Emily Boyce MSN, RN-BC, NE-BC, PhD(c)

Appendix P

Permission to use the Technology Self-Efficacy Scale



Kenneth Kass, PhD · 1st

Executive Vice President of Information Technology at Endeavor Schools

AUG 24

Emily Boyce MSN, RN-BC, NE-BC, PhD(c) • 4:01 PM

Technology Self Efficacy Scale permission

My name is Emily Boyce. I am a PhD student at University if Nevada, Las Vegas. I am writing to request written permission to use your Technology Self Efficacy Scale in my research study. Thank you in advance for your reply.

Sincerely,

Emily Boyce MSN, RN-BC, NE-BC, PhD(c)

Kenneth Kass, PhD • 7:07 PM

Hi! Sure thing, thanks for asking. Let me know if I can do anything to help you. Good luck in your research!

Appendix Q

Permission to Use the Technology Readiness Index 2.0

From: Charles Colby <ccolby@rockresearch.com>
Sent: Sunday, August 28, 2022 2:18 PM
To: Emily Boyce <boycee1@unlv.nevada.edu>
Subject: RE: [EXTERNAL] Technology Readiness Index 2.0 permission

Hello Emily, the paperwork looks good. You now officially have a license to use the TRI 2.0 for your academic study. As a resource, I am providing a list of scale items and recommendations on fielding. Let me know if you have any questions.

Regards,

Charles L. Colby
Principal, Chief Methodologist and Founder
Office: 703 757 5213 ext. 112
10130 G Colvin Run Road, Great Falls, VA 22066
www.rockresearch.com | ccolby@rockresearch.com

From: Emily Boyce <boycee1@unlv.nevada.edu>
Sent: Sunday, August 28, 2022 4:33 PM
To: Charles Colby <ccolby@rockresearch.com>
Subject: Re: [EXTERNAL] Technology Readiness Index 2.0 permission

Thank you for the information. Attached is the signed agreement. I appreciate the support and ability to use to scale.

Appendix R

Terms of Use Agreement of the Technology Readiness Index 2.0

TERMS OF USE OF THE TECHNOLOGY READINESS INDEX 2.0 BY A. PARASURAMAN AND ROCKBRIDGE ASSOCIATES, INC.

(July 23, 2014)

Thank you for your interest in our Technology Readiness Index (TRI). The scale is available in two versions:

1) A full 16 item scale used for studies focusing primarily on technology readiness (TR); this scale provides measures on four TR dimensions, optimism, innovativeness, discomfort and insecurity;

2) A 10 item scale for studies where TR is one of the variables for the analysis, but not the main focus of the research; the 10 item scale allows you to create an overall measure of TR and classify respondents into one of five technology belief segments;

To use the TRI, you need to do the following:

- Review the terms and conditions below;
- Email, Fax, mail or courier the document with a signed order form;
- We will send back the scale questions and instructions for using the scale;
- You collect the data and apply the analysis as indicated in our directions;
- We will provide you with normative data from our latest National Technology Readiness Survey and if you desire, will classify your respondents into technology belief segments for you.

If you have questions, contact:

Charles L. Colby
Principal, Chief Methodologist and Founder
Rockbridge Associates, Inc.
703-757-5213, x12
10130 G Colvin Run Road
Great Falls, VA 22066
ccolby@rockresearch.com

TERMS AND CONDITIONS

The technology readiness index by A. Parasuraman and Rockbridge Associates, Inc. is copyrighted and may be used only with written permission. Commercial users are typically charged a fee for the use of the scale, but we will grant a free license to academic researchers subject to some conditions. These conditions are as follows:

First, you need to guarantee that this is for scholarly research only and not part of a commercial consulting project.

Second, the license is for a one-time use. In the event you need to use the scale again for tracking, you will need to get permission from us in writing again. We will most likely grant this permission if there is a need for scholarly research.

Third, we ask that you acknowledge the copyright by footnoting the scale questions with the following note: "These questions comprise the Technology Readiness Index 2.0 which is copyrighted by A. Parasuraman and Rockbridge Associates, Inc., 2014. This scale may be duplicated only with written permission from the authors." This footnote should be inserted in working documents of your survey and published versions of the questionnaire and/or questions. We do not expect you to display the footnote on actual versions shown or read to survey respondents.

Fourth, we would like to be kept informed of what you are learning, including receiving copies of any publishing resulting from your work.

Fifth, if it is acceptable to you, we would like to receive a copy of the dataset in SPSS, Excel or other easily readable electronic format. This is optional. There is no need to identify the survey respondents for a confidential survey.

Sixth, for non-English versions of the study, we ask for a copy of the translation and permission to use the instrument for our own research.

I have read the above terms and conditions and would like to license the TRI 2.0 Index. Please send me the scale and instructions for use, along with an invoice (if applicable).

Emily Boyce Emily Boyce Student Researcher 8/28/22

Signature Name/Title Date

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MS in Nursing Informatics, May 2010 – UNIVERSITY OF MARYLAND, Baltimore, MD
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BS in Nursing, May 2003 – THE COLLEGE OF NEW JERSEY, Ewing, NJ
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LICENSURE:

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Hospital Corporation of America (HCA) Corporate, Nashville, TN
Jan 2015 - July 2016
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Jun 2007 – Jan 2008
Registered Nurse, Critical Care

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HONORS/AWARDS:
Sigma Theta Tau Nursing Honor Society/Early induction Top 5% of Junior class
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Professional Nursing Organization of Students Leadership Award

MEMBERSHIPS/AFFILIATIONS:
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PRESENTATIONS:
Next Gen Learning Conference: NurseThink for Nurse Educators (2023) – Poster Presentation "Technology Readiness of Pre-licensure Nursing Students"
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Clinical Care Classification Conference w/Dr. Virginia Saba (2016) – Presenter "Evidence Based Documentation Education Approach"