8-1-2018

Electronic Health Record Instruction in First-Semester Nursing Students: A Comparative Study

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ELECTRONIC HEALTH RECORD INSTRUCTION IN FIRST-SEMESTER NURSING STUDENTS: A COMPARATIVE STUDY

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August 2015

A dissertation submitted in partial fulfillment
of the requirements for the

Doctor of Philosophy – Nursing Education

School of Nursing
Division of Health Sciences
The Graduate College

University of Nevada, Las Vegas
August 2018

UNLV | GRADUATE COLLEGE

Dissertation Approval

The Graduate College
The University of Nevada, Las Vegas

July 25, 2018

This dissertation prepared by

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entitled

Electronic Health Record Instruction in First-Semester Nursing Students: A Comparative Study

is approved in partial fulfillment of the requirements for the degree of

Doctor of Philosophy – Nursing Education
School of Nursing

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Abstract

The use of health information technology has been shown to have positive effects on patient outcomes and provider efficiency. New nurses make more than half of the 7 million life-threatening medication errors that occur each year, and electronic health records (EHRs) have been shown to significantly reduce these errors. Nurses now are expected to enter practice with a solid foundation in health information technology and the use of the EHR. Unfortunately, the vast majority of nursing schools do not specifically train their students in effective EHR utilization. Academic EHRs (AEHRs) are software packages with learning features that can be incorporated in the classroom, simulation, and skills labs. Existing studies have only examined student preferences for their use, with little or no data on improvement in quantifiable outcomes. The purpose of this study was to investigate if the use of an AEHR improved self-efficacy, reduced anxiety, and enhanced competence compared to a traditional PowerPoint presentation on EHR usage. Bandura's social cognitive theory was the guiding framework of this study.

This study used a quasi-experimental design with first-semester students enrolled in a Baccalaureate of Science in Nursing (BSN) program. The control group received EHR instruction in a traditional 1-hour PowerPoint lecture. The intervention group received a 1-hour instructional session using and navigating in an AEHR (Lippincott DocuCare). Pre- and postinstruction measures and surveys showed undergraduate nursing students who received hands-on AEHR instruction had increased self-efficacy, less anxiety, and increased competency compared to peers who received the traditional instruction. The results of this study indicate that the use of an AEHR in nursing curricula may be a more effective teaching strategy to improve students' self-efficacy, anxiety, and competency.

Acknowledgments

A sincere thank you to my committee: Dr. Lori Candela (my chair), Dr. Catherine Dingley, Dr. Carolyn Yucha, and Dr. Joseph Morgan. Dr. Candela, you are one of the most inspirational educators and mentors I have ever known. You inspired me to study harder and want to learn more. I did not plan to continue my education after my master's degree; however, you opened the door to my PhD journey and gave me a little push through it…thank you! Dr. Dingley and Dr. Yucha, thank you for your mentoring and ongoing encouragement. Dr. Morgan, I appreciate your patience and support as you guided me through the statistical analyses.

I also would like to extend a heartfelt thank you to my family and friends. To my husband, Jack, you stood by my side throughout this entire journey, never letting me give up. Everything I have accomplished and the person I have become are because of you. To my daughters, Darby and Haley, you inspired to me to be a better role model for you. I hope you have learned that with dedication and perseverance, goals can be reached and the glass ceiling shattered! To my friends, who are my chosen family, there are no words to describe my appreciation for all the love and support you have provided over the last four years during my master's and PhD. Each of you rallied around me when I was struggling with balancing day-to-day responsibilities, school, and my health. You provided me with strength and never let me fall.

Finally, a huge thank you to Eric Dettman. Without you, my research would not have been possible. You went above and beyond providing access to DocuCare and ongoing instructional support. I am so grateful to you for making all the trips to Las Vegas for each of my data collections to ensure everything went smoothly.

Dedication

I dedicate my research and dissertation to my husband, Dr. Jack Ruckdeschel. I believe our paths crossed many years ago at the right moment and for reasons God saw fit. You came into my life when I was broken and dealing with innumerable challenges. Your love and devotion brought me back to life. Going back to graduate school was a dream that I never thought would become a reality. You have always valued the importance of education and inspired the confidence in me to achieve my career and educational goals. You believed in me and gave me faith to believe in myself. I am a better person because of you. Thank you for supporting me during my master's degree and my PhD; I could not have done this without you. You have stood by my side cheering me on, giving me support when needed, and have loved me unconditionally (even when I was unbearable)! I appreciate everything you have sacrificed to see me through this journey. I love you with all my heart.

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Chapter 1: Introduction

The rapid proliferation of technologies to access, utilize, store, and communicate critical health care information and the demonstration that such technologies improve clinical outcomes (Health Information Technology, 2014) have resulted in health care employers expecting new nursing graduates to be competent in the use of an electronic health record (EHR; Gardner & Jones, 2012). According to Shin, Cummings, and Ford (2018), clinical nurse educators reported new nursing graduates were not proficient in the use of technology in acute care settings. Bembridge, Levett-Jones, and Jeong (2011) found that new nursing graduates reported they received health information-technology instruction in nursing school from nurse educators unfamiliar with health information systems and incongruent with EHR usage in their current work environment. In another study, more than three quarters of recent nursing graduates did not feel prepared to utilize an EHR for patient care (Candela & Bowles, 2008). According to Miller et al. (2014), only 20% of new nursing graduates reported having received EHR instruction during nursing school. In the past, only 1% of nursing programs provided technology education specific to the use of an EHR (Brooks & Erickson, 2012). Little has changed, as most nursing programs continue to acknowledge the need to integrate EHR education into the curricula (Miller et al., 2014).

Federal mandates and professional organizations such as the Institute of Medicine are the driving force behind the adoption of EHRs in clinical practice (Gardner & Jones, 2012). The Health Information Technology for Economic and Clinical Health Act of 2009 provided the U.S. government with the authority to aid in the progress and use of health information technology through programs such as Medicare and Medicaid (Gardner & Jones, 2012). The Health Information Technology for Economic and Clinical Health Act provided resources for

reimbursement through the Centers for Medicare and Medicaid Services (CMS) to qualified health care professionals and organizations that exhibit meaningful use (CMS, 2018). The CMS (2018) defined *meaningful use* as utilizing an approved EHR system to improve the quality of patient care, reduce errors, and promote optimal patient outcomes. Healthcare practices and institutions that fail to demonstrate meaningful use face deductions in reimbursement. In 2017, a 3% deduction in Medicare reimbursements was assessed on those institutions that had not adopted an EHR or did not demonstrate meaningful use (CMS, 2018). This deduction increased to 4% in 2018 and will continue to rise depending on future adjustments (CMS, 2018). The rapid advances in technology and the potential reimbursement implications of the Health Information Technology for Economic and Clinical Health Act of 2009 are rapidly making paper charts obsolete and skilled use within EHRs an expected practice imperative.

This chapter discusses the background of the topic and provides a description of the problem and its significance to nursing. Next, the application to nursing practice is explained. Lastly, the purpose of the study is identified, the research questions are listed, and definitions of theoretical and operational terms used in this study are provided.

Background and Statement of the Problem

Nurses are expected to have information literacy skills and to be able to provide evidence-based, safe, and competent care. The EHR is an essential part of health care and is elemental for compiling, saving, and retrieving patient data, as well as monitoring patient care and information (Jones & Donelle, 2011). Additionally, the EHR and electronic devices, such as smartphones, are replacing face-to-face communication and telephone calls, permitting communication among health care providers through e-mail or texts. This transformation in health care has created a profound need for nurses to be competent in information technology

and, in particular, the use of the EHR (Pilarski, 2010). In order to meet this need, nursing education must be transformed (Gardner & Jones, 2012). However, many nursing programs have continued with a traditional curriculum employing paper records (Lucas, 2010; Meyer, Sternberger, & Toscos, 2011). As a result, many nursing graduates are making the transition into clinical practice unprepared to use and navigate the EHR.

The EHR has become an essential part of health care and has been introduced as a means to enhance the quality of patient care by facilitating the delivery of safe and competent care, thereby improving the overall health of patients (Clarke et al., 2016). According to Bowman (2013), the purpose of EHRs is to decrease errors and promote patient safety. Despite these benefits, concerns remain regarding improper use or complications with the EHR system. For example, the selection of a wrong item in a drop-down list, mistakes related to the use of the copy/paste function, and software design glitches may result in clinical decision errors (Bowman, 2013; Lin, 2010).

New nurses make nearly 50% of the 7 million annual medication errors (Saintsing, Gibson, & Pennington, 2011). The proper use of an EHR has been shown to reduce medication errors by 50% compared to paper charting (Hinojosa-Amaya et al., 2016). However, exclusive dependence on the EHR to guarantee that no medication errors occur may create a false sense of security and lead to failure on the part of the nurse and health care institution (Linsky & Simon, 2013). Therefore, by increasing EHR knowledge, competency, and skill level, nurses will better understand health information systems used in the practice environment, making them more mindful, which could further prevent medication errors. Students must be properly educated and trained while in nursing school to prevent user error and recognize problems within the EHR before issues impact patient care (Bowman, 2013; Miller et al., 2014; Pilarski, 2010).

Nurses in the clinical setting, however, have reported limited confidence and competency in their use of EHRs (Schenk et al., 2016). Nurses who reported a lack of confidence in using an EHR demonstrated a lack of readiness and were less likely to utilize the technology correctly (Kuo, Liu, & Ma, 2013). This might be rooted in their lack of exposure to EHR training while in nursing school. Gardner and Jones (2012) stressed the importance of graduate nurses entering the workforce to be competent in computerized documentation and in navigating the EHR.

Significance of the Problem

Coupled with the federal mandates, many stakeholders including insurers, health care providers, hospital facilities, members of the nursing profession, and nurse educators recognize the need for EHR training to begin in nursing school; however, very few nursing schools have integrated this training into the curriculum (Pilarski, 2010). The American Association of Colleges of Nursing (AACN, 2008) published nursing baccalaureate essentials, and Baccalaureate Essential IV is Information Management and Application of Patient Care Technology: "Baccalaureate graduates must have competence in the use of information technology systems, including decision-support systems, to gather evidence and to guide practice" (p. 17). The Accreditation Commission for Education in Nursing (2017) Standard 4.1 states the nursing curriculum is to be consistent with contemporary practice. Additionally, the Technology Informatics Guiding Educational Reform (TIGER) Informatics Competencies Collaborative recommended all practicing nurses and nursing students demonstrate competency and literacy in basic computer skills and information management (TIGER, 2009). Furthermore, the National League for Nursing (2015) issued a call "to teach with and about technology to better inform healthcare interventions that improve healthcare outcomes and prepare the nursing workforce" (p. 4).

New nursing graduates need to be prepared to collect and document patient data in the EHR in order to provide a foundation for the health care team to make decisions. Additionally, advanced health care technology offers built-in safeguards within the EHR, which nurses must be able to recognize and use (Perry & King, 2009). As evidenced by the lack of formal EHR training, most nursing programs fall short in meeting these essential elements (Pilarski, 2010). As a result, new nursing graduates may enter practice unprepared to work effectively in this electronic medium, which ultimately may have a negative impact on the delivery of safe and efficient patient care. Considering the major role nurses have in patient care, efficiency in the use of an EHR is critical to providing nursing care. Nurses who have more knowledge regarding the use of an EHR have shown an increased readiness to use an EHR, a better attitude towards using an EHR, and more efficiency when using an EHR (Habibi-Koolaee, Safdari, & Bouraghi, 2015).

Quality and Safety Education for Nurses (2014) recognized nursing informatics as a competency for delivering safe and quality care. This competency defines knowledge, skills, and attitudes regarding the use of technology to be developed in pre-licensure programs. Documentation and planning of patient care within the EHR are necessary skills in achieving this competency (Gardner & Jones, 2012). New nursing graduates who lack the proper instruction in EHR use may be reluctant to document and utilize the EHR for additional resources, including its safeguards. The Joint Commission (2015) addressed safe use of health information technology, with actions centering on safety culture and process improvement. Besides having a negative impact on patient care, errors or missing documentation could lead to downward adjustments in reimbursement payments in the form of penalties from Medicare and Medicaid (Gardner & Jones, 2012). Moreover, failure to use this technology appropriately could result in

negative patient outcomes that also could lead to costly legal issues for nurses and their employers.

Thousands of patients die in hospitals each year due to preventable medical errors. Hinojosa-Amaya et al. (2016) reported the number of preventable deaths each year as between 44,000 and 98,000 patients. Millions of life-threatening medical errors occur each year, with many of these errors made by new nurses (Saintsing et al., 2011). These errors cost hospitals approximately $46 million per day, accounting for 16% of patient care costs (Zimmerman & House, 2016). According to the CMS (2012), an EHR "can improve patient care by reducing the incidence of medical error by improving the accuracy and clarity of medical records" (para. 3). Bonkowski et al. (2013) reported an 80.7% reduction in medication errors with the use of an EHR barcode-assisted medication-administration system. Therefore, the EHR is a critical tool for reducing errors in the clinical setting, improving patient safety, and enhancing the overall quality of care.

Application to Practice

The existing literature has offered little evidence to inform potential changes in technology use in the nursing curriculum (Miller et al., 2014; Spencer, 2012). However, stakeholders still expect nurses to be competent in the use of existing technology (Gardner & Jones, 2012; Herbert & Connor, 2016; Pilarski, 2010; Shin et al., 2018; Warboys, Mok, & Frith, 2014). Although researchers and practitioners have recognized that students need EHR instruction, studies exploring how nursing programs can modify their curricula to address gaps in technology competency are behind the curve of innovation (Brooks & Erickson, 2012; Meyer et al., 2011; Miller et al., 2014). The major difficulty with the literature in this area was the lack of studies on EHR instruction with quantifiable measures as outcome variables (Gomes, Linton, &

Abate, 2013). This study demonstrated quantifiable measurements to assist in informing changes in nursing curricula.

Purpose of the Study

One strategy to promote EHR competency within nursing education is the use of an academic EHR (AEHR; Brooks & Erickson, 2012; Gardner & Jones, 2012; Herbert & Connor, 2016; Meyer et al., 2011). The AEHR is an EHR software program with learning features that can be incorporated in the classroom or in a simulated fashion, so students can navigate and document in an EHR in a nonthreatening learning environment (Gloe, 2010). This study investigated whether AEHR instruction given to first-semester undergraduate nursing students using Lippincott DocuCare improved self-efficacy, reduced anxiety, and enhanced the EHR competence of first-semester nursing students when compared to a traditional lecture using a PowerPoint presentation on EHR usage. The purpose of this study was to provide data on which teaching approach is more effective at providing EHR instruction.

Research Questions

The core research question was the following: Is there a statistically significant difference in EHR self-efficacy, anxiety level, and competency between first-semester undergraduate nursing students who receive traditional EHR training and those who receive hands-on AEHR training utilizing the DocuCare system? Three specific research questions were addressed:

1. Are there significant differences in students' perceived EHR self-efficacy, anxiety, and competency before versus after receiving EHR instruction using the traditional lecture approach?

2. Are there significant differences in students' perceived EHR self-efficacy, anxiety, and competency before versus after receiving EHR instruction using a hands-on AEHR training approach?

3. What, if any, difference is there in the amount of change (post- minus presurvey score) in students' EHR self-efficacy, anxiety, and competency between the two instructional groups: (a) the control group receiving EHR training using the traditional lecture format and (b) the intervention group receiving hands-on AEHR training?

Definition of Terms

The following terms are theoretically defined followed by the operational definition. The definitions were established from recent literature.

Academic electronic health record (AEHR). An AEHR is a simulated and completely functional software system that students can employ to learn to navigate technology and document patient care (Gardner & Jones, 2012). For the purposes of this study, the AEHR utilized was Lippincott DocuCare, authored by Lippincott (2017) and published by Wolters Kluwer. Students navigated a fictitious patient chart within DocuCare to retrieve patient data.

Anxiety. Defined as a distressing state of mind causing worry, stress, and nervousness ("Anxiety," 2017), anxiety can affect feelings and behavior and can manifest physical symptoms (Hollenbach, 2016). For the purpose of this study, anxiety is the feeling of stress and nervousness that occurs when students are working within an EHR. Anxiety was defined and quantified using the six-item version of the State-Trait Anxiety Inventory (STAI-6; Marteau & Bekker, 1992; Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983).

Electronic health record (EHR). Defined as a computerized version of the traditional paper chart for a patient that includes health-related information (CMS, 2012). For purposes of this study, the EHR is technology students utilize on their assigned hospital ward to retrieve and record data on their assigned patient during clinical rotations.

EHR competency. This term is defined as assimilation of knowledge, skills, and approach in performing various tasks and EHR exercises as well as understanding the impact and effects technology has on nursing practice (Spencer, 2012). For the purpose of this study, EHR competencies are computer skills beginning nursing students exhibit, including searching for pertinent patient information and accessing data. This competency was defined and quantified using a researcher-adapted scavenger hunt assessment located in DocuCare (Lippincott, 2017).

First-semester nursing student. For the purposes of this study, a first-semester nursing student is an individual who has completed course requirements for admission into a nursing school and is in the first semester of the nursing program.

New graduate nurse. For the purpose of this study, a new graduate nurse is defined as an individual who has completed the required academic courses and clinical training ("Graduate Nurse," 2018) but has not received professional licensure.

Health information technology. This general concept embodies a variety of technologies for health care providers to store, examine, and share health information in an electronic environment (Health Information Technology, 2018). For the purpose of this study, health information technology includes the EHR.

Lippincott DocuCare. Lippincott DocuCare is an AEHR designed to educate students to about clinical documentation (Lippincott, 2017). The software may be referred to as simply DocuCare.

Navigation. This term is defined as moving around a computer screen by tapping computer keys and clicking on tabs or menus to activate menus or functions ("Navigation–Computer Definition," 2017). For the purposes of this study, navigation refers to moving around within the AEHR by clicking on tabs to retrieve patient data.

Nursing informatics. This term refers to the practice of utilizing nursing science and technology to improve the way data become knowledge to enhance patient care and outcomes (McGonigle, Hunter, Sipes, & Hebda, 2014). For the purpose of this study, nursing informatics is the fundamental computer knowledge and skills to communicate such as navigating the Internet and e-mailing, supporting decisions, and searching for patient-related information.

Paper charting. For the purposes of this study, paper charting is a handwritten version of a patient's medical record from a health care practitioner or institution.

Self-efficacy. This term is defined as the confidence and belief in one's ability to establish and carry out the necessary actions to succeed (Artino, 2012). For the purposes of this study, self-efficacy is the students' confidence and ability to believe they can successfully work and navigate within an EHR. Self-efficacy was defined and quantified using the Pretest for Attitudes Toward Computers in Healthcare (P.A.T.C.H. v.3) instrument (Kaminski, 2016).

Traditional instruction. For the purposes of this study, traditional instruction was a lecture with PowerPoint slides.

Summary

The time has come when everyone who delivers health care needs to utilize an EHR. Yet many nursing programs have not revised their curriculum to incorporate EHR training. The lack of knowledge regarding the use of an EHR puts new nursing graduates at a tremendous disadvantage as they enter the workforce. New nursing graduates often lack the knowledge and skill level vital to utilize an EHR to deliver safe and competent care. Stakeholders in many health care sectors expect nursing graduates to be proficient in EHR use and patient care technology. The responsibility of nurse educators is to provide students with all the tools and resources they need to succeed. Therefore, nursing programs need to consider the inclusion of this crucial

component of education to prepare graduates for practice (Gardner & Jones, 2012). The integration of EHR instruction has been investigated mostly qualitatively and infrequently researched looking at quantifiable student outcomes. Studies employing quantifiable outcomes to examine EHR teaching strategies are necessary to revise nursing curricula. Such research-based strategies are essential to have a nursing curriculum congruent with today's technology-driven health care environment.

Chapter 2: Review of Literature and Theoretical Framework

This chapter reviews the literature on integrating EHR training into the undergraduate nursing curriculum. The review utilized Cumulative Index to Nursing and Allied Health Literature (CINAHL), PubMed, and Cochrane Library. The review included scholarly journals, articles, books, and research studies from 2005 to 2018. The following keywords were used: *electronic health records in undergraduate nursing education, academic electronic health record, integrating electronic health record instruction in nursing curriculum*, and *nursing informatics competencies*. Overall, research studies investigating EHR use and student outcomes were extremely limited. Most articles were descriptive in nature, and several only examined student perceptions of the EHR. The literature was clear that new nursing graduates should enter the workforce fully prepared to competently use EHRs (Gardner & Jones, 2012; Pilarski, 2010; Warboys et al., 2014); however, studies were lacking to determine how to accomplish this task. Several themes were identified in the review of literature: (a) the impact of technology, (b) the presence of a knowledge gap, (c) curriculum considerations, and (d) challenges and barriers.

Impact of Technology

Advances in technology are embedded in health care and have a tremendous effect on disease prevention and detection (Perry & King, 2009). These advances drive utilization of health care services and increase the demands on health care professionals to keep abreast of these changes. Information technology advances also have contributed greatly to providing ready access to the changes in medical and nursing practice but, in turn, demand that nurses be able to utilize EHRs effectively and efficiently (Perry & King, 2009; Risling, 2017).

Nurses are interconnected with health information technology, including the EHR, as a fundamental component of daily nursing practice. Information and technology systems aid in

evidence-based practice and clinical decision-making (TIGER, 2010). EHRs can improve critical thinking and clinical reasoning by new graduate nurses (Pilarski, 2010). EHR systems have the capacity to alert nurses to potential patient care conflicts as well as provide resources for referencing diagnoses and medications (Health Information Technology, 2018; Lucas, 2010). These built-in safety mechanisms aid nurses and other health care professionals in reducing errors leading to improving patient outcomes (Health Information Technology, 2018; Lucas, 2010). Nursing graduates therefore are expected to demonstrate competency in navigating and documenting data in an EHR when entering the workforce (Risling, 2017). Despite this expectation, many employers perceive new nursing graduates to be technologically unprepared (Herbert & Connor, 2016; Pilarski, 2010).

Health care facilities and professionals are now obligated to demonstrate meaningful use of EHRs or face reductions in Medicare reimbursement (Gardner & Jones, 2012). This potential penalty has accelerated implementation plans and, therefore, increased the need for nurses to be competent in the use of this technology. Technology has a tremendous impact on how nurses practice, reemphasizing the importance of educating students about informatics and EHRs (Meyer et al., 2011). The AACN (2008) reflected this in the 2008 revision of its *Essentials of Baccalaureate Education of Professional Nursing Practice* to require graduate nurses to be competent in patient care technology and information management. The National League for Nursing (2015) weighed in by issuing a call "to teach with and about technology to better inform healthcare interventions that improve healthcare outcomes and prepare the nursing workforce" (p. 4). Furthermore, TIGER (2010) Informatics Competencies for Every Practicing Nurse Collaborative recommended all practicing nurses and nursing students demonstrate competency

and literacy in basic computer skills and information management. TIGER (2010) identified five requirements for graduating nursing students to demonstrate their competency:

1. Establish the type and degree of the health information needed.
2. Obtain required health information competently and efficiently.
3. Analyze all health information as well as its origin to determine what information is relevant and of value.
4. Acquire the ability to use health information effectively in order to carry out particular tasks.
5. Assess the result of the application of the health information. (p. 9)

The various reports briefly described above show that EHR training is essential in essential in nursing education. Such training is likely to get even more emphasis as health care agencies convert to EHR.

Knowledge Gap

De Gagne, Bisanar, Makowski, and Neumann (2012) found a lack of general agreement between health information technologists and educators concerning the extent and timing of technology training in the nursing curriculum. Unlike many nurse educators, De Gagne et al. advised that nursing students should have a basic knowledge of computers before program entry and that more advanced technology skills, such as navigating and retrieving data from health information systems, be acquired before graduating from the nursing program. Early and continuous technology instruction throughout nursing school could bridge the gap between nursing education and professional practice, thereby improving the transition into a technology-driven work environment.

Nursing graduates should be proficient in EHR navigation and documentation as a requirement of all nursing programs (Pilarski, 2010). According to Lucas (2010), many nursing programs have not adopted EHR training into their curriculum "and continue to use paper charting as a means to instruct on documentation skills for assessment and medication administration" (p. e97). Furthermore, Candela and Bowles (2008) reported that 76% of recent nursing graduates did not feel that they were prepared to utilize an EHR for patient care. Nurses who are not able to utilize an EHR are at a tremendous disadvantage in the workplace (Gardner & Jones, 2012).

Nursing education must provide a curriculum that is congruent with the expected nursing practice environment (Brooks & Erickson, 2012; Lucas, 2010). The EHR is a vital element of nursing care. It would be difficult for a nurse to provide care without the use of an EHR, as it is the repository for all patient information (Bowers et al., 2011). Technology should not, however, be a source of increased stress or perceived as more work, hence the importance of integrating EHR instruction into nursing curricula (Lucas, 2010). Those involved with direct patient care must be able to understand the dynamics of an EHR and possess the skills to navigate it proficiently (Brooks & Erickson, 2012).

The TIGER Informatics Competencies Collaborative developed a model of nursing informatics competencies that includes basic computer skills and health information literacy and management (TIGER, 2010). A commonality among these competencies is for graduates to have a certain level of knowledge to effectively use an EHR when caring for patients (Gardner & Jones, 2012). In response to the lack of technology instruction in nursing education, many professional organizations and informatics experts have developed competency lists; however, these competencies still need to be integrated into nursing curricula (Gardner & Jones, 2012).

Taken together, these few studies demonstrated a knowledge gap among nursing educators about use of the EHR. Again, this gap must be addressed for nurses to provide safe, efficient, and effective care to patients.

Curriculum Considerations

Limited studies have reported the incorporation of EHR instruction in the curriculum. Jones and Donelle (2011) conducted a study to assess EHR usability among 13 undergraduate nursing students. Participants received a 10-minute overview of the EHR prior to the usability assessment. Following the overview, each student was given a task ranging from simple retrieval of patient information to documentation of patient care on a fictitious patient. Data collection occurred through a "think-aloud" protocol in which participants verbalized their thoughts and feelings as they navigated the EHR. Additionally, the participants completed an open-ended question survey allowing them to reflect on the experience. The results uncovered three recurring themes requiring further education and training including: (a) being a novice user, (b) threats to confidentiality and security, and (c) the need for repetition and practice (Jones & Donelle, 2011). Being a novice user was an interesting finding, as 12 of the 13 participants had self-reported as proficient or expert computer users prior to the study. Results also revealed security of patient information was an important learning objective. Jones and Donelle concluded that EHR use in student training proved to be an effective way to teach navigation and documentation.

Limitations of their study included small sample size and participant selection. Students volunteered; therefore, students who participated might have felt more confident in their computer skills. Additionally, the EHR chosen for Jones and Donelle's (2013) study highlighted only basic functions and might not reflect usability issues found in other EHRs. Even though the

fictitious patient scenario was an effective strategy, a usability assessment at an actual point of care might have identified other issues (Jones & Donelle, 2013).

Warboys et al. (2014) found that students and nurse educators had problems accessing the EHR in the clinical setting due to lack of computers and restrictions placed on students and instructors. Baillie, Chadwick, Mann, and Brooke-Read (2013) conducted a survey and found that feedback and evaluation of a student's charting during clinical rotations may be limited due to time constraints, which do not allow students to learn best practices in electronic documentation.

Gardner and Jones (2012) reported that integrating an AEHR into the curriculum allowed the students to practice and receive feedback in a lower stress environment than actual clinical practice. However, Brooks and Erickson (2012) identified only 1% of nursing programs utilizing an AEHR. Warboys et al. (2014) examined student impressions about an AEHR as a learning tool and what level of EHR use was needed for a positive impression of effective learning. The study consisted of a single-group educational intervention design of 220 baccalaureate students. Warboys et al. used a researcher-developed EHR-use perception survey. Findings revealed that students who used the EHR at least five times felt more positive about documenting and navigating in the EHR (Warboys et al., 2014). This finding supported a similar study that examined the attitudes of registered nurses towards EHRs and found more experience utilizing the EHR led to its being perceived as more useful (De Veer & Francke, 2010).

Chung and Cho (2017) investigated AEHR use in nursing education as well as faculty and student perceptions of AEHRs in nursing education. Data were collected from a researcher-developed instrument to determine attitude and perception of knowledge regarding documentation and the use of AEHRs. A total of 21 nursing faculty and 62 nursing students

responded via e-mail from five nursing programs in the United States. Additionally, nine nursing faculty from a single university in the midwestern United States responded to five semi-structured interview questions to determine challenges with providing, teaching, and adopting AEHRs in nursing education. Chung and Cho found nursing faculty and nursing students perceived that an AEHR could be helpful in educating students in nursing documentation and better prepare them to use health information technology in future practice. Faculty resistance, lack of resources, and lack of faculty knowledge of AEHRs were identified as challenges with providing, teaching, and adopting AEHRs in nursing curricula (Chung & Cho, 2017).

The use of an AEHR appeared to be a popular choice as an educational tool. Meyer et al. (2011) reported that the integration of an AEHR into nursing curricula may assist new graduate nurses in understanding the importance of an EHR in the promotion of safe, quality patient care. An AEHR can be incorporated in the classroom, simulation, and skills labs to prepare students for real-life clinical practice (Gloe, 2010). Gardner and Jones (2012) suggested integrating an AEHR throughout the curriculum and revising overall program and individual course objectives to meet Baccalaureate Essential IV that concentrates on the application of patient care technology. For this review, no published studies could be found, however, that actually demonstrated an AEHR could result in tangible and quantifiable changes in nursing student self-efficacy, anxiety, and competency compared to existing classroom approaches.

Lucas (2010) described a joint project between a Bachelor of Science in Nursing (BSN) program and seven area hospitals. The information technology department of one of the health care institutions developed an AEHR accessible to students at all times of the day from any location. The AEHR contained 10 fictitious patients and allowed students to practice EHR literacy skills such as navigation and retrieval of patient data and documentation of assessments.

The outcomes of the project were reported as positive, with students appreciating the ability to learn with the use of an AEHR; however, no comparative data were presented.

Bowers et al. (2011) described an innovative Student Nurse Portal project. The project was designed by a team of nurse leaders who were members of the Deans' Roundtable, educators, and members of the Cleveland Clinic health care system. They developed online programs that consisted of three courses: (a) Introduction to the EHR, (b) Applications of the EHR for Use in Healthcare, and (c) EHR and Nursing Practice. Students assigned to the Cleveland Clinic for clinical rotations were required to complete the first two courses prior to the beginning of their clinical experience. Students from 11 of 14 participating nursing schools completed these courses in a single semester. More than half (66%) of the students who participated in the Student Nurse Portal courses, and who were mentored by their clinical instructors, reported they felt very prepared or adequately prepared to use the EHR (Bowers et al., 2011).

Meyer et al. (2011) suggested that the integration of an AEHR throughout the nursing curriculum may better prepare nursing graduates to practice in a technology-driven health care environment. The authors described an AEHR, identified as Academic Education Solution (AES) designed by Cerner Corporation. Twenty-three nursing programs adopted AES and integrated it throughout the nursing curriculum. Prior to the implementation of AES, the entire faculty was required to attend a 2-day orientation. The implementation process occurred one course at a time. AES was introduced in a nursing fundamentals course during the first semester and acted as a supplement to lectures through progressive patient case scenarios. AES assisted students in using critical thinking skills as well as navigating the system to locate relevant patient data. Critical thinking skills were assessed using case scenario assignments. AES progressed

with students as they progressed through the nursing program. No formal quantitative measurement was completed, and student concerns were focused on difficulty signing in to the system. Meyer et al. concluded that the value of an AEHR is in learning the significance of data entry and management in order to enhance knowledge and information, not learning a specific EHR.

> Using various types of EHRs is similar to using various types of word-processing software, Internet browsers, or computer operating systems: Once you grasp the principles of each category, you can translate your skills to different software products with a minimal learning curve. (Meyer et al., 2011, pp. 43-44)

Very few studies have examined EHR instruction in an undergraduate nursing curriculum. The studies that do exist only evaluated student perceptions, attitudes, and opinions of an EHR. In order to determine how best to provide EHR instruction, quantitative data are needed to provide evidence on which instructional method is best.

Challenges and Barriers

The lack of knowledge among nursing faculty regarding health information technology and electronic documentation poses a challenge to incorporating current EHR technology into the curriculum (Gardner & Jones, 2012; Gloe, 2010). Many faculty members lack sufficient knowledge regarding the use and selection of EHRs; therefore, they are not able to provide proper training and instruction to students (Gloe, 2010). Additional staff may be required to provide training for faculty to gain competency and improve their comfort level with the EHR (Ornes & Gassert, 2007).

Gardner and Jones (2012) pointed out that it is impractical to fully prepare new nursing graduates to document and navigate an EHR as hospitals utilize many different types of patient documentation systems. Expecting nurses to learn all EHR systems is unrealistic, but nursing students should acquire certain competencies during their education (Gardner & Jones, 2012).

Meyer et al. (2011) maintained that once students grasped the concepts of data entry and management, as well as computer and health information literacy skills, the application of these skills was much easier in whatever EHR system they used.

Cost was initially perceived as a challenge when AEHR systems were first introduced (Brooks & Erickson, 2012; Gloe, 2010). Cost of installation and maintenance of integrating an AEHR into a nursing curriculum initially ranged from a $3,000 start-up fee to well over $30,000, not including ongoing maintenance fees (Lucas, 2010). This cost could have posed a barrier for colleges and universities that lacked funding unless they could partner with an affiliated health care institution or receive funding through grants or community coalitions (Brooks & Erickson, 2012). However, the cost of an AEHR today is much more affordable. Wolters Kluwer offered a 6-month license for Lippincott DocuCare system used in this study to students for $53.99, which is approximately $40.00 per semester (based on a trimester structure).

If nursing graduates are not provided the opportunity to practice EHR navigation and documentation during nursing school, they likely will struggle in the clinical setting (Lucas, 2010). Despite numerous reports of student satisfaction with various teaching methodologies, a major gap remains in the literature pertaining to experimental studies exploring various types of EHR instruction and quantifiably measured student outcomes.

Theoretical Framework Informing the Study

The literature review made apparent that most studies were focused on the technical aspects of utilizing the EHR and how students perceived it. To better prepare students for the current work environment, they need to understand the process of transforming data into nursing practice. Kaminski (2015) illustrated this as a pyramid of data, information, knowledge, and wisdom. Loosely based on that model, the vision and concepts of this process became the

framework for this study, and a new, original model was developed by the researcher, as shown in Figure 1. Learning takes place on a continuum of data that are received and then processed into information. The information is then transformed into knowledge, which better prepares nursing students to use technology in professional practice. Measuring competency, self-efficacy, and anxiety would assess whether the students adequately learned the material and could carry this knowledge into professional practice.

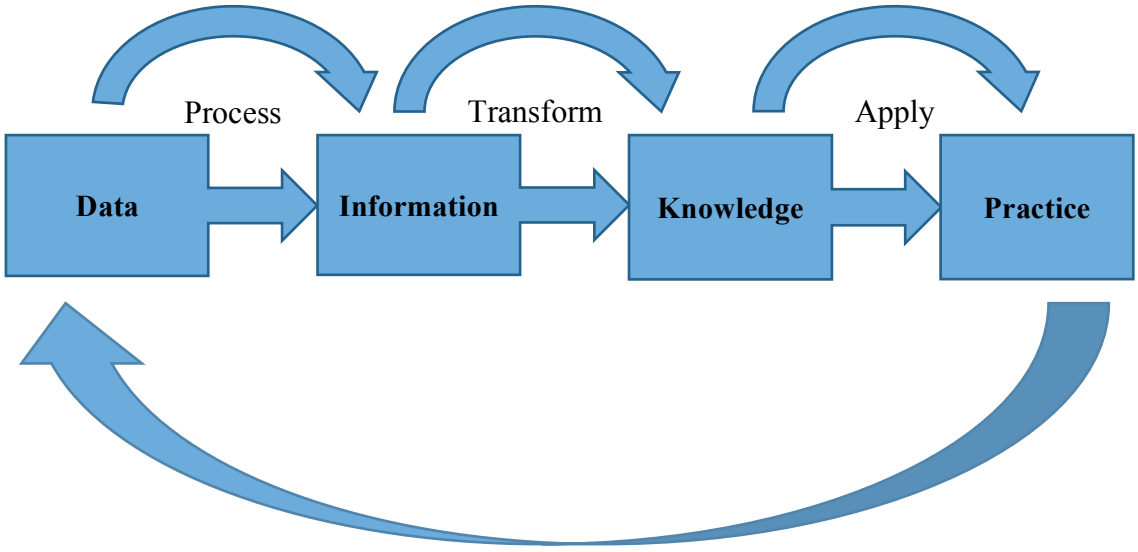


Figure 1. Electronic health record (EHR) learning model. Data are processed into information and transformed into knowledge, which is applied to practice.

The purpose of this study was to investigate which teaching approach was more effective at providing EHR instruction to first-semester nursing students: the use of a traditional lecture employing PowerPoint or an AEHR. This study was informed by Bandura's (1991, 2001) social cognitive theory, which was initially described as the social learning theory in the 1960s

(Bandura, 1977). Bandura (1986) later developed the social cognitive theory to address how learning takes place in a social surrounding. Learning is influenced by environment as well as behavioral and cognitive factors (Bandura, 1991). The reciprocal connection of these factors allows students to learn new behavior and motivates them to change, demonstrating self-efficacy (Bandura, 1991). Social cognitive theory hypothesizes that self-efficacy impacts motivation, which is linked to academic performance (Bandura, 2001). Komarraju and Nadler (2013) found that students who had higher self-efficacy performed better academically. Higher academic performance is accomplished through self-regulation, motivation, and the ability to persevere through challenging times (Komarraju & Nadler, 2013). Furthermore, students who have the ability to manage personal, behavioral, and environmental elements, such as scheduled study time and avoiding distractions, tend to exhibit more self-efficacy (Abara & Lokena, 2010; Komarraju & Nadler, 2013).

According to social cognitive theory, interactions among personal, behavioral, and environmental elements are thought to explain human functioning and to play important roles in learning new knowledge and skills (Saylor, 2015). The premise of social cognitive theory is that learning takes place in a social environment with a vital and reciprocal interaction of the person, behavior, and environment; an individual's cognitive ability (what the person perceives and interprets) and the individual's current actions will affect the person's behavior in the future (Perry & King, 2009). Instructional methods may influence learning by adopting strategies focused on any or all three components of personal, behavioral, and environmental factors (Saylor, 2015). These factors are the theoretical framework for the basis and the outcome measures of this study, as shown in an original model created by the researcher in Figure 2.

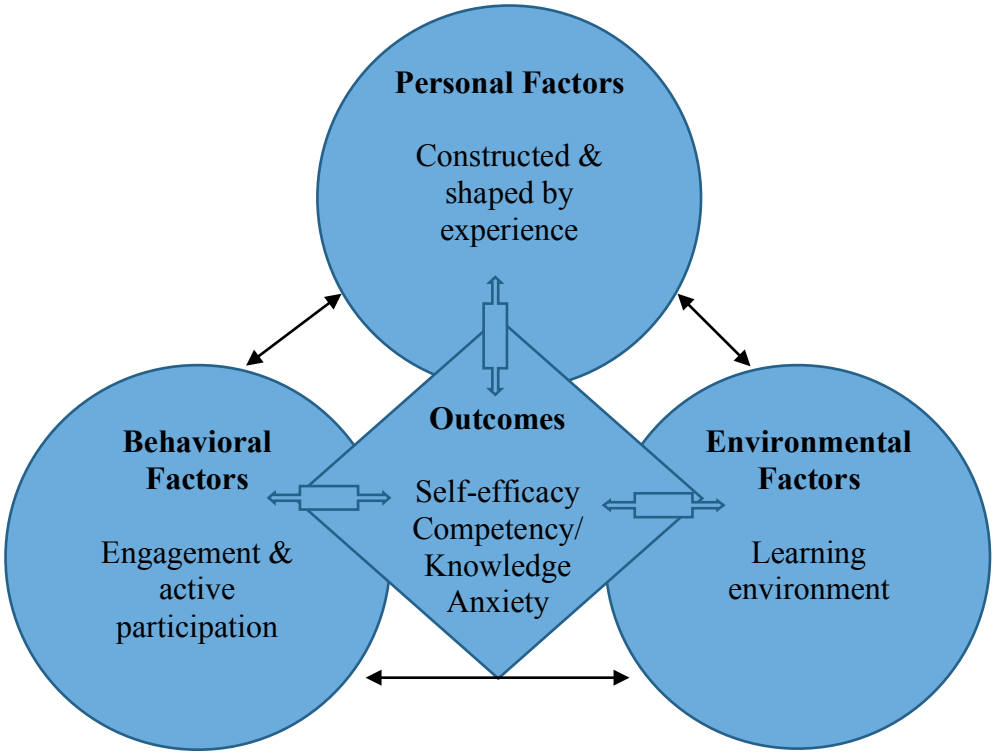


Figure 2. Social cognitive theory of reciprocal determinism. The interaction of personal, behavioral, and environmental factors impacts self-efficacy, competency/knowledge, and anxiety of the learner.

Personal factors are characteristics that are constructed and shaped by previous experience. For this study, these personal factors were determined by the student demographic survey, which identified gender, age, ethnicity, and previous EHR experience. Some personal factors that can affect learning behaviors are age and previous technology experience. For instance, younger students might be more technologically savvy, and those with previous EHR experience might be more interested and comfortable expanding their skills.

Behavioral factors are student habits and actions that they bring to the learning activity. In this study, engagement and active participation of the nursing students were strongly encouraged and observed during each teaching and learning session.

Environmental factors resonate from outside stimulation that affect student learning. In this study, open communication (allowing for questions and answers during the instruction) and teaching strategies (traditional lecture with PowerPoint versus the use of an AEHR) were identified as environmental factors. Technology obstacles and difficulties were also identified as environmental factors. For this reason, the student investigator received training on the use of the AEHR prior to the start of the study. Additionally, a training specialist from the AEHR company was on site to provide instructor and student support during each learning session. By having on-site support during the learning session, any technological issues were quickly resolved so student engagement was not interrupted.

Social cognitive theory posits that learning takes place through observation of other individuals' attitudes, behaviors, and the outcomes of those behaviors (Bandura, 1977). From observing others, the student gains an understanding of how new behaviors are achieved and is able to recall these behaviors to guide future actions (Bandura, 1986). In order for effective modeling of behavior to occur, four circumstances are essential: (a) attention, (b) retention, (c) reproduction, and (d) motivation (Bandura, 1986). In this study, students gained attention, retention, and motivation by placing a functional value on EHR skills. In this instance, the functional value for the student was the opportunity to be better prepared to enter clinical rotations and, ultimately, the workplace.

As for reproduction, screenshots of an AEHR were provided to students in the control group receiving traditional lecture instruction, and a hands-on navigation experience using DocuCare was provided to students in the intervention group. These types of presentation allowed students to mentally reproduce the image when needed in the future.

This study also explored Bandura's subcategory of self-efficacy. Self-efficacy is "the belief in one's capabilities to organize and execute the courses of action required to manage prospective situations" (Bandura, 1991, p. 256). The nursing students who participated in this study completed a self-efficacy, anxiety, and competency survey regarding the use of an EHR before and after each teaching intervention. Self-efficacy and anxiety are most likely correlated (Tahmassian & Moghadam, 2011), and by measuring both constructs, the value of the teaching intervention could be further determined. Utilizing the concepts from the social cognitive theory, the instructor has the ability to promote and improve student learning and self-efficacy in today's technology-rich environment by focusing on the intrinsic reward of increased confidence and personal satisfaction of acquiring skills needed for clinical practice (Perry & King, 2009).

Summary

Nursing programs must transition the curriculum to provide EHR training in order to successfully prepare students to enter the workforce; however, how best to accomplish this remains unresolved. This study established and increased knowledge on how best to integrate EHR instruction in the nursing curriculum through the use of an AEHR.

Bandura's (1991) social cognitive theory formed the framework of this study. Learning is dependent on the interaction between the student, behavior, and environment. The EHR instructional method utilized by the instructor can shape any or all of these components. Additionally, social cognitive theory presumes that learning takes place through modeling behavior. Attention, retention, reproduction, and motivation are elements that must be present for effective modeling of behavior to occur. Finally, self-efficacy (an outcome measure of this study) was identified as a subtype of social cognitive theory. Self-efficacy and anxiety are

interrelated and jointly impact the student's belief that he or she can carry out the necessary tasks to successfully use an EHR.

Chapter 3: Methodology

This chapter presents the research methodology chosen for this study. The research design for this study compared two groups of nursing students receiving different instructional methods on the use of an EHR. This quasi-experimental, two-group, pre- and posttest design contributed evidence-based information to nursing academia on best methods to instruct students on EHRs. This chapter presents the following: (a) the research questions and hypotheses, (b) research design and sample, (c) study variables and instruments, (d) data collection method, (e) statistical analyses, (f) ethical considerations, and (g) limitations of the study.

Research Questions and Hypotheses

The specific aim of this study was to investigate and compare student outcomes before and after EHR instruction using a traditional lecture approach versus an AEHR. The overarching research question was the following: Is there a statistically significant difference in EHR self-efficacy, anxiety level, and competency between first-semester undergraduate nursing students who receive traditional lecture EHR instruction and those who receive hands-on AEHR training utilizing the DocuCare system?

Research Question 1. Are there significant differences in students' perceived EHR self-efficacy, anxiety, and competency before versus after receiving EHR instruction using the traditional lecture approach? Hypothesis 1 was that students receiving the EHR training using the traditional lecture approach would show a statistically significant difference in self-efficacy, anxiety, and competency on the posttest. Null Hypothesis 1 was that students receiving traditional lecture instruction would not show a statistically significant difference on the posttest. Each of the three variables (self-efficacy, anxiety, and competency) was tested separately.

Research Question 2. Are there significant differences in students' perceived EHR self-efficacy, anxiety, and competency before versus after receiving EHR instruction using a hands-on AEHR training approach? Hypothesis 2 was that students receiving the hands-on AEHR training would show a statistically significant difference in self-efficacy, anxiety, and competency on the posttest. Null Hypothesis 2 was that students receiving hands-on AEHR training would not show a statistically significant difference on the posttest. Each of the three variables (self-efficacy, anxiety, and competency) was tested separately.

Research Question 3. What, if any, difference is there in the amount of change (post-minus presurvey score) in students' EHR self-efficacy, anxiety, and competency between the two instructional groups: (a) the control group receiving EHR training using the traditional lecture format and (b) the intervention group receiving hands-on AEHR training? Hypothesis 3 was that students receiving the AEHR training would show a statistically significant difference in self-efficacy, anxiety, and competency compared to students receiving traditional instruction. Null Hypothesis 3 was that the two groups of students would not show statistically significant differences. Each of the three variables (self-efficacy, anxiety, and competency) was tested separately.

Research Design and Sample

The study used a quasi-experimental, two-group, pre- and posttest design. A convenience sample included two groups of first-semester undergraduate nursing students enrolled in a Nursing Fundamentals course. All students were invited to participate in the study, which took place immediately after their Nursing Fundamentals course. The school of study enrolled 48 first-semester students in each term (fall, spring, and summer). The total sample population was 92 students (i.e., $n = 10$ from the Fall 2017 semester, $n = 40$ students from the Spring 2018

semester, and $n = 42$ students from the Summer 2018 semester). Before each semester, a coin toss determined which type of instruction the participating students would receive. Coin tosses determined students in the fall and spring received traditional instruction; therefore, summer students received the intervention. Due to the low number of students in the fall semester, the study was extended to include the summer semester to achieve an adequate effect size. The low participation in the fall was likely due to location (students had to change classrooms in the fall), lack of encouragement, incentive, and understanding of the study. Students who participated in the study in the spring and summer remained in the same classroom as their Nursing Fundamentals course. The course instructor encouraged students during each class to participate in the after-class study. Additionally, the student researcher introduced herself to students the day before the study during skills lab to briefly explain the importance of the study. An incentive of a $10 Starbucks gift card was provided to all students who completed the study.

Inclusion and exclusion criteria. Inclusion criteria for this study were (a) enrollment in the BSN degree program at the school of study, (b) current enrollment as a first-semester undergraduate nursing student, and (c) current enrollment in the Nursing Fundamentals course. Exclusion criteria were any students repeating the Nursing Fundamentals course; such students could participate in the study instruction and could complete the same instruments, but their data would be excluded from analysis.

Sample size justification. Power calculations were performed using the Power Analysis and Sample Size software. A total of 92 responses (50 traditional and 42 hands-on instruction) were received from the study invitation; all 92 agreed to informed consent and attempted to complete the survey. A total of 12 respondents failed to answer all of the pre- and postsurvey self-efficacy (P.A.T.C.H.) questions, and 1 respondent failed to answer all of the pre- and

postsurvey anxiety (STAI-6) questions. Those 13 respondents were omitted from the analysis, leaving a sample size of $N = 79$. A sample size of 79 (45 in the control group and 34 in the intervention group) achieved 80% power at the .05 level of significance to detect a medium effect size of 0.64.

Study Variables and Instruments

Independent variable: Instructional group. The instruction type variable was measured on a categorical measurement scale with two categories. This variable was coded as 0 if the study participant received EHR instruction using the traditional lecture approach (control group) or 1 if the study participant received EHR hands-on instruction using the AEHR system (intervention group).

Independent variable: Time (pre- and postinstruction). The variable of time was measured by pre- and postmeasurements of the dependent variables. The premeasurement represented the dependent variable prior to the instruction, and the postmeasurement represented the dependent variable after the instruction.

Dependent variable: Self-efficacy. The variable of self-efficacy was measured on a continuous measurement scale. The score was calculated as the sum total of the 50 survey items on the P.A.T.C.H. v.3 instrument (Kaminski, 2016; see Appendices A and B), after recoding the responses according to the instructions provided by the author of the P.A.T.C.H. instrument. The scale is available for free download from the Nursing Informatics Learning Center website (Kaminski, 2016). Each item score can take on values between 1 and 5, with a total score range of 0 to 100. Lower values indicate less perceived self-efficacy using computers in the health care setting, whereas higher scores indicate more perceived self-efficacy using computers in health

care. The P.A.T.C.H. scale proved to be reliable and valid with a Cronbach alpha score of .92 and an internal consistency score of .85, respectively (Vijayalakshmi & Math, 2013).

Dependent variable: Anxiety. The variable of anxiety level was measured on a continuous measurement scale. The score was calculated as the average of the six questions on the STAI-6 instrument (see Appendix C), after recoding the responses according to the instructions provided by Spielberger et al. (2003), authors of the original STAI instrument. This scale is in the public domain and does not require permission for use. Each item score can take on values between 1 and 4. Smaller values indicate less perceived anxiety related to using computers in the health care setting, whereas larger scores indicate more perceived anxiety related to using computers in the health care setting. The shortened survey by Marteau and Bekker (1992) was used in this study in place of the entire questionnaire. Many of the items in the full questionnaire referred to depression and were not applicable to this study; therefore, the short survey was used to capture data on anxiety only. The STAI-6 instrument has a Cronbach alpha of .85 demonstrating its reliability. Factor analysis was done to determine construct validity, and the STAI-6 instrument also proved to be valid with a score of .824 (Vitasari, Wahab, Herawan, Othman, & Sinnadurai, 2011).

Dependent variable: Competency. The variable of competency was measured on a continuous measurement scale. The score was calculated as the percentage of questions answered correctly on the scavenger hunt assessment located in DocuCare (see Appendix D). The scavenger hunt began when the student investigator initiated the assessment and to end when the student completed the assessment or when 15 minutes elapsed, whichever occurred first. Smaller scores indicated less competency using an EHR, whereas larger scores indicated more competency using an EHR. This competency test is a knowledge test adapted from the scavenger

hunt assignment used by Lippincott DocuCare (Lippincott, 2017) and developed for this study. Sample items students must locate in the EHR are date of birth, most recent lung sounds, baseline blood pressure, and date of the most recent chest x-ray.

Confounding variables. Potential confounding variables identified in this study were student contamination and technology issues. Contamination was minimized by dividing the control (fall and spring) and intervention group (summer) by semesters rather than randomizing students into two groups in the same semester. Possible technological problems such as log-in or usability issues were addressed by having a training specialist from the software company present at the instructional sessions.

Data Collection Method

This research project began with the selection of an AEHR. Three AEHR software options were considered. Lippincott DocuCare was selected due to support, customer service, ease of using the program, and cost. Prior to and throughout the planning phases, discussions regarding the project were ongoing with the dean of the School of Nursing for her approval and support. Once the research plan was completed, a meeting with the Nursing Fundamentals course instructor took place to review the project and gain her approval.

All first-semester nursing students enrolled in the Nursing Fundamentals course were recruited. The instructional session took place immediately following the Nursing Fundamentals course during Week 2 of each semester. All students received an individual code to log in to DocuCare. This code was considered the participant identification number, which was maintained with correlating names on a list kept by the student investigator. Each student brought a laptop or was provided one by the School of Nursing.

The study consisted of two groups: a control group and an intervention group. The groups were randomized by a coin toss. The student investigator flipped a coin for each cohort; heads received EHR instruction using a traditional PowerPoint lecture (control group), and tails received EHR instruction using the hands-on AEHR (intervention group). First-semester students enrolled in the Nursing Fundamentals course during the Fall 2017 (n = 10) and Spring 2018 semesters (n = 40) comprised the control group. First-semester students enrolled in the Nursing Fundamentals course during the Summer 2018 semester (n = 42) comprised the intervention group.

The control group (the fall and spring cohort) received EHR instruction in a 1-hour lecture during Week 2 of the semester. This traditional instruction consisted of a PowerPoint presentation (see Appendix E for an outline of the presentation) followed by a question-and-answer session. The PowerPoint presentation highlighted the reasons for EHRs, the role of an EHR in nursing care, and EHR components. Various AEHR screenshots were also included in the PowerPoint presentation that allowed for a visualization of tabs within an AEHR. These tabs included patient demographics, assessment, vital signs, medication administration record, intake and output, diagnostic testing, laboratory values, and nursing diagnoses.

The intervention group (the summer cohort) received a 1-hour instructional session with hands-on use and navigation of the AEHR during Week 2 of the semester followed by a question-and-answer session. Reasons for EHR use, the role of EHRs in nursing care, and the various components within an EHR were briefly discussed prior to the student investigator guided navigation in the AEHR. See Appendix F for AEHR screenshots for a fictitious patient. Students followed along on their laptops as the student investigator guided them through the tabs of the AEHR. See Appendix G for the project timeline.

To evaluate competency, both groups of students completed an eight-item scavenger hunt in the AEHR preinstruction and postinstruction. The scavenger hunt is an activity by DocuCare assessing the ability of students to locate various items and patient information within the AEHR. The scavenger hunt was a timed assessment. Students had 15 minutes to locate the items before the scavenger hunt ended. Competency was measured based on the amount of the exercise completed correctly.

Demographic data for this project were collected to help describe the sample. These data were collected from a brief questionnaire administered along with pretests, which asked for student gender, age, ethnicity, and previous EHR experience. Self-efficacy and anxiety data were collected from a presurvey and postsurvey completed immediately prior to and immediately after instruction, respectively. Data were analyzed and reported as a group, not individually.

Statistical Analyses

All statistical analyses were performed using the Statistical Package for the Social Science (SPSS) version 24. All of the analyses were two tailed with a .05 alpha level. Paired samples *t*-tests were used to test research questions one and two in order to determine the significance of with-in group mean differences on overall student outcomes (self-efficacy, anxiety, and competency). An independent samples *t*-test was used to test research question three to determine if there was a statistically significant difference between the means in the control and experimental group. Characteristics of the study sample were described using the mean, standard deviation, and range for continuous variables and percent and frequency for categorical variables. Cronbach's alpha was used to evaluate the internal consistency reliability of the self-efficacy, anxiety, and competency scale scores.

These analyses were designed to answer the fundamental question of whether or not the use of an AEHR could demonstrate a positive impact on first-semester students' self-efficacy, anxiety, and competency when using an EHR. If so, findings would support introduction of the software into the undergraduate nursing curriculum with further analysis of its impact on critical outcomes such as medication errors in the initial postgraduate year.

Ethical Considerations

Approval by the school and the University Institutional Review Board was obtained prior to initiating the study. The study was explained to the students prior to each teaching session and informed consent obtained. All data (including the consent form) were collected online using Qualtrics Research Suite survey software. The informed consent included a check box whether or not students wished to have their data used in any future research or publications. Qualtrics is a reputable company that maintains privacy through encryption and therefore was a favorable choice for maintaining student privacy (Qualtrics, 2017). To further ensure the privacy of the students' identities, each student was assigned an identification number, which was kept on a written log by the student investigator. All personal information was coded to ensure confidentiality, stored in a secured cabinet available only to the student investigator, and will be destroyed 3 years following the completion of the study.

Study Limitations

Limitations of this study included a small sample size and time. The confines of this study only permitted two groups from three consecutive terms to be used. Time allotted for EHR instruction was also a limitation. Due to the constraints of the existing curriculum, a 1-hour teaching session was permitted at this time.

Summary

A comparative, quasi-experimental design was utilized to determine student outcomes after receiving EHR instruction by way of a traditional lecture approach versus the use of an AEHR. This design allowed for the analysis of student self-efficacy, anxiety, and competency while using an EHR. Ethical considerations were identified and maintained throughout the course of this study. The limitations of this study were also discussed.

Chapter 4: Results

The purpose of this study was to investigate whether the use of an AEHR would improve self-efficacy, reduce anxiety, and enhance competence compared to a traditional PowerPoint presentation on EHR usage in first-semester nursing students. This chapter discusses the results, including a description of the sample. Additionally, the inferential analyses are presented by research question and by variable.

Sample Demographics

The study invitation yielded 92 responses. All 92 respondents agreed to informed consent and attempted to complete the baseline and follow-up surveys. A total of 12 respondents failed to answer all baseline and follow-up self-efficacy survey (P.A.T.C.H.) questions, and 1 respondent failed to answer all baseline and follow-up anxiety survey (STAI-6) questions. Those 13 respondents were omitted from the analysis, leaving a usable sample size of $N = 79$.

Among the 79 study participants, 45 were in the control group receiving traditional lecture-based instruction, and 34 were in the intervention group receiving hands-on AEHR instruction. There were more women than men. The largest ethnic group was Asian/Pacific Islander (see Table 1). Only 9 students (11.4%) reported having had any previous EHR experience. See Table 1 for detailed descriptive statistics of demographic features.

Table 1

Demographic Characteristics of the Sample in Total and by Instruction Type

	Total ($N = 79$)		Traditional ($n = 45$)		Hands-on AEHR ($n = 34$)	
Demographic	*n*	%	*n*	%	*n*	%
Gender						
Female	58	73.4	34	75.6	24	70.6
Male	21	26.6	11	24.4	10	29.4
Age						
18–21	46	58.2	27	60.0	19	55.9
22–40	33	41.8	18	40.0	15	44.1
Ethnicity						
Asian/Pacific Islander	31	39.2	20	44.4	11	32.4
White	24	30.4	12	26.7	12	35.3
Hispanic	14	17.7	8	17.8	6	17.6
Other	6	7.6	4	8.9	2	5.9
Black	4	5.1	1	2.2	3	8.8

Note. AEHR = academic electronic health record.

Research Question 1: Control Group Receiving Traditional Lecture Instruction

Are there significant differences in students' perceived EHR self-efficacy, anxiety, and competency before versus after receiving EHR instruction using the traditional lecture approach? Hypothesis 1 was that students in the control group receiving the EHR training using the traditional lecture approach would show a statistically significant difference in self-efficacy, anxiety, and competency on the posttest. Each of the three variables (self-efficacy, anxiety, and competency) was tested separately.

Assumptions. Paired-samples *t*-tests were conducted to determine any within-group differences. The assumptions for the paired-samples *t*-tests on the entire data set were evaluated prior to conducting all the data analyses. Specifically, the assumption that there were no outliers in the change score was evaluated by first computing the change score by subtracting the presurvey score from the postsurvey score. Then, a box plot was produced to visually identify

whether or not outliers were present. The box plot gave no indication of extreme outliers. The second assumption for the paired *t*-tests to be valid was that the distribution of the change scores had a roughly normal distribution. This assumption was evaluated by inspection of a histogram of the change scores. The histogram gave no indication of a nonnormal distribution. The assumptions for all the paired *t*-tests were considered satisfied.

Self-efficacy. The variable of self-efficacy was measured on a continuous measurement scale. The score was calculated as the sum total of the 50 survey items on the P.A.T.C.H. v.3 instrument (Kaminski, 2016). Each item score can take on Likert-scale agreement values between 1 and 5, with a total score range of 0–100. Lower values indicate less perceived self-efficacy using computers in the health care setting. Sample survey statements are "In healthcare, computers could save a lot of paperwork" and "Computers in healthcare will create more work for nurses" (scored in reverse). The results of the paired-samples *t*-tests demonstrated that after traditional instruction, students in the control group had a statistically significant increase in perceived EHR self-efficacy, $t(44) = 4.81$, $p < .001$, $d = 0.72$. The average postinstruction self-efficacy score was significantly higher than the average preinstruction self-efficacy score (see Table 2). Figure H1 in Appendix H shows the error bar chart.

Table 2

Control Group Self-Efficacy Scores Pre- and Postinstruction

Time	*M*	*SD*	95% confidence interval
Preinstruction	74.20	11.58	[70.22, 77.68]
Postinstruction	77.98	10.80	[77.98, 81.22]

Note. $N = 45$. Scores on the Pretest for Attitudes Toward Computers in Healthcare version 3, with a range of 0–100.

Anxiety. The variable of anxiety level was measured on a continuous measurement scale; the score was calculated as the average of the six questions on the STAI-6 instrument (Marteau

& Bekker, 1992; Spielberger et al., 2003). Smaller values indicated less perceived anxiety related to using computers in the health care setting. Students in the control group had a statistically significant decrease in perceived anxiety, $t(44) = 3.25$, $p < .002$, $d = 0.49$. The average postinstruction anxiety score was significantly smaller than the average preinstruction anxiety score (see Table 3). Therefore, first-semester nursing students who received traditional instruction in EHR showed a statistically significant decrease in computer-related anxiety after the instruction (see Figure H2 in Appendix H for the error bar chart).

Table 3

Control Group Anxiety Scores Pre- and Postinstruction

Time	*M*	*SD*	95% confidence interval
Preinstruction	1.96	0.65	[1.77, 2.15]
Postinstruction	1.77	0.63	[1.58, 1.96]

Note. $N = 45$. Scores on the Spielberger State Trait Anxiety Inventory–6, with a range of 1–4. Lower scores demonstrate decreased anxiety.

Competency. The variable of competency was measured on a continuous measurement scale. The score was calculated as the percentage of questions answered correctly on the scavenger hunt assessment located in DocuCare. Smaller scores indicated less competency using an EHR, whereas larger scores indicated more competency using an EHR. The results of the paired-samples *t*-tests demonstrated a statistically significant increase in students' competency after receiving traditional instruction in EHR, $t(44) = 11.04$, $p < .001$, $d = 1.65$. The average postinstruction competency score was significantly higher than the average preinstruction competency score (see Table 4). Therefore, first-semester nursing students who received traditional instruction showed a statistically significant increase in competency after the instruction (see Figure H3 in Appendix H for the error bar chart).

Table 4

Control Group Competency Scores Pre- and Postinstruction

Time	*M*	*SD*	95% confidence interval
Preinstruction	39.63	8.91	[36.95, 42.31]
Postinstruction	56.67	10.89	[53.39, 59.94]

Note. $N = 45$. Scores on a scale of 0–100%.

Conclusion. The null hypothesis for Research Question 1 was that students in the control group would not show a statistically significant difference in self-efficacy, anxiety, and competency following traditional instruction on EHR. The null hypothesis is rejected, as students in the control group showed significantly improved scores on all three variables after instruction. The positive effect size was medium for anxiety, medium to large for self-efficacy, and very large for competency.

Research Question 2: Intervention Group Receiving Hands-On AEHR Instruction

Are there significant differences in students' perceived EHR self-efficacy, anxiety, and competency before versus after receiving EHR instruction using a hands-on AEHR training approach? Hypothesis 2 was that students in the intervention group receiving the hands-on AEHR training would show a statistically significant difference in self-efficacy, anxiety, and competency on the posttests. As with Research Question 1, each of the three variables (self-efficacy, anxiety, and competency) was tested separately.

Assumptions. Paired-samples *t*-tests were conducted to determine any within-group differences. The assumptions for the paired-samples *t*-tests on the entire data set were evaluated prior to conducting all the data analyses and considered satisfied.

Self-efficacy. The results of the paired-samples *t*-tests demonstrated a statistically significant increase in the intervention-group students' self-efficacy after receiving hands-on AEHR instruction, $t(33) = 7.00$, $p < .001$, $d = 1.20$. The average postinstruction self-efficacy

score was significantly higher than the average preinstruction self-efficacy score among the intervention group receiving hands-on AEHR instruction (see Table 5). Therefore, first-semester nursing students who received hands-on AEHR instruction showed a statistically significant increase in EHR self-efficacy after the instruction (see Figure H4 in Appendix H for the error bar chart).

Table 5

Intervention Group Self-Efficacy Scores Pre- and Postinstruction

Time	*M*	*SD*	95% confidence interval
Preinstruction	74.53	8.83	[71.45, 77.61]
Postinstruction	87.35	9.64	[83.99, 90.71]

Note. $N = 34$. Scores on the Pretest for Attitudes Toward Computers in Healthcare version 3, with a range of 0–100.

Anxiety. The results of the paired-samples *t*-tests demonstrated a statistically significant decrease in students' anxiety after receiving hands-on AEHR instruction, $t(33) = 6.29$, $p < .001$, $d = 1.08$. The average postinstruction anxiety score was significantly lower than the average preinstruction anxiety score among students in the intervention group (see Table 6). Therefore, first-semester nursing students who received hands-on AEHR instruction showed a statistically significant decrease in anxiety after the instruction (see Figure H5 in Appendix H for the error bar chart).

Table 6

Intervention Group Anxiety Scores Pre- and Postinstruction

Time	*M*	*SD*	95% confidence interval
Preinstruction	2.00	0.65	[1.77, 2.22]
Postinstruction	1.24	0.36	[1.11, 1.36]

Note. $N = 34$. Scores on the Spielberger State Trait Anxiety Inventory–6, with a range of 1–4.

Competency. The results of the paired-samples *t*-tests demonstrated a statistically significant increase in intervention-group students' competency after receiving hands-on AEHR instruction, $t(33) = 28.60$, $p < .001$, $d = 4.88$. The average postinstruction competency score was significantly higher than the average preinstruction competency score among intervention-group students receiving hands-on AEHR instruction (see Table 7). Therefore, first-semester nursing students who received hands-on AEHR instruction showed a statistically significant increase in EHR competency after the instruction (see Figure H6 in Appendix H for the error bar chart).

Table 7

Intervention Group Competency Scores Pre- and Postinstruction

Time	*M*	*SD*	95% confidence interval
Preinstruction	40.69	8.40	[37.76, 43.62]
Postinstruction	95.10	8.73	[92.05, 98.14]

Note. $N = 34$. Scores on a scale of 0–100%.

Conclusion. The null hypothesis for Research Question 2 was that students in the intervention group would not show a statistically significant difference in self-efficacy, anxiety, and competency following hands-on AEHR instruction. The null hypothesis is rejected, as students in the intervention group showed significantly improved scores on all three variables after instruction. The positive effect size was very large for the three variables as well.

Research Question 3: Comparison Between Instructional Groups

What, if any, difference is there in the amount of change (post- minus presurvey score) in students' EHR self-efficacy, anxiety, and competency between the two instructional groups: (a) the control group receiving EHR training using the traditional lecture format and (b) the intervention group receiving EHR instruction using the hands-on AEHR training approach? Hypothesis 3 was that students in the intervention group receiving the hands-on AEHR training would show a statistically significantly difference in self-efficacy, anxiety, and competency

compared to students in the control group receiving traditional instruction. As with Research Questions 1 and 2, each of the three variables (self-efficacy, anxiety, and competency) was tested separately.

Assumptions. The assumptions for all the independent-samples *t*-tests on the entire data set were evaluated prior to conducting the analysis. Specifically, the first assumption was that there were no outliers in the dependent variable (e.g., change in the self-efficacy score, postsurvey scores minus presurvey scores) for either group (traditional lecture group and AEHR group). This assumption was tested by inspection of box plots of the change scores, separately for each instructional group. The box plots gave no indication of extreme outliers.

The second assumption was that the dependent variable had a normal distribution for both groups. This assumption was evaluated by inspection of histograms of the change scores, separately for each instructional group. The histograms gave no indication of a nonnormal distribution for either group.

The third assumption, homogeneity of variance, was that the variation in the dependent variable was the same for both groups (traditional lecture group and AEHR group). This assumption was tested using Levene's test. The Levene's test showed the variances were homogeneous; therefore, the assumptions for the independent-samples *t*-test were considered satisfied.

Self-efficacy. The results of the independent-samples *t*-test indicated first-semester nursing students in the intervention group, who received hands-on AEHR instruction, showed a statistically significant greater increase in self-efficacy after instruction compared to undergraduate nursing students in the control group, who received traditional lecture and PowerPoint instruction, $t(77) = 4.94$, $p < .001$, $d = 1.12$. The average increase in the self-efficacy

score for the intervention group was significantly greater than the average increase for the control group (see Table 8). See Figure H7 in Appendix H for the error bar chart.

Table 8

Comparison of Mean Change in Self-Efficacy Score in Control and Intervention Groups

Instruction group	*n*	*M* change	*SD*	95% confidence interval
Control: Traditional instruction	45	3.78	5.27	[2.20, 5.36]
Intervention: Hands-on AEHR	34	12.82	10.69	[9.09, 16.55]

Note. AEHR = academic electronic health record. Scores on the Pretest for Attitudes Toward Computers in Healthcare version 3, with a range of 0–100.

Anxiety. The results of the independent-samples *t*-test indicated first-semester nursing students in the intervention group, who received hands-on AEHR instruction, showed a statistically significantly greater decrease in anxiety after instruction compared to undergraduate nursing students in the control group, who received traditional instruction, $t(77) = 4.53$, $p < .001$, $d = 1.04$. The average decrease in anxiety score for the intervention group was larger than the average decrease in anxiety score for the control group (see Table 9). See Figure H8 in Appendix H for the error bar chart.

Table 9

Comparison of Mean Change in Anxiety Score in Control and Intervention Groups

Instruction group	*n*	*M* change	*SD*	95% confidence interval
Control: Traditional instruction	45	-0.19	0.40	[-0.31, -0.07]
Intervention: Hands-on AEHR	34	-0.76	0.70	[-1.01, -0.51]

Note. AEHR = academic electronic health record. Scores on the Spielberger State Trait Anxiety Inventory–6, with a range of 1–4.

Competency. The results of the independent-samples *t*-test indicated first-semester nursing students in the intervention group, who received hands-on AEHR instruction, showed a statistically significantly greater increase in competency after instruction compared to

undergraduate nursing students in the control group, who received traditional instruction, $t(77) = 15.41$, $p < .001$, $d = 3.50$. The average increase in competency score for the intervention group was larger than the average increase in competency score for the control group (see Table 10). See Figure H9 in Appendix H for the error bar chart.

Table 10

Comparison of Mean Change in Competency Score in Control and Intervention Groups

Instruction group	*n*	*M* change	*SD*	95% confidence interval
Control: Traditional instruction	45	17.04	10.35	[13.93, 20.15]
Intervention: Hands-on AEHR	34	54.41	11.09	[50.54, 58.28]

Note. AEHR = academic electronic health record. Scores on a scale of 0–100%.

Conclusion. The null hypothesis for Research Question 3 was that students receiving the AEHR training would not show a statistically significantly difference in self-efficacy, anxiety, and competency compared to students receiving traditional instruction. The null hypothesis is rejected, as students in the intervention group receiving hands-on AEHR instruction showed significantly improved scores on all three variables after instruction.

Summary

The results of first-semester nursing student scores on measures of EHR perceived self-efficacy, perceived anxiety, and competency were compared before and after EHR instruction. The control group received traditional lecture instruction with PowerPoint slides. The intervention group received hands-on, guided instruction with an AEHR. The results indicated that both the control group receiving traditional instruction and the intervention group receiving hands-on AEHR instruction showed statistically significant improvement in perceived self-efficacy, perceived anxiety, and competency related to EHR use. However, the independent-samples *t* tests indicated the intervention group had statistically significantly greater

improvement in self-efficacy, anxiety, and competency scores. Findings suggest use of the hands-on AEHR utilizing the DocuCare system was more effective than traditional instruction with lecture and PowerPoint. The meaning of these results along with their implications and recommendations are discussed in Chapter 5.

Chapter 5: Discussion

The purpose of this study was to determine if there was a statistically significant difference in EHR self-efficacy, anxiety level, and competency between first-semester undergraduate nursing students in a control group who received traditional lecture EHR instruction and those in an intervention group who received hands-on AEHR training utilizing the DocuCare system. The design of the study answered three core research questions, each with three variables. This chapter presents a discussion of the findings of each research question. From these findings, conclusions and implications regarding nursing education are considered. Finally, limitations of the study and recommendations for future research are provided.

Interpretation of Findings

Sample. There were 45 participants in the control group receiving traditional instruction and 34 participants in the intervention group receiving hands-on AEHR instruction. The demographics of the sample were interesting. Males represented 26.6% of the sample, which is above the national average of 15% (National League for Nursing [NLN], 2014). In terms of ethnicity, Asian/Pacific Islanders comprised between 39.2% of the sample, while Hispanics made up nearly 18%. In comparison, the AACN (2016), reported that 32.3% of baccalaureate nursing students are ethnic minorities: Black or African American, 9.7%; Asian/Pacific Islander, 8.3%; and Hispanic, 11%. The large percentage (69.6%) of ethnic minorities in this study indicated great diversity well above the national average. The NLN (2014) reported 85% of nursing students are female, and 18% are over the age of 30 (a breakdown of age ranges was not reported). These demographics are promising as they suggest progress towards increasing diversity in nursing programs.

Research Question 1. Are there significant differences in students' perceived EHR self-efficacy, anxiety, and competency before versus after receiving EHR instruction using the traditional lecture approach? A statistically significant difference was found in all variables following traditional instruction in the control group: self-efficacy was higher, anxiety was lower, and competency scores were higher. The lecture-based instruction had the greatest effect on competency ($d = 1.65$), followed by self-efficacy ($d = 0.72$) and anxiety ($d = 0.49$). This suggests that a traditional lecture highlighting the reasons for EHRs, the role of an EHR in nursing care, and EHR components had a positive impact on increasing self-efficacy, reducing anxiety, and improving competency. The inclusion of some AEHR screenshots in the PowerPoint presentation might explain the greater effect size in competency scores. Even though teaching EHR use in the classroom by way of a PowerPoint presentation may not be ideal, having some instruction is better than none at all.

The literature strongly suggested, however, a need for nursing programs to reform the curriculum to include technology and simulated learning activities such as the AEHR (Gardner & Jones, 2012; Meyer et al., 2011). Chung and Cho (2017) noted that nurse educators still widely teach paper-based documentation, even though such instruction may not be adequate because of its lack of congruency with real practice. Gardner and Jones (2012) pointed out that nursing faculty are reluctant to change the traditional curriculum due to their lack of knowledge about EHRs. Most nursing faculty do not have experience with EHRs and have only practiced paper-based charting (Chung & Cho, 2017).

Research Question 2. Are there significant differences in students' perceived EHR self-efficacy, anxiety, and competency before versus after receiving EHR instruction using a hands-on AEHR training approach? A statistically significant difference was found in all variables

following the AEHR approach used in the intervention group: self-efficacy was higher, anxiety was lower, and competency scores were higher. According to the histograms and box plots, equal variances of the samples were assumed. The use of a hands-on AEHR had a dramatic effect on competency ($d = 4.88$), followed by self-efficacy ($d = 1.20$) and anxiety ($d = 1.08$). This finding demonstrates the hands-on use of an AEHR to teach EHR navigation significantly improved self-efficacy, reduced anxiety, and improved competency. A previous study by Terzioglu et al. (2016) confirmed the significance of student practice in an instructionally guided learning environment. Terzioglu et al. found that nursing students who practiced in an instructional learning environment until they were competent had reduced anxiety and improved psychomotor skills.

Findings of this study are consistent with the study by Johnson and Bushey (2011), who reported the use of an AEHR enhanced students' critical thinking skills. Johnson and Bushey found that the use of an AEHR increased student ability to navigate and retrieve relevant patient information. Jones and Donelle (2011) also indicated that the use of an AEHR in nursing school enhances nursing students' self-confidence, knowledge, and competence, better preparing them for real-world practice.

This approach to learning an EHR also has been shown to encourage critical thinking skills, bridging the theory-to-practice gap (Jones & Donelle, 2011). According to Bandura's (2001) social cognitive theory, learning takes place by observing others and is influenced by cognitive, behavioral, and environmental factors. In this study, students were guided through navigation of an AEHR. The students were able to observe the instructor/student investigator navigate various components within an AEHR, allowing them to model that behavior. Bandura's (2001) theory is consistent with the substantial increase in competency scores seen in this study.

Additionally, students were motivated to change their behavior and learn EHR documentation because they soon will be entering a technology-rich work environment where they will be expected to be knowledgeable and proficient in EHR use.

Research Question 3. What, if any, difference is there in the amount of change (post-minus presurvey score) in students' EHR self-efficacy, anxiety, and competency between the two instructional groups: (a) the control group receiving EHR training using the traditional lecture format and (b) the intervention group receiving EHR instruction using the hands-on AEHR instruction approach? The results of the analyses demonstrated a statistically significant greater increase in self-efficacy scores with the use of an AEHR (M = 12.82, SD = 10.69) compared to the traditional instruction group (M = 3.78, SD = 5.27). This finding signifies that students had much higher perceived self-efficacy when using an EHR after receiving instruction with hands-on use of an AEHR. Supportive of this finding is a study by Lucas (2010), who found students who received hands-on EHR instruction system prior to their clinical rotation felt more confident to carry out documentation tasks. Lucas noted that students who had a hands-on learning experience while in school gained confidence and efficiency in EHR use, which ultimately led to more time to develop other essential skills such as critical thinking and prioritization.

Participants using the AEHR also showed a statistically significant reduction in anxiety scores (M = -0.76, SD = 0.70) compared to the traditional instruction group (M = -0.19, SD = 0.40). This finding indicates student anxiety regarding the use of an EHR was reduced more after receiving instruction with hands-on use of an AEHR. The reduction in anxiety could be directly related to the increase in self-efficacy scores. Social cognitive theory posits a causal relationship between self-efficacy and anxiety (Bandura, 2007). The students' perceived self-efficacy allowed them the ability to control apprehensive thoughts, thereby reducing their anxiety.

Competency scores had the greatest change of all three variables. Again, students receiving the hands-on AEHR instruction showed a greater increase in competency scores (M = 54.41, SD = 11.09) compared to the traditional instruction group (M = 17.04, SD = 10.35). The change in competency scores between the two instructional groups had the largest effect size (d = 3.50), followed by self-efficacy (d = 1.12) and anxiety (d = 1.04).

De Gagne et al. (2012) suggested that technology education in nursing programs continues to be questionable because there is no clear evidence on the best teaching strategy and which components of health care information technology should be taught in the undergraduate curriculum. This study strongly suggests otherwise. The present study shows that even a brief, guided navigation in an AEHR can have a significant impact on increasing self-efficacy, reducing anxiety, and improving competency when compared to a traditional lecture on EHRs.

Students in this study were guided through various tabs within the AEHR to locate clinical information including patient demographics, medications, vital signs, assessment data, laboratory values, and diagnostic testing results. Similarly, Warboys et al. (2014) reported that nursing students felt more positive about EHRs with increased use of an AEHR. Warboys et al. stated students who used the AEHR five or more times over the course of the semester felt they were confident and knowledgeable compared to the students who used the AEHR less than five times. The data from this study can assist academic nursing programs in how to best provide EHR training in the nursing curriculum to bridge the gap between nursing education and professional nursing practice. The EHR learning model proposed in chapter two can serve as a guide for the teaching-learning process.

EHR Learning Model. The proposed EHR learning model served as a visual guide to understand the process of assimilating EHR knowledge. This learning model suggested that it is

the transfer of data into information, which is then transformed into knowledge that leads to better nursing practice. This model explained how students took the data presented in the EHR instruction and successfully transformed the information into knowledge about EHR use. Students were then able to take the new knowledge regarding EHR use and apply it to practice. Students were more successful at navigation and retrieval of patient information following the EHR instruction, as evidenced by the greater increase in competency scores. The results of this study confirm the utility of the EHR learning model in understanding the facilitation of effective learning.

Implications and Application to Nursing Education

The need for EHR instruction and the use of an AEHR has been discussed widely in the literature (Chung & Cho, 2017), but very little empirical evidence has supported how AEHR use should be integrated into the curriculum. The results of this study support the need for a change in pedagogy. This study shows that the use of an AEHR is effective at increasing self-efficacy, reducing anxiety, and improving competency, therefore acting as a guide to teaching and learning strategies. Ultimately, however, the true value of an AEHR lies in allowing students to gain confidence in the utilization of an EHR in a setting that is not driven by the chaotic immediacy of the initial clinical exposure on a hospital inpatient rotation.

Recommended procedural plan for AEHR integration. A thorough, well-developed plan is essential for successful integration of an AEHR into the nursing curriculum (Gloe, 2010). First and foremost, the plan needs an administrative champion; a department chair, a program director, or the Dean. That individual must be seen as in favor of the change and willing to give resources and support to the faculty member(s) charged with implementing the program.

Undertaking the adoption of an AEHR into the curriculum is a significant and ongoing process. To assure success, challenges and potential barriers (such as interest and motivation, time involved, and cost) must be considered from the beginning. The need for the changes does not lie merely in enhancing the ability of students to identify data in the EHR, it lies in the ultimate benefit of improved patient outcomes. The relationship between improved patient outcomes and the proficiency of graduate nurses in EHR utilization must be held out as the overarching benefit of all the effort that will be required for the implementation process.

The implementation cannot be done as an add on to routine teaching, clinical, and research duties. A lead for the implementation process needs to be empowered by the administrative "champion" and adequate time (salary) allocated in their schedule. This individual should be one who is excited about AEHR integration. This may require a full-time faculty position with administrative support or a faculty member with at least 50% effort assigned to the process. If less than a full-time position, there may need to be additional faculty time assigned and compensated for as well as the administrative support.

The cost of AEHR products has decreased substantially since they were first available and the number of companies featuring AEHR products has risen. The institution needs to dedicate the resources to implement the system. Funding can be obtained to help offset the cost of the AEHR such as private donations, grants, and partnerships with community agencies, but implementation should not be tied to obtaining these additional funds.

Nursing schools can, and should, research various companies to find an AEHR that best fits the needs of their curriculum, faculty, and students. Progressing through the plan may be troublesome at times; therefore, considerable attention, perseverance, and commitment are

necessary (Gloe, 2010). To accomplish successful integration of EHR instruction into undergraduate nursing curriculum, the following procedural plan is suggested:

1. The first step is to identify who will be the administrative "champion" and who will be the lead facilitator faculty member(s) in the implementation process.
2. Secondly, a meeting between the governing body of the nursing program and faculty members is needed to ensure that the entire faculty understands:
    a. The overlying purpose of the change.
    b. Who is leading the implementation process.
    c. The faculty time resources and financial support that will be dedicated to the project.
    d. That the leadership of the institution is committed to a successful implementation; faculty input and advice will be sought and incorporated before and during the process, but the overall goal of implementing a curricular change is secure.
3. The funding for an AEHR needs to be committed.
    a. The lead facilitator (a faculty member supportive of AEHR integration) will identify and meet with various AEHR vendors. After meeting with vendors, a follow-up meeting with the governing body is necessary to present the various options and cost of each.
    b. A formal proposal is presented to the governing body that includes the background, rationale for the selection, testimonials from other programs, and costs associated with the selected AEHR (Gloe, 2010). At this point, the governing body will give their approval or suggestions for proceeding

c. To relieve pressure on the school's budget, however, various grants should be identified (i.e., Robert Woods Johnson Foundation) and applied for. Private donations from the community dedicated to improving technology in education can be solicited. A partnership with a local agency allowing students access to their EHR training program can reduce the financial responsibility on nursing schools (Lucas, 2010). Additionally, the cost may be reasonable for students to incur as part of their student fees.

4. An action plan with measurable goals and timeline needs to be developed to begin the process.
5. Faculty skills and knowledge regarding electronic documentation needs to be addressed for them to effectively and comfortably educate students in this area. Spencer (2012) suggested starting with pairing the needs of faculty and curriculum. A faculty member should be chosen as an informatics specialist or super user to direct the remaining faculty in their training. This person should be considered a nursing informatics expert and have the ability to lead this pursuit in faculty development and training, as well as assist with instructional teaching strategies (Pilarski, 2010). Additionally, a nursing informatics specialist can be consulted to provide the necessary training to close this knowledge gap. Workshops that focus on health information technology, EHR documentation, and incorporating an EHR into nursing curricula can be identified and attended. Nursing administration needs to provide the time and resources for faculty development in order to ensure a successful implementation (Gardner & Jones, 2012).
6. After faculty members have been adequately trained, EHR instruction will be officially integrated into the curriculum. This integration will begin in the first-semester

fundamental and theory/clinical courses (in the classroom, lab, and simulation) and continue throughout the curriculum. The continuation of training throughout the curriculum will aid in meeting the rapidly changing nature of the field. The training will become more complex each semester.

Patient safety and quality of care. The Quality and Safety Education for Nurses (QSEN, 2014) has recognized nursing informatics as a competency for delivering safe and quality care. To meet the requirement that all health care providers utilize EHRs, student outcomes should be aligned to meet BSN program requirements and Baccalaureate Essential IV, Information Management and Application of Patient Care Technology (AACN, 2008). Students not exposed to EHRs until clinical rotations are not adequately prepared and pose a potential risk to patient safety and quality care (Meyer et al., 2011). Learning an EHR during clinical rotations is not ideal for learning safe and best practice of EHR documentation (Baillie et al., 2013).

Limitations

There were several limitations identified with this study. This study used a small convenience sample from three cohorts of first-semester nursing students at a single university, which could have affected generalizability. The small sample size might have affected the results. Demographically, the sample was somewhat atypical of the general student nursing population. A larger sample more congruent with national nursing student demographics might have yielded different results.

The time involved to complete the study might have impacted students' desire to participate in the study. Given the rigor of the undergraduate nursing curriculum, a 1-hour block of time needed to complete the study during the Nursing Fundamentals course was unavailable. Therefore, the study was conducted immediately after the Nursing Fundamentals course.

Additionally, the completion of a pretest, instruction, and posttest all in a 1-hour block of time might have affected the results. A posttest given at a later date, but prior to any EHR exposure in clinical rotations, might have better captured what the students retained from the instruction. Marsden and Torgerson (2012) indicated that the more time between pre- and posttest, a greater effect from the intervention is likely due to maturation.

The instrument used in this study to assess self-efficacy (P.A.T.C.H. v.3; Kaminski, 2016) had 50 questions, the length of which might have contributed to the failure of 12 participants to complete this survey. A shorter, 32-question version of this instrument is available (Kaminski, 2006) and might have increased student completion. The shorter version focused on questions about technology and omitted questions that were not pertinent to this study such as, "Patients should not look for health and illness information on the Internet."

Future Research

This study explored two teaching approaches to EHR instruction in first-semester undergraduate nursing students: (a) a traditional lecture approach using a PowerPoint presentation and (b) hands-on training with the use of an AEHR. Suggestions for future research include using multiple schools of nursing to increase the number and diversity of participants and lengthening the time period for the study. Such a study could include the EHR instruction in the Nursing Fundamentals course. The findings in this study, specifically the increase in competency scores, show that the use of an AEHR will better prepare nursing students to use this knowledge and practice in a technology-rich environment. Effective and improved technology training in nursing school can bridge the gap between nursing education and the technologically rich health care environment. Additional research is needed to explore best teaching methods, the use of AEHRs, and the effects of integration across the curriculum. The differences between graduates

from programs that use AEHRs versus those not using AEHRs is unknown. A longitudinal study examining this during the 1st year of practice from the nurse, employer, and patient outcome perspectives is imperative to increase understanding in this area.

Further research exploring the optimal amount of hands-on and simulation time using the AEHR needs to be determined; it is unlikely that a 1-hour intervention provided as an add-on to the curriculum will be sufficient. Lack of skill and knowledge regarding EHR use can have a serious impact on patient safety (Brooks & Erickson, 2012; Pilarski, 2010). The ultimate assessment of AEHR technology will be the effect of AEHR-based training on factors such as nursing error rates, patient safety, efficiency, and overall satisfaction.

Summary

This last chapter outlined the findings and recommendations for this EHR study of first-semester undergraduate nursing students. The time has come when everyone who delivers health care needs to utilize an EHR. Despite this requirement, many nursing programs have not revised their curriculum to incorporate nursing informatics and EHR education. As a student, the lack of knowledge regarding the EHR creates unnecessary anxiety and interferes with effective learning. Furthermore, nursing graduates are entering the workforce unprepared. They lack the knowledge and skill level vital to utilize an EHR in order to deliver safe and competent care. As a key stakeholder in nursing education, employers in many health care sectors expect nursing graduates to be proficient in patient-care technology. The responsibility of the nurse educator is to provide students with all the tools and resources they need to succeed in practice. Therefore, nursing programs need to include this crucial component of education to prepare graduates for practice in this technology-driven health care environment (Gardner & Jones, 2012).

This study clearly demonstrates the superior efficacy of a hands-on AEHR approach to teaching EHR utilization when compared to traditional lectures. In and of itself, the study suggests that academic nursing programs should strongly consider investing in such systems and fully integrating them into the curriculum. The optimal way to deploy the systems to ultimately impact patient safety will require further investigation.

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

On Mon, April 23, 2018 10:28 am, Angela Ruckdeschel wrote:

Good morning,
My name is Angela Ruckdeschel. 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,
Angela Ruckdeschel, MSN, RN, PhD(c)

From: "June Kaminski" <june@nursing-informatics.com>
Subject: Re: Requesting permission to use P.A.T.C.H. Scale
Date: April 28, 2018 at 1:30:40 AM PDT
To: "Angela Ruckdeschel" <ruckdesc@unlv.nevada.edu>

Hello Angela,

You have my permission to use my PATCH scale in your graduate work.

Please keep me abreast of your results.

Good Luck with your study!!

June Kaminski RN MSN PhD(c)

Appendix B: P.A.T.C.H. Assessment Scale v.3

Directions: Each indicator is to be rated using a five-point Likert scale. For each statement, choose the response that best reflects your attitude related to using computers in the healthcare setting.

Scale:

1. Agree Strongly	2. Agree	3. Not certain	4. Disagree	5. Disagree strongly

1. The computer is a powerful 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 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 someday will pout 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. 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 be 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 smartphone.
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. Hand written charting is much more complete than electronic documentation.
50. Nurses should be involved in the planning of national Electronic Health Records.

Appendix C: STAI-6

Self-Evaluation Questionnaire (Y-6 item)

A number of statements that people have used to describe themselves are given below. Read each statement and then circle the most appropriate number to the right of the statement to indicate how you feel right now, at this moment. There are no right or wrong answers. Do not spend too much time on any one statement but give the answer which seems to describe your present feelings best.

	Not at all	Somewhat	Moderately	Very much
1. I feel calm	1	2	3	4
2. I am tense	1	2	3	4
3. I feel upset	1	2	3	4
4. I feel relaxed	1	2	3	4
5. I feel content	1	2	3	4
6. I am worried	1	2	3	4

Please make sure you that you have answered all of the questions.

Note. From "The Development of a Six-Item Short-Form of the State Scale of the Spielberger State-Trait Anxiety Inventory (STAI)," by T. M. Marteau and H. Bekker, 1992, *British Journal of Clinical Psychology, 31*, 301-306. In the public domain.

Appendix D: Permission to Use Scavenger Hunt From DocuCare

From: "Dettman, Eric" <Eric.Dettman@wolterskluwer.com>
Subject: RE: Summer data collection
Date: May 2, 2018 at 12:47:38 PM PDT
To: Angela Ruckdeschel <ruckdesc@unlv.nevada.edu>

Hey Angela,
I hope all is well. Got word back from the product team and you are good to go with permission on the Scavenger Hunt, etc. per our end user license agreement 2.4.2.

See you soon.

Thanks,

Eric Dettman
480-272-0222 cell
eric.dettman@wolterskluwer.com

Appendix E: Slide Outline of Traditional Lecture PowerPoint Presentation

1 **The Electronic Health Record (EHR)**

Angela Ruckdeschel, MSN, RN

2 **Objectives**

- Define Electronic Health Record (EHR).
- Develop an understanding of the use of an EHR in nursing care.
- Identify the components within the EHR.
- Describe the guidelines for quality documentation.
- Identify patient data and documentation relevant to Level One nursing students.

3 **Definition Of EHR**

- Computerized version of the traditional paper chart for a patient that includes health-related information

4 **Why Not Paper?**

- Federal Mandates
- Health Information Technology for Economic and Clinical Health (HITECH) Act of 2009
- Technology Informatics Guiding Education Reform (TIGER)
- Immediate access to clinical information
- Integration with other services (i.e. laboratory, radiology, pharmacy, etc.)
- Secure messaging

5 **Role of EHR in Nursing Care**

- Legal documentation
- Decision support
- Communication
- Reimbursement
- Education
- Research

- Auditing and monitoring

6 **EHR Components: Data Retrieval Relevant to Inpatient Nursing**

- Order entry
- Medication delivery: Bar-coded medication administration
- Documentation
    - Templates
- Clinical reminders

7 **Guidelines for Quality Documentation**

- Factual
- Accurate
- Complete
- Current
- Organized

8 **Retrieval of Patient Data & Documentation Relevant to You: The Level One Nursing Student**

- Assessment
- Basic neurology assessment
- Basic circulation
- Progress notes
- Vital signs and other data recording (i.e. pain rating, activity, intake & output, safety)
- Medication administration

9 **Screen Shots**

10 **Screen Shot: ADLs**

11 **Screen Shot: Intake and Output (I&O)**

12 **Screen Shot: Vital Signs**

13 **Screen Shot: Assessment**

Appendix F: EHR Screenshots of a Fictitious Patient

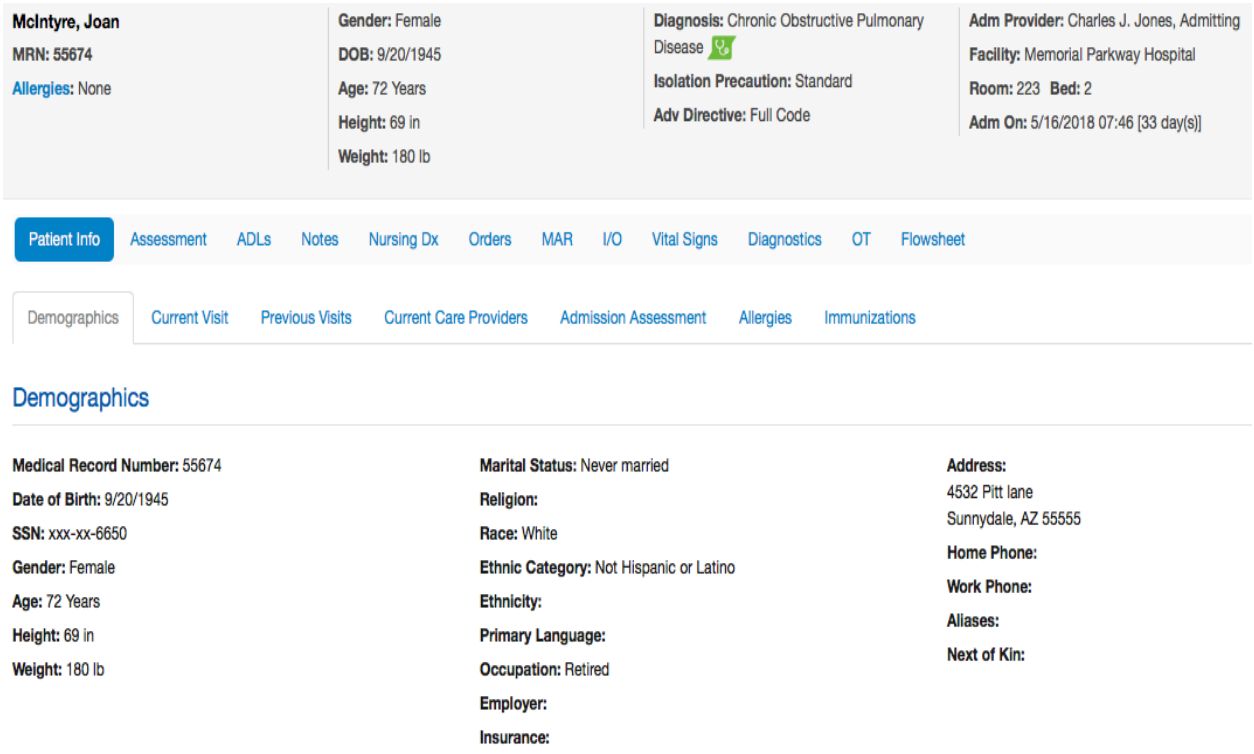


Figure F1. Electronic health record of a fictitious patient: Patient info and demographics.

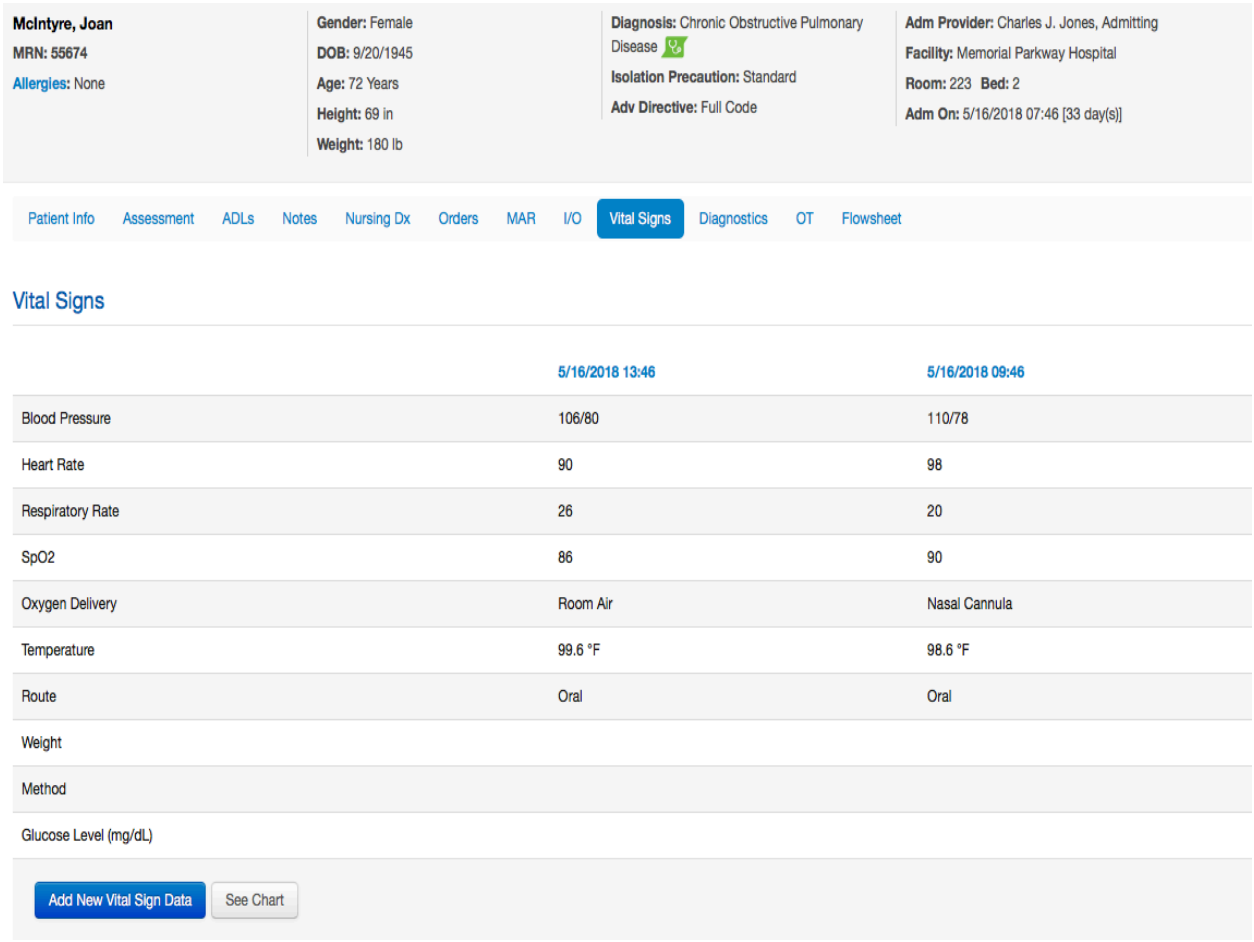


Figure F2. Electronic health record of a fictitious patient: Vital signs.

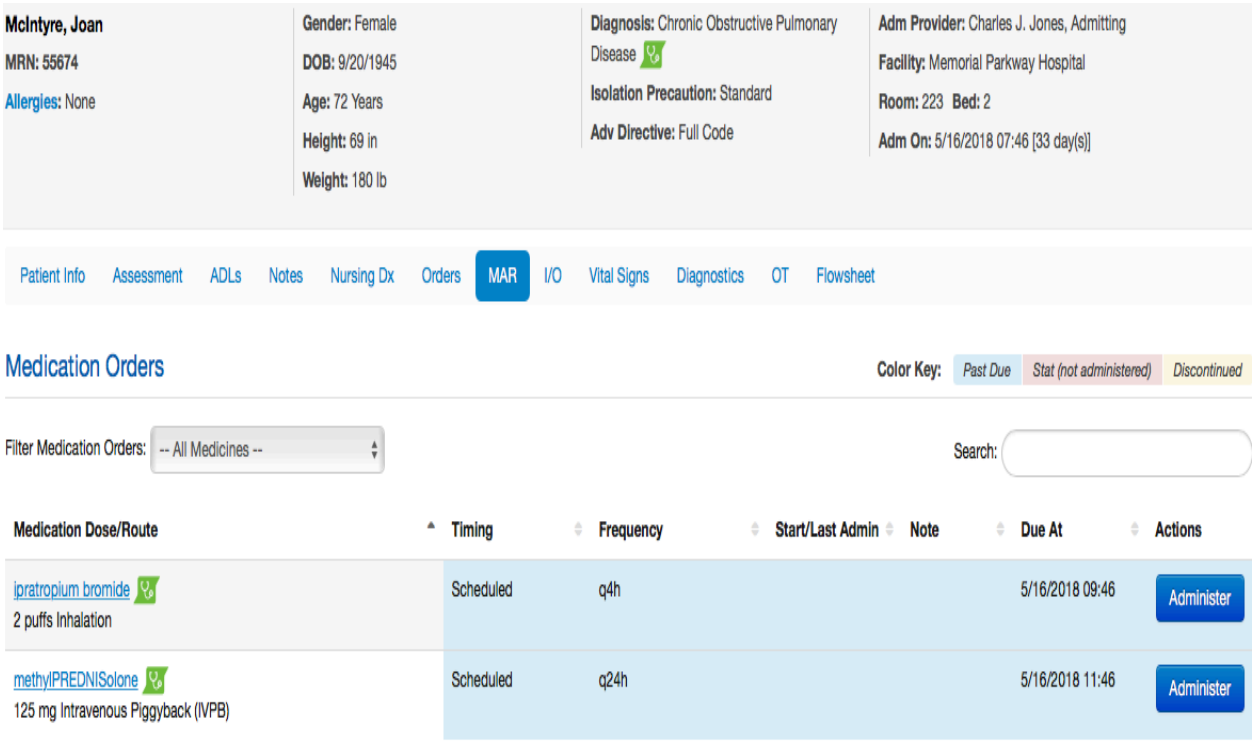


Figure F3. Electronic health record of a fictitious patient: Medication orders.

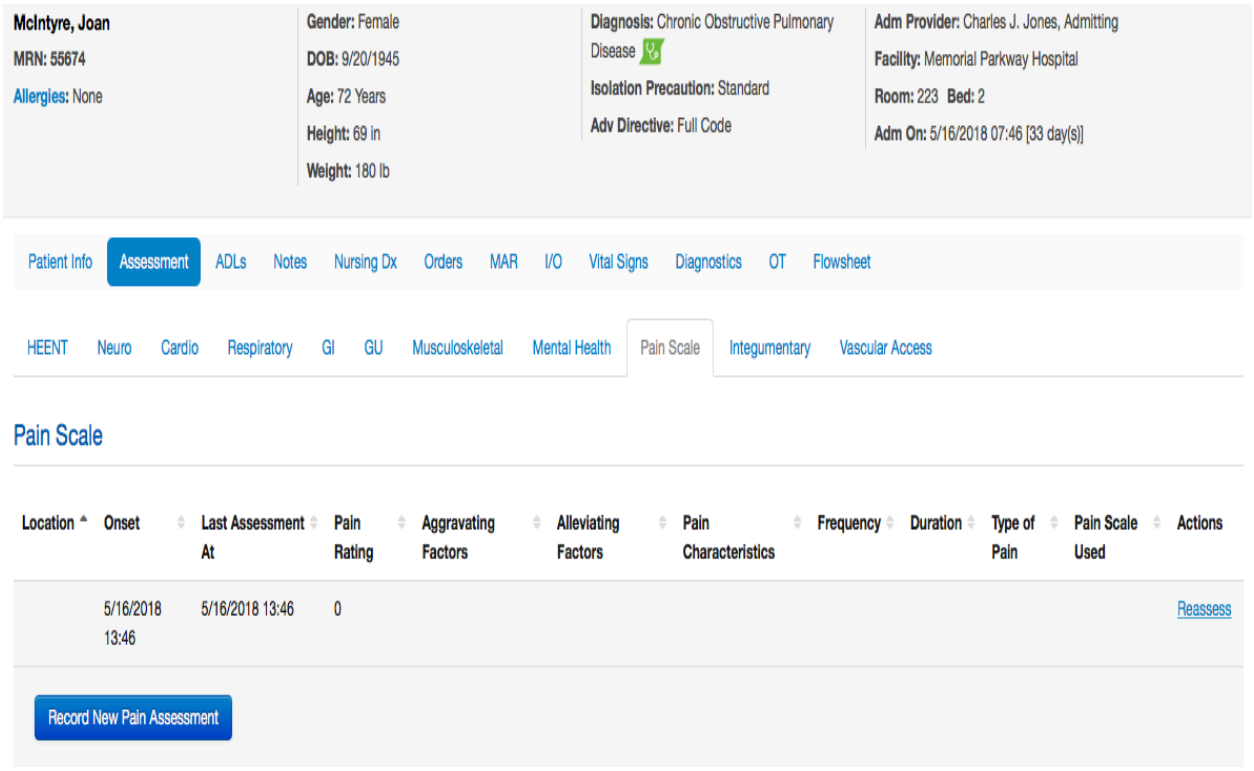
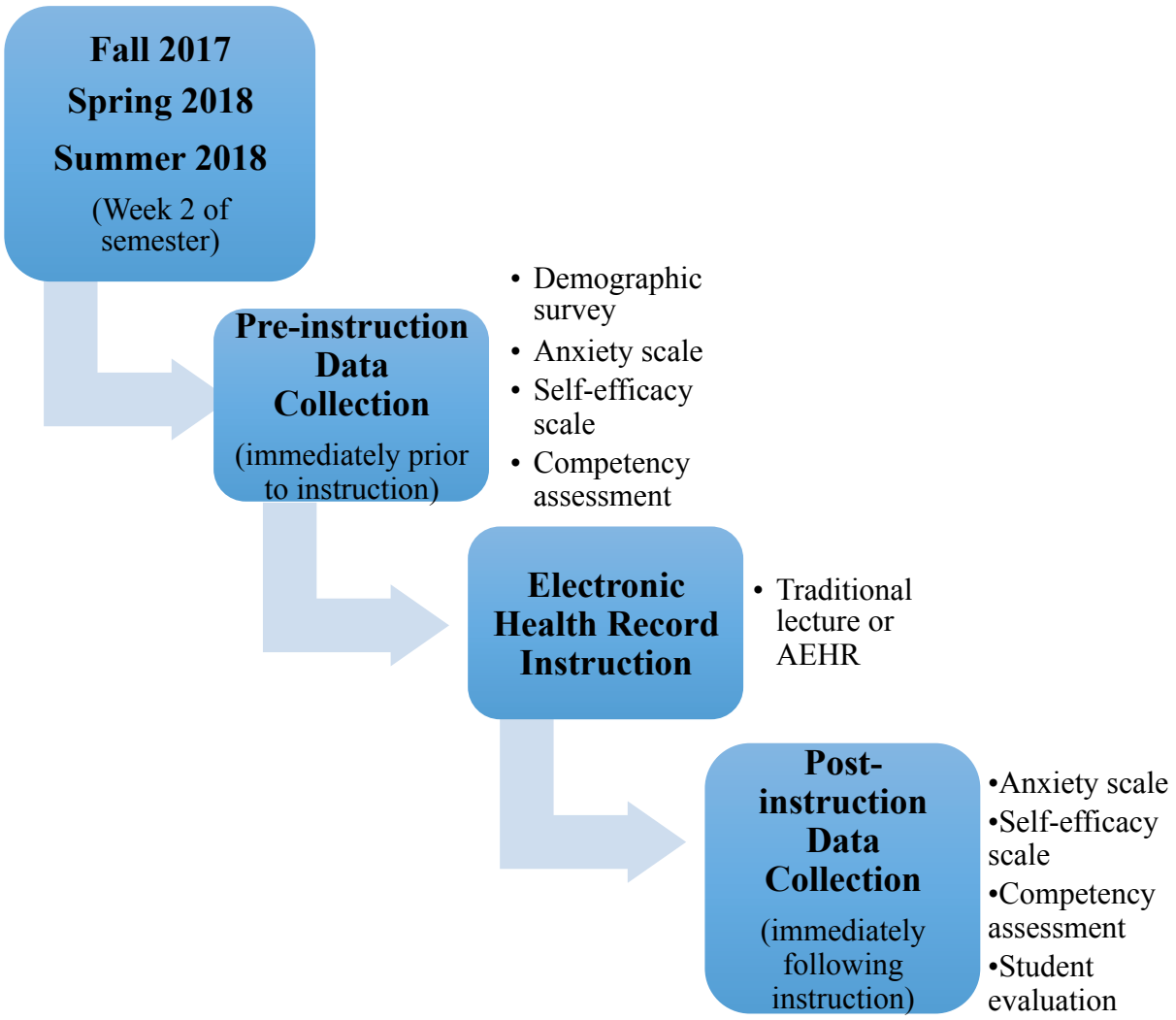


Figure F4. Electronic health record of a fictitious patient: Assessment and pain scale.

Appendix G: Project Timeline



Appendix H: Error Bar Charts

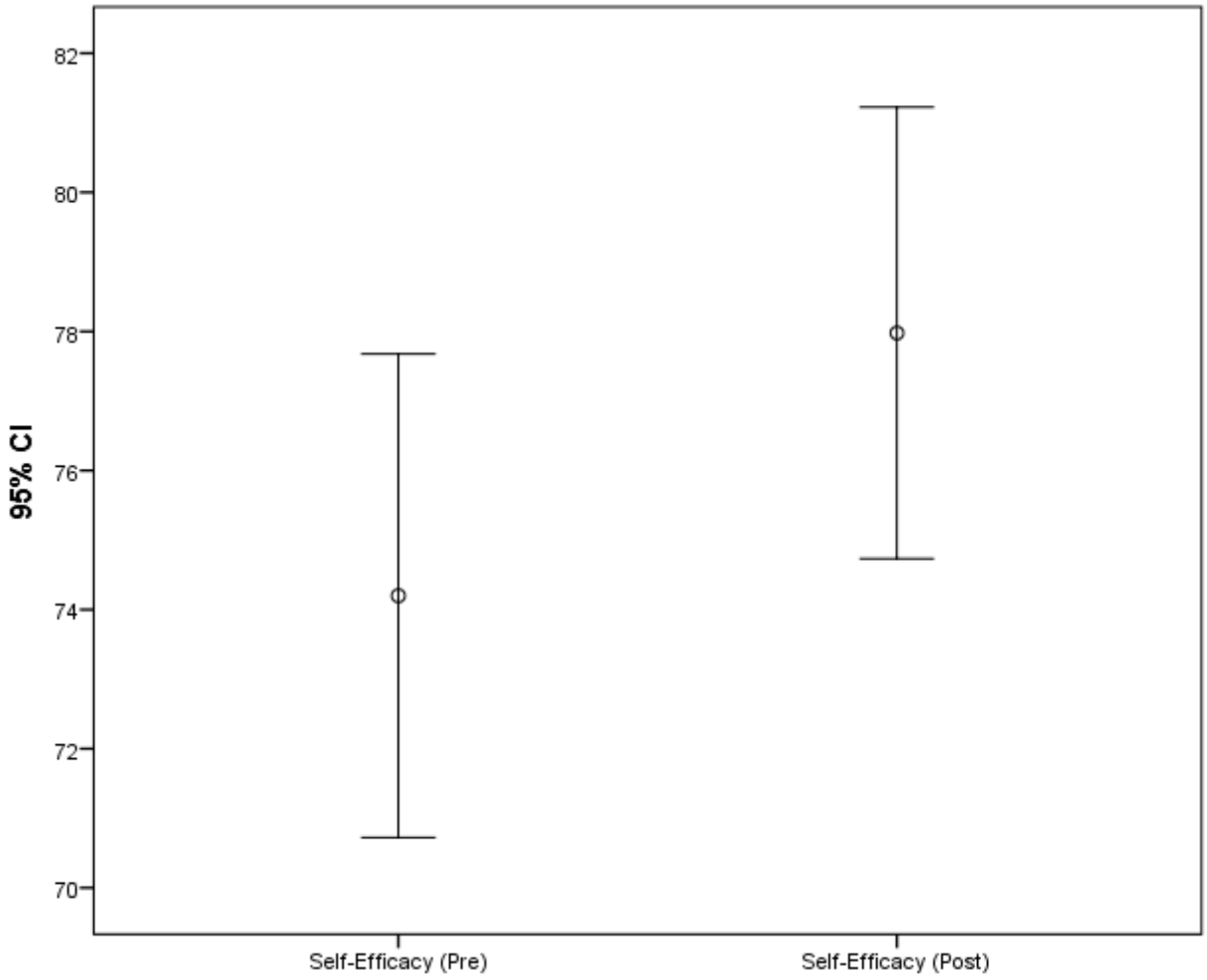


Figure H1. Error bar chart of self-efficacy pre- and postsurvey scores among undergraduate nursing students who received traditional instruction on electronic health record use. $n = 45$. Paired t-test results: $t(44) = 4.81$, $p < .001$, $d = 0.72$. Scores on the Pretest for Attitudes Toward Computers in Healthcare version 3, with a range of 0–100.

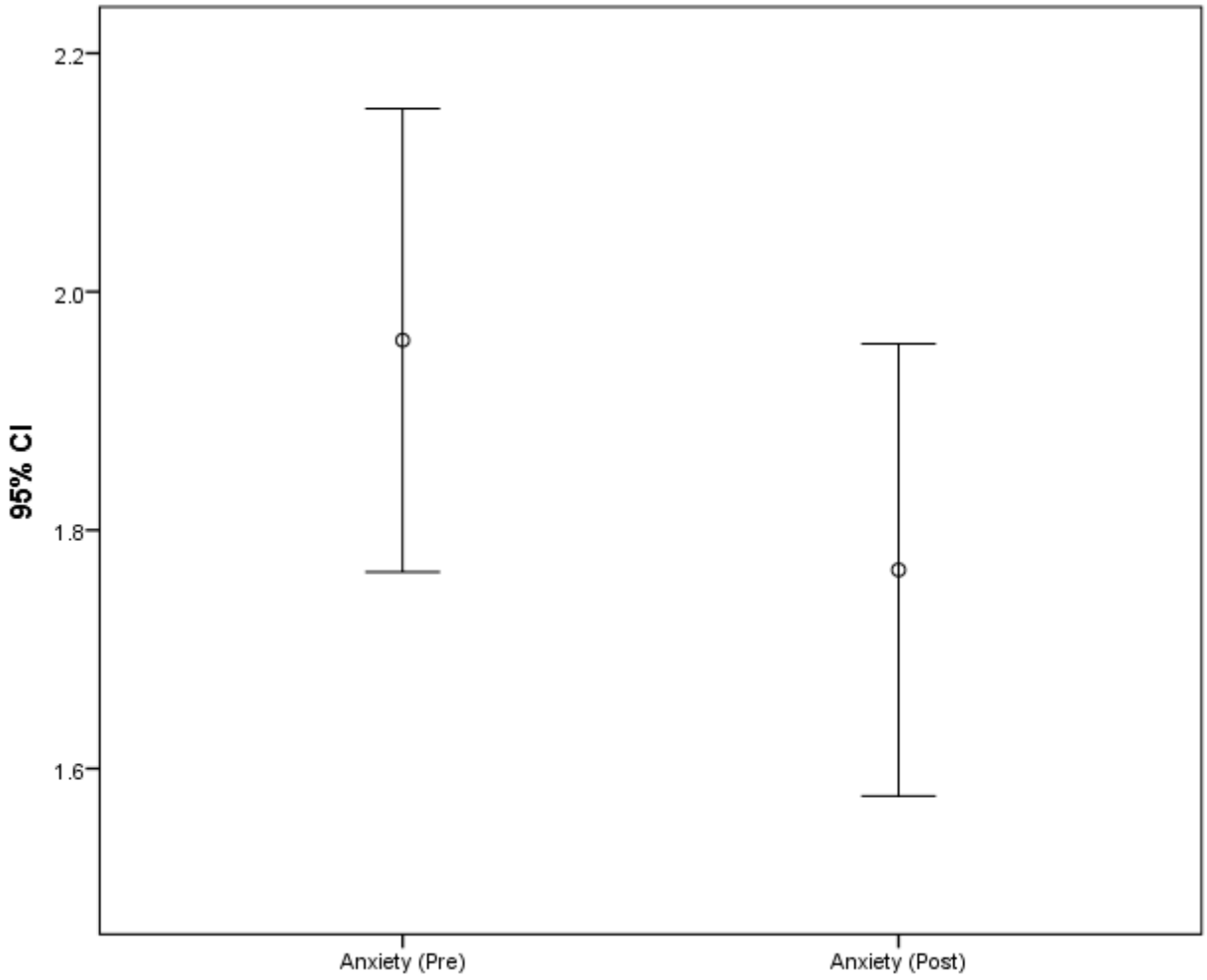


Figure H2. Error bar chart of anxiety pre- and postsurvey scores among undergraduate nursing students who received traditional instruction on electronic health record use. $n = 45$. Paired t-test results: $t(44) = 3.25$, $p = .002$, $d = 0.49$. Scores on the Spielberger State Trait Anxiety Inventory–6, with a range of 1–4.

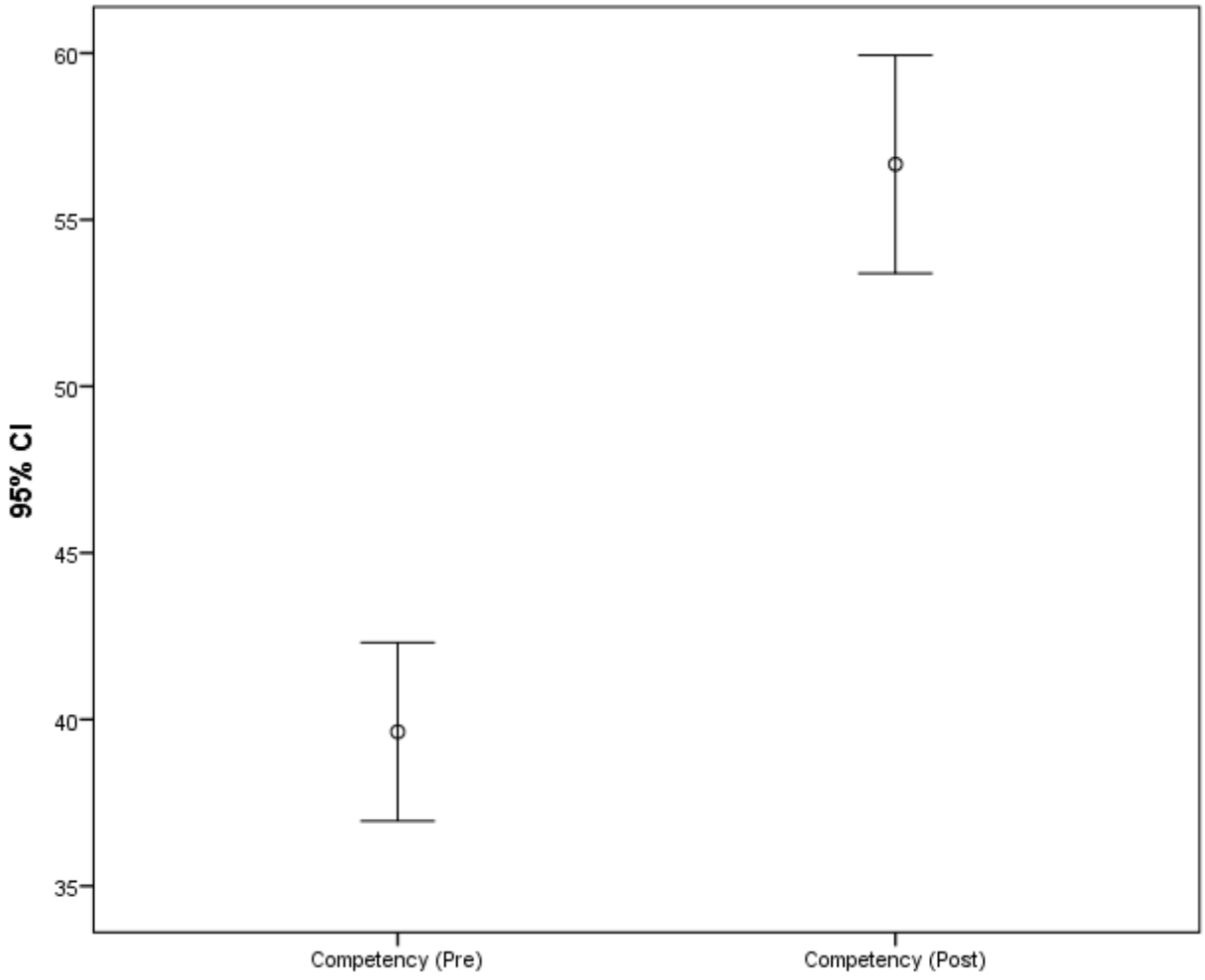


Figure H3. Error bar chart of competency pre- and posttest scores among undergraduate nursing students who received traditional instruction on electronic health record use. $n = 45$. Paired t-test results: $t(44) = 11.04$, $p < .001$, $d = 1.65$. Scores on a scale of 0–100%.

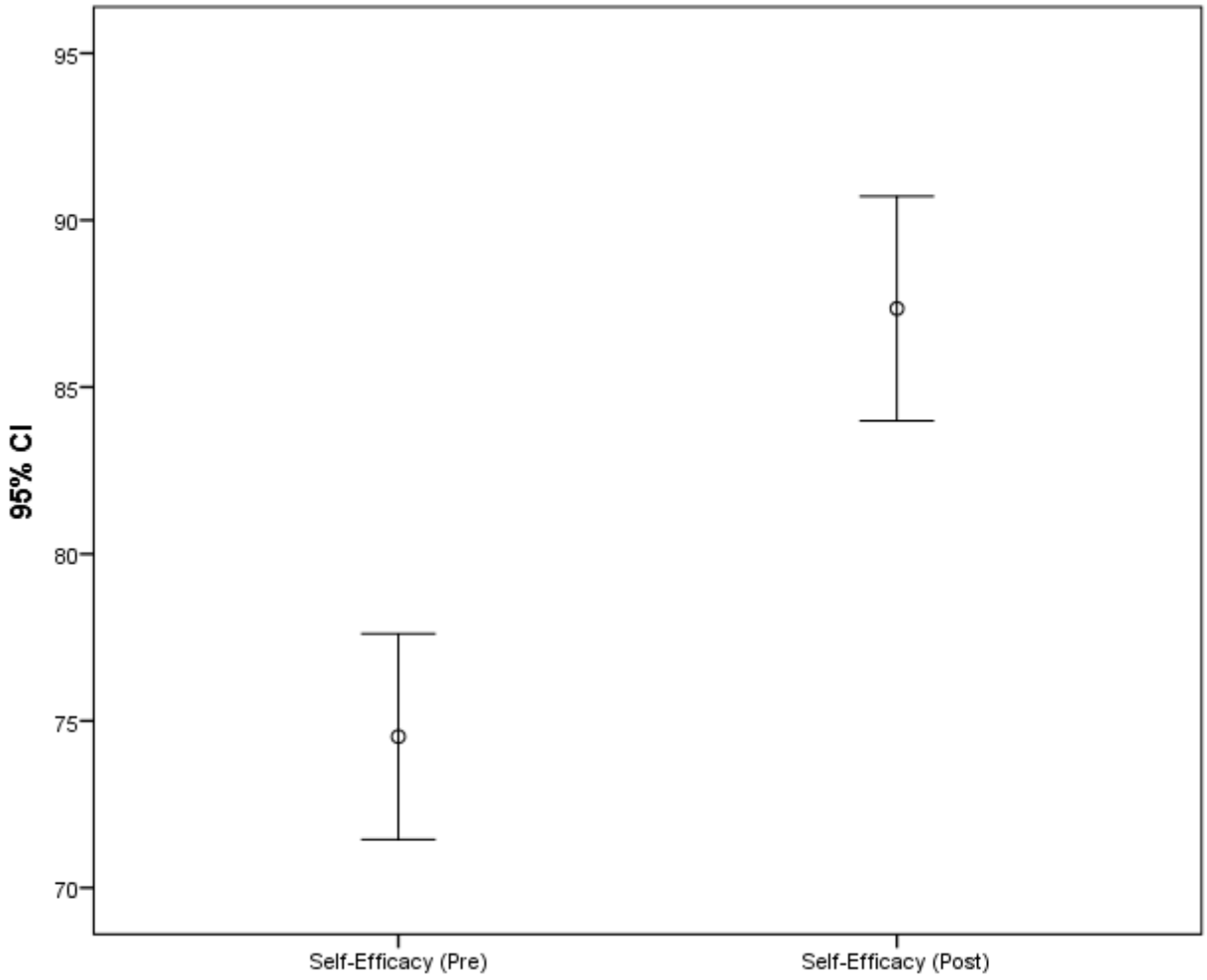


Figure H4. Error bar chart of self-efficacy pre- and postsurvey scores among undergraduate nursing students who received hands-on academic electronic health record instruction. $n = 34$. Paired t-test results: $t(33) = 7.00$, $p < .001$, $d = 1.20$. Scores on the Pretest for Attitudes Toward Computers in Healthcare version 3, with a range of 0–100.

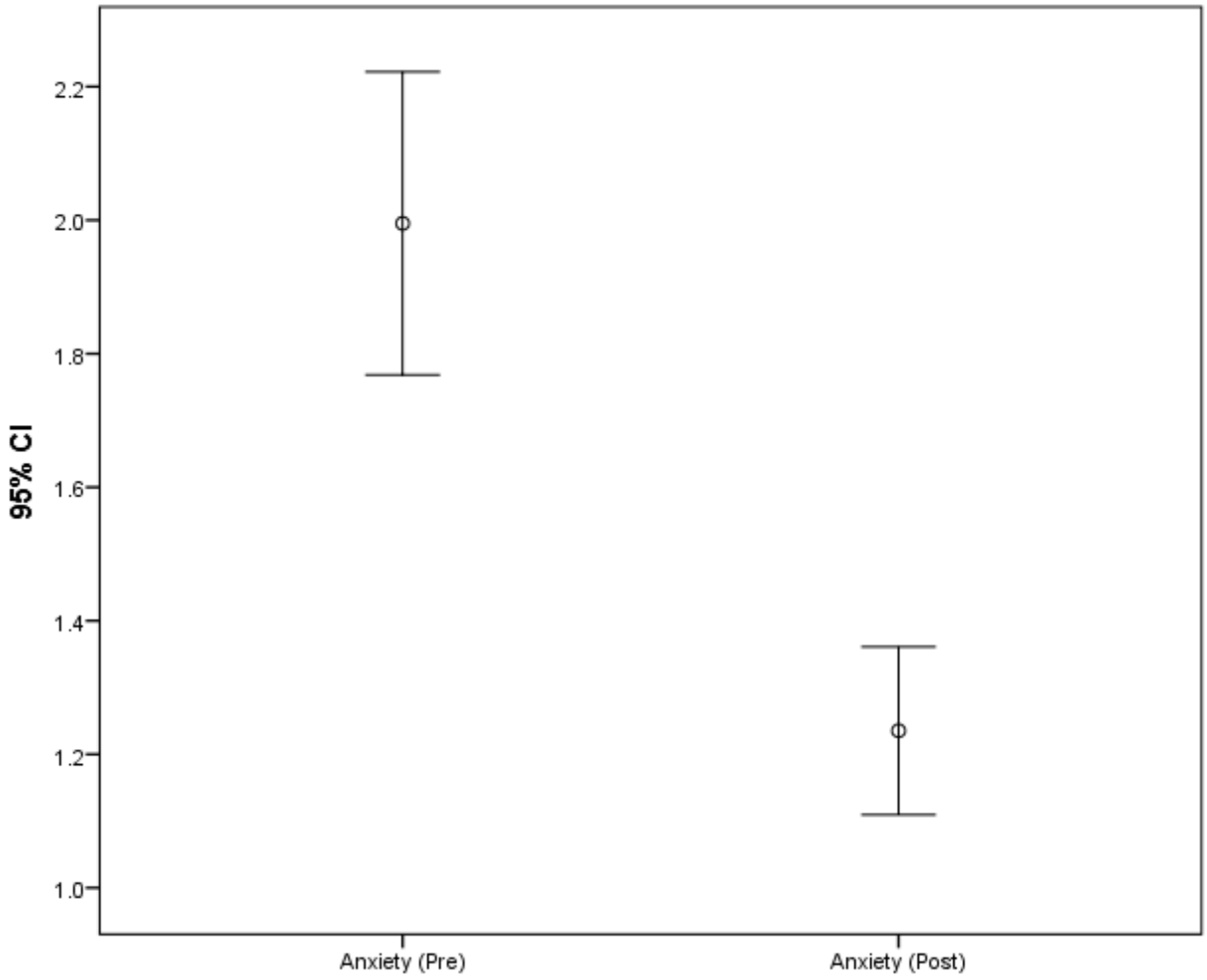


Figure H5. Error bar chart of anxiety pre- and postsurvey scores among undergraduate nursing students who received hands-on academic electronic health record instruction. $n = 34$. Paired *t*-test results: $t(33) = 6.29$, $p < .001$, $d = 1.08$. Scores on the Spielberger State Trait Anxiety Inventory–6, with a range of 1–4.

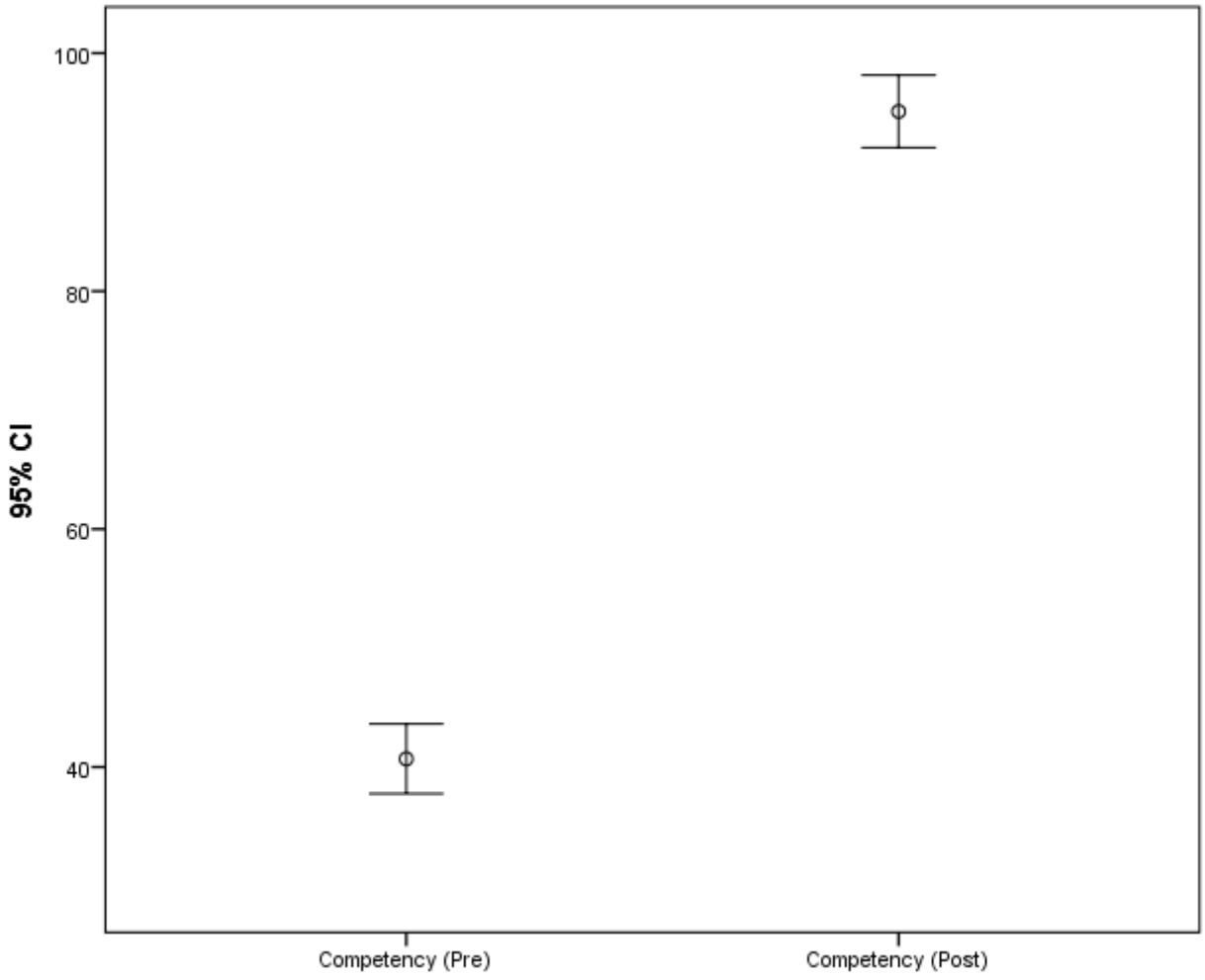


Figure H6. Error bar chart of competency pre- and posttest scores among undergraduate nursing students who received hands-on academic electronic health record instruction. $n = 34$. Paired t-test results: $t(33) = 28.60$, $p < .001$, $d = 4.88$. Scores on a scale of 0–100%.

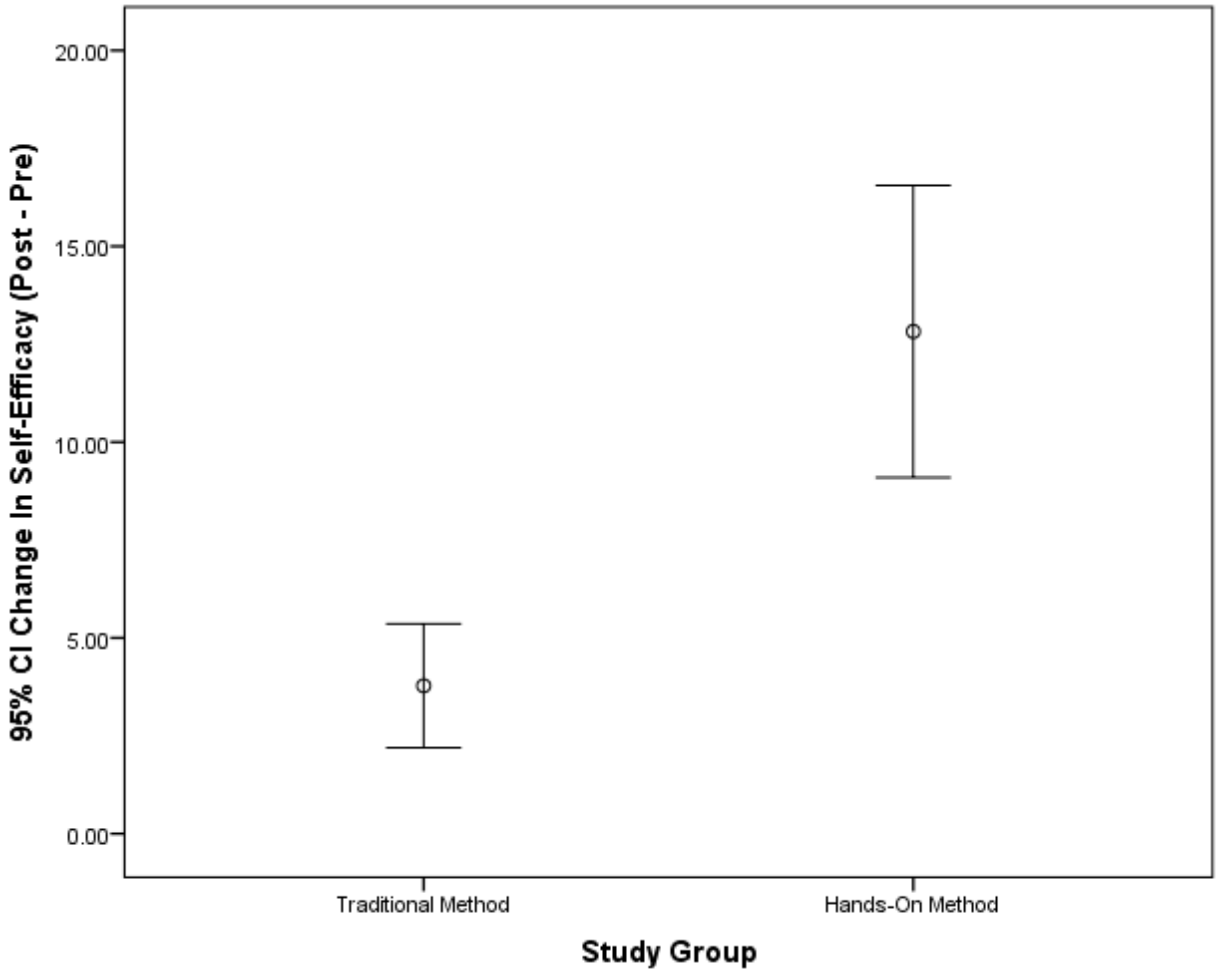


Figure H7. Error bar chart of change in self-efficacy scores after instruction for undergraduate nursing students who received traditional instruction (n = 45) and those who received hands-on academic electronic health record instruction (n = 34). Independent-samples t-test results: $t(77) = 4.94$, $p < .001$, $d = 1.12$. Scores on the Pretest for Attitudes Toward Computers in Healthcare version 3, with a range of 0–100.

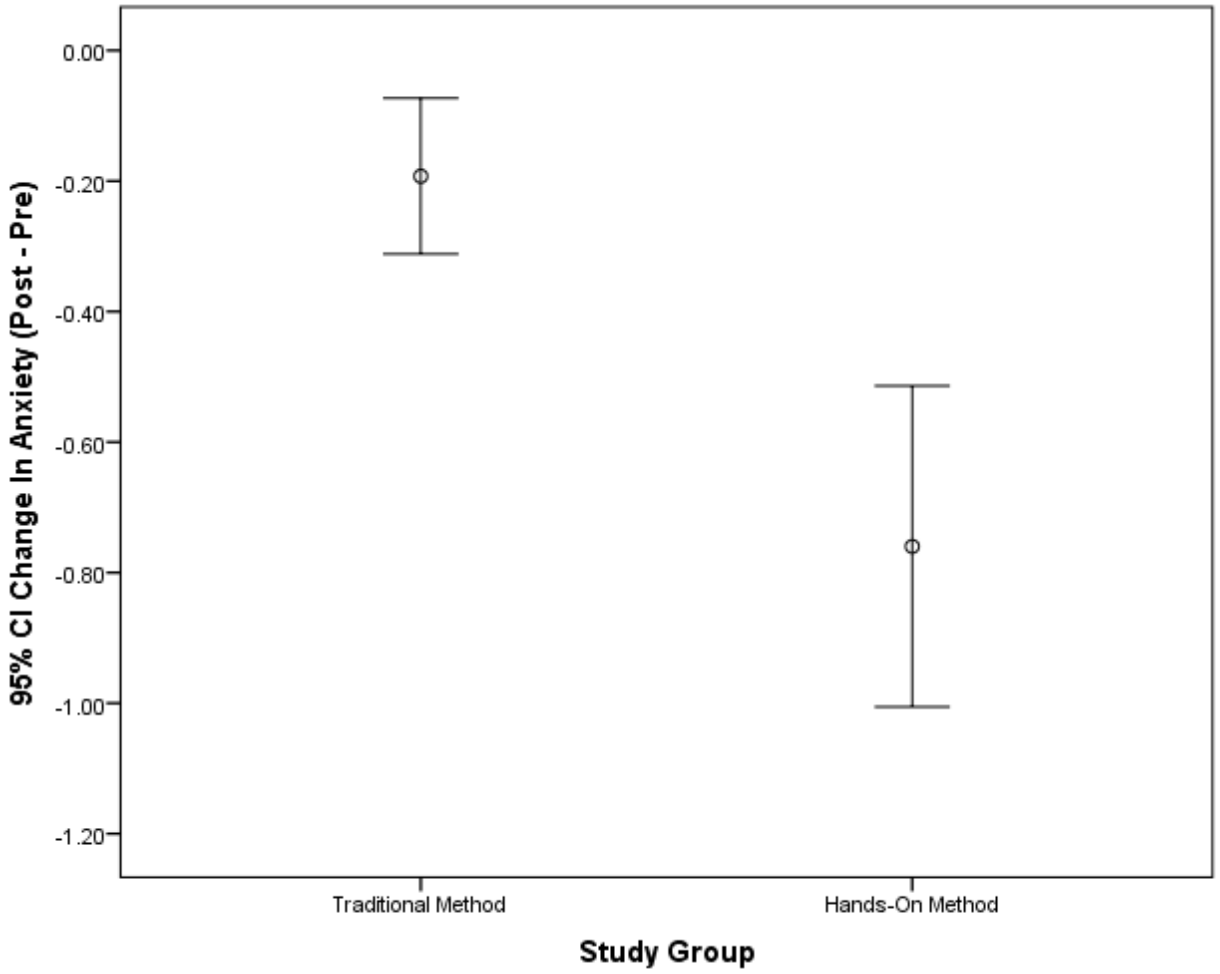


Figure H8. Error bar chart of change in anxiety scores after instruction for undergraduate nursing students who received traditional instruction (n = 45) and those who received hands-on academic electronic health record instruction (n = 34). Independent-samples t-test results: $t(77) = 4.53$, $p < .001$, $d = 1.04$. Scores on the Spielberger State Trait Anxiety Inventory–6, with a range of 1–4.

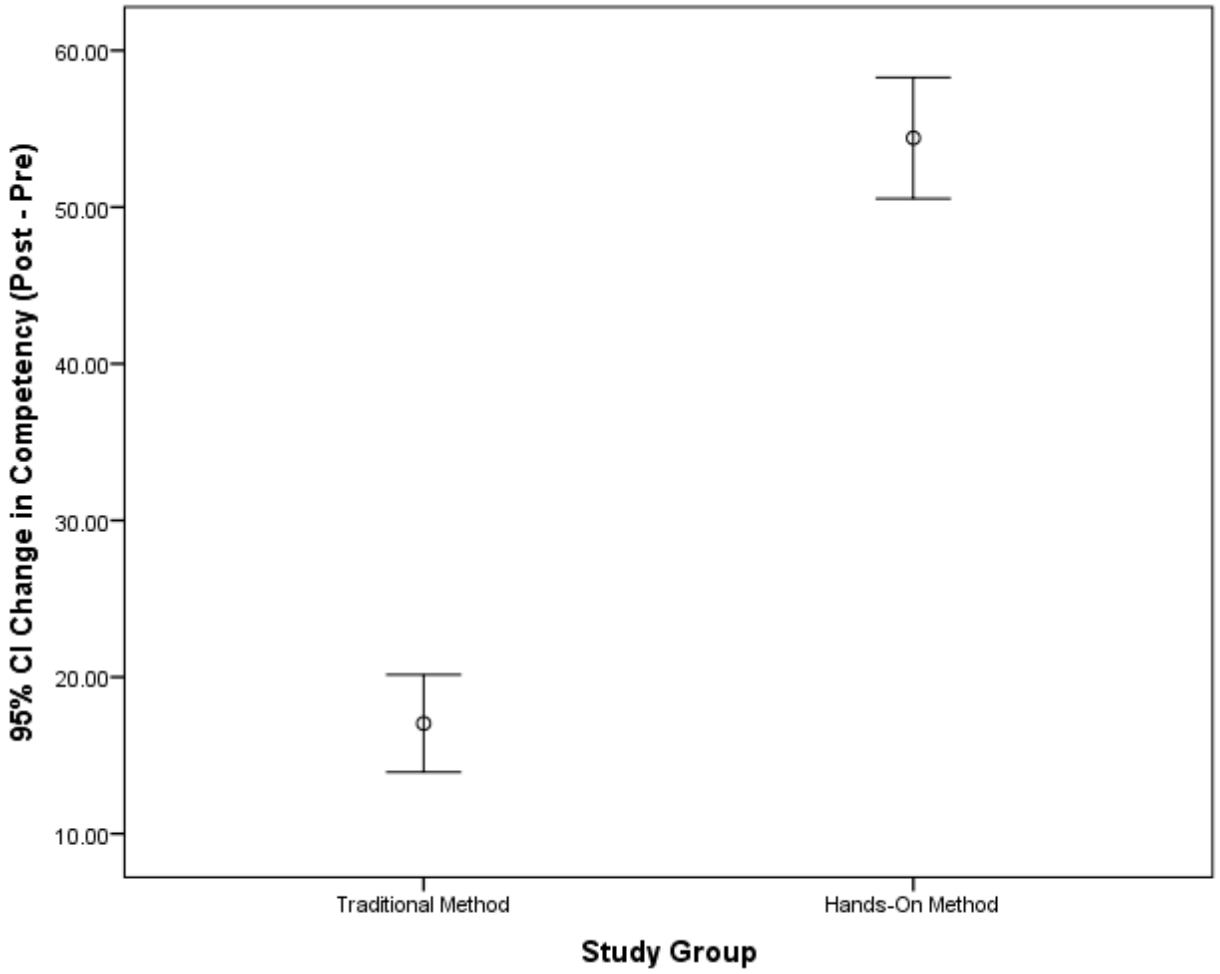


Figure H9. Error bar chart of change in competency scores after instruction for undergraduate nursing students who received traditional instruction (n = 45) and those who received hands-on academic electronic health record instruction (n = 34). Independent-samples t-test results: $t(77) = 15.41$, $p < .001$, $d = 3.50$. Scores on a scale of 0–100%.

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Curriculum Vitae

Angela R. Ruckdeschel, R.N., M.S.N.
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Summary: Registered nurse with over 18-years experience in oncology, primarily within the setting of academic cancer centers and 2-years experience in the setting of community hospices. Skilled in all aspects of comprehensive patient assessment and care, patient education on medications and disease processes, patient monitoring for safety and follow-up and coordination of care with pharmacists and physicians. Skilled in development and implementation of graduate nurse preceptorships and remedial skill education for staff nurses.

Skills: Excellent organizational skills, effective communication and writing skills, strong ability to mentor new and established nurses, strong analytic skills and working computer knowledge. Skilled in developing and implementing quality improvement measures, auditing for quality improvement and training.

***Current Position*:**

University of Nevada Las Vegas School of Nursing
Full time graduate student with expected graduation in August 2018.

Graduate Student in PhD Program-Nursing Education September 2015-present
Research assistant Summer 2016-present
Graduate assistant Fall 2016-Spring 2017

Work Experience:

Creekside Hospice, Las Vegas, NV

Nurse Educator/Preceptor November 2013-March 2014
Responsible for ongoing evaluation of individual education needs of existing staff nurses and implementation of mentoring for new hires. Revised hospice nursing orientation program.

Nathan Adelson Hospice, Las Vegas, NV

Nurse Educator/Trainer-Auditor: January 2012-August 2013
Developed and implemented graduate nurse orientation and training. Developed, implemented and provided ongoing training for 'Shape of the Visit.' Leader of "Service Excellence Team for Quality Measures." Lead auditor for internal Medicare audit. Conducted complete chart audit for all patients on service greater than 180 days and wrote ADR summary on each patient.

Triage Registered Nurse: April, 2011-January, 2012
Provided patient care based on the nursing process while effectively maintaining the standard of care through assessment, planning, implementation and evaluation.

Nevada Cancer Institute, Las Vegas, NV

Registered Nurse-Infusion Center: June 2009-April 2011
Worked in infusion center with emphasis on nursing education for primary nurses and new nurses in the development of their assessment and chemotherapy administration skills.

Karmanos Cancer Institute, Detroit, MI

Registered Nurse-Infusion Center: September 2004-May 2009
Responsible for all nursing duties in high volume chemotherapy suite, in particular patient assessment /education and central line management. Additional duties included preparation of patient education materials and clinical leader of a "Fast Track" unit designed to rapidly assess patients for chemotherapy readiness.

Registered Nurse-Phase 1 Infusion Center: September 2003-
September 2004
Infusion nurse for large, complex phase 1 unit with over 40 phase 1 experimental trials at any time.

H. Lee Moffitt Cancer Center, Tampa, FL

Primary Nurse-Thoracic Oncology: June 1997-August 2003
Responsible for multiple activities within the context of a multidisciplinary thoracic oncology team with emphasis on patient evaluation and education, pain management, clinical nurse leader duties, scheduling and interaction with clinical research staff, physicians, pharmacists and advanced practitioners.

Registered Nurse-Endoscopy: October 1996-June 1997
Responsible for patient care during a variety of endoscopic procedures.

Inpatient Registered Nurse: March 1994-October 1996
Duties included complete primary care for medical-surgical oncology patients with extensive patient education, post-operative and wound care, as well as inpatient chemotherapy treatment.

Administrative Leadership Roles:

Nathan Adelson Hospice
Service Excellence Team for Pain Quality Measure
Performance Improvement for Care Planning Process

Nevada Cancer Institute
Nurse Practice Committee
Nurse Preceptor/Educator
Moffitt Cancer Center
Task Force for Referring Physicians
Lung Cancer Awareness Program Planning Committee
Clinical Ladder Committee
Professional Practice Resource Council
QA Committee
Staffing and Scheduling

Education:

University of South Florida, Tampa, FL	**B.S.N Nursing, May 1994**
University of Nevada Las Vegas, Las Vegas, NV	**M.S.N Nursing, August 2015**

Honors:

Golden Key Honor Society	**2014-Present**
Harry and Rebecca Lahr Foundation Scholarship	**2014/2015, 2015/2016, 2016/2017, & 2017/2018**
Sigma Theta Tau Honor Society	**2015-Present**
Outstanding Graduate Student Award	**2015**
Jonas Nurse Leaders Scholar Program	**2016-2018**
Phi Kappa Phi	**2017-Present**
UNLV Graduate College Medallion	**2018**

Licensure:

Nevada: 62460
Florida: 2842642
Michigan: Inactive

Publications:

1. Kawi, J., & Ruckdeschel, A. (2017, March). Evidence-based online information on opioids. In J. Inouye (Organizer), *mHealth and Wearable Technology Application for Global Health.* Symposium conducted at the 14th Annual National Conference, Asian American/Pacific Islander Nurses Association, Honolulu, Hawaii.
2. Stone (**Ruckdeschel**) A, Ellis C, and DeBartolo J, A Nursing Professional Practice Model Within an Ambulatory Care Setting (Abstract) Oncology Nursing Society Annual Meeting, 1999.
3. Massaro T, Munroe D, Schisler L, White R, Stone (**Ruckdeschel)** A, Gambill A, Shirkman N and Tuttle M. A Professional Practice Model: Two Key Components. Nursing Management 1996. 27: 43-47.