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**THE EFFECT OF A LEARNING ENVIRONMENT USING AN ELECTRONIC
HEALTH RECORD (EHR) ON UNDERGRADUATE NURSING STUDENTS'
BEHAVIORIAL INTENTION TO USE AN EHR**

A Dissertation in

Instructional Systems

by

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ABSTRACT

The purpose of this study was to explore the effect of a learning environment using an Electronic Health Record (EHR) on undergraduate nursing students' behavioral intention (BI) to use an EHR. BI is defined by Davis (1989) in the Technology Acceptance Model (TAM) as the degree to which a person has formulated conscious plans to perform or not perform some specified future behavior. BI is determined by measuring the perceived usefulness (PU) and perceived ease of use (PEOU) of a particular technology or information system.

The study employed 56 undergraduate nursing students, both juniors and seniors, from three (3) accredited Schools of Nursing in a survey research approach that uses a cross-sectional between-subjects design. One-on-one interviews also were used to document undergraduate nursing students' perceived behavioral intention of an EHR in the learning environment on clinical rotations and on practice.

Participants were recruited using sampling procedures during the fall 2010 and spring 2011 semesters. They were either enrolled at (1) Schools of Nursing that bring an authentic EHR experience into the curricula in order to teach nursing practice or; (2) a School of Nursing that uses a paper-based approach to teach nursing practice. In both environments students also had experience with an EHR on clinical rotations.

Participants were asked to complete a self-administered questionnaire that has items to assess the perceived usefulness (PU) and the perceived ease of use (PEOU) of an EHR. They were also given the option to participate in a follow-up interview. During the interview, they were asked to share their perceptions of their behavioral intention to

use an EHR on their clinical rotations and in practice.

The mean scores for all the survey responses and the mean score for individual items on the questionnaire and their standard deviations were consistent across both learning models. The data did not predict behavioral intention for either factor PU or PEOU. There was a significant difference between the BI to use an EHR between junior and senior students' educated in a learning environment using an EHR with senior students reporting a higher BI score.

Regarding the interviews, there was a reported impact to PU and PEOU for the majority of the participants interviewed. In general, participants reported a positive impact on their behavioral intention to use an EHR. All participants agreed that there was value in having an Electronic Health Record (EHR) to teach nursing practice integrated within the school curricula (classroom, skills lab, and simulation lab).

The conclusions of this study can be offered as suggestions for improving the education of nursing students in the United States. Based on the results and the findings presented in this study, faculty members at schools of nursing should consider implementing an EHR in the classroom, skills lab, and simulation lab in order to positively impact students' behavioral intention to use an EHR. Additionally, EHR implementation in the classroom, skills lab, or simulation lab will likely lead to an increase in understanding of the technology and how it relates to nursing practice, an increase in knowledge and skill set, an increase in competence, an increase in comfort level with technology, a decrease in stress and anxiety when using an EHR on clinical rotation, and will ultimately serve to better prepare nursing students for nursing practice. Limitations of this study and recommendations for future research are also shared.

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CHAPTER 1

INTRODUCTION

Research Problem

Advances in healthcare information technology (HCIT) over the last decade have been pervasive in the healthcare industry. Central to this transformation is an Electronic Health Record (EHR). In 1999, the Quality of Care committee at the Institute of Medicine (IOM) published a report; *To Err is Human - Building a Safer Health System*. This report stated that at least 44,000 and as many as 98,000 Americans die annually from preventable medical mistakes. In 2002, the American Academy of Nursing (AAN) held an interdisciplinary conference consisting of 20 organizations that have a focus to use information technology to improve the delivery of patient care. At that conference, it was suggested that emerging technologies like an EHR can help to decrease medical errors and increase the time available for direct patient care. (American Academy of Nursing, 2002). Poon, Jha, Christino, Honour, Fernandopulle, Newhouse, Middleton, Leape, Bates, Blumenthal, and Kaushal (2006) found there is a limitation in comprehensive knowledge about the level of HCIT and clinical information systems (CIS) adoption in the United States. To encourage adoption, professional organizations like the Institute of Medicine (IOM) and the National League for Nursing (NLN) agree that as more hospitals integrate HCIT and EHRs, the education of nursing professionals should include basic informatics concepts alongside the basic science concepts in order to

produce nurses who are ready for 21st century care planning. Many baccalaureate nursing programs are addressing computer literacy skills, rather than information system literacy skills (McNeil, Elfrink, Bickford, Pierce, Beyea, Averill, & Klappenbach, 2003). The skills acquired through information system literacy are needed most in order to effectively drive evidenced-based care and evidenced-based decision making.

Academic institutions are asking the question, what is the best way to build a clinical information systems base at their schools?

In 2001, IOM published another report, *Crossing the Quality Chasm*, which called for a redesign of the American Health System with a fundamental focus on innovation and the quality delivery of patient care. One of the key recommendations was to pay attention to the role of informatics in healthcare and to implement information technology (IT) into the clinical education of future health professionals. In order to teach information literacy vs. computer literacy, curriculum content should include virtual case studies that help students “think in a data driven mode that, in turn, provides the foundation for evidence-based practice” (Connors, Weaver, Warren, & Miller, 2002, p. 230). Connors et al. further suggest that if educators create a central learning environment using a CIS base, then clinical data management concepts can be taught through applications within that CIS. The focus would be on gathering, retrieving, and analyzing data for use in decision making and creating quality in patient care. These skills get to the heart of information literacy, “a skill set that enables nurses to locate, access, and evaluate information” (McNeil et al. 2003, p. 342).

Since 2001, institutions of higher education have sought to integrate the Institute of Medicine’s recommendations into the education of health professionals in several

ways. It has been suggested by Warren, Meyer, Thompson, and Roche (2010) that in order to prepare students for the digital environments in which they are entering “nursing students must master basic informatics concepts and information technology competencies” (Introduction section, para. 1). In order to prepare graduates for the workforce, McNeil et al. (2003) writes “timely information for effective decision making,” (Abstract section, p. 341) is required and information technology used to support nursing practice “must be integrated into nursing program curricula” (Abstract section, p. 341). Multiple sources have documented the importance of making sure that nurses are prepared for informatics practice (Carty & Rosenfield, 1998; Connors et al., 2002; Gassert, 1998; McNeil et al. 2003; McNeil and Odom, 2000; & Staggers, Gassert, and Curran, 2001). Guidelines for the inclusion of informatics content in nursing education have been developed by several “organizations such as the American Association of Colleges of Nursing (AACN) (1998), the American Nurses Association (ANA) (2001), and the Pew Health Professions Commission (Bellack & O’Neil, 1998)” (McNeil et al., p. 342). The challenge remains and is posed in the form of a question by McNeil et al., “How can nursing graduates be prepared to deliver evidence-based practice within the changing world of nursing information technology if a knowledge gap exists among nurse educators and nursing programs do not include information technology content?” (p. 348).

For widespread adoption of these new and emerging technology systems to take hold, it is clear that access needs to be provided. There needs to be a systemic approach taken by our clinical leaders across the healthcare industry. This approach needs to be holistic and include providers, private corporations, and public institutions of higher

education. Educators are at the foundation of this effort and need to begin to adopt these systems and technologies in the classroom to educate both graduate and undergraduate students on a clinical information systems base through the context of an Electronic Health Record (EHR). Emphasizing the importance of information sciences alone will do very little to advance teaching and learning. Unless opportunities are available for students to use EHR technologies as they learn their clinical skills, important competencies will not be developed. Students need the opportunity to demonstrate psychomotor skills while developing communication and clinical judgment skills. This pedagogical approach to teaching nursing techniques has been outlined by the University of Kansas, School of Nursing (Warren, 2010). Students need hands-on access to these technologies including an EHR in order to learn. The literature suggests that future clinicians will become both competent and proficient in the use of informatics if they have hands-on access to new and emerging technologies and are educated on a CIS base using modern technologies such as an EHR. Other studies have shown that people who have more education in a particular area are better able to learn and continue to learn from experience. (Lleras-Muney & Lichtenberg, 2002). However, there is a lack of research in general in regard to informatics acceptance or the intention to use informatics in the workplace (Holden & Karsh, 2010).

Purpose Statement

This study will reach nurse educators by exploring an area of interest that has been largely ignored. The study contributes to the knowledge base by exploring the effect of a learning environment using a clinical information systems (CIS) base through

the context of an Electronic Health Record (EHR) on the behavioral intention (BI) of undergraduate nursing students' to use an EHR. BI is defined by Davis (1989) in the Technology Acceptance Model (TAM) as the degree to which a person has formulated conscious plans to perform or not perform some specified future behavior. Attitude influences a person's BI to use a particular technology or information system (e.g. EHR) and is determined by measuring the perceived usefulness (PU) and perceived ease of use (PEOU) of a particular technology or information system. BI is thought to be a reliable predictor of actual use and is meant to inform the level of EHR acceptance among undergraduate nursing students' who have access to an EHR in the learning environment, whether that learning environment includes an EHR in the curricula (classroom, skills lab, or simulation lab) or access to an EHR on clinical rotation. The goal of this study was to use the TAM to investigate the effect a learning environment that brings authentic CIS experiences into curricula through the context of an EHR will have on the behavioral intention to use an EHR. As an extension to this goal, I also looked to determine if a difference existed in the BI to use an EHR between junior and senior undergraduate nursing students educated in a learning environment using a clinical information systems base. Finally, I investigated the perceptions that junior and senior undergraduate nursing students hold in regard to the value of an EHR in the learning environment. The focus will be on nursing students' perceived behavioral intention to use an EHR on their clinical rotations and in practice. This investigation challenges at least two assertions made by many nurse educators. First that the experiences all nursing students need can be obtained solely through clinical rotations. Second that there is little value in a learning environment using an EHR and that having a clinical information system or an EHR in

the classroom is unnecessary. This study examines the effect of a learning environment using a CIS base through the context of an EHR on undergraduate nursing students' BI to use an EHR and the undergraduate nursing students' perceived behavioral intention to use an EHR on clinical rotations and in practice.

Research Questions

1. What effect does a learning environment using an Electronic Health Record (EHR) have on senior nursing students' behavioral intention to use an EHR?
 - a. Is there a difference in the behavioral intention to use an Electronic Health Record (EHR) between junior and senior students' educated in a learning environment using an EHR?
2. What effect does a learning environment using a paper-based approach and clinical rotations have on senior nursing students' behavioral intention to use an EHR?
3. What is the impact on perceived behavioral intention to use an Electronic Health Record (EHR) on clinical rotations and on practice?
4. What is the perceived value of having an Electronic Health Record (EHR) to teach nursing practice in the classroom, skills lab, or simulation lab?

Hypotheses

1. (H1) Senior nursing students' using an Electronic Health Record (EHR) within the learning environment will have a positive behavioral intention to use an Electronic Health Record (EHR).
 - a. (H0) There will be no significant difference between the behavioral intention to use an Electronic Health Record (EHR) between junior and senior nursing students' educated in a learning environment using an EHR.
2. (H2) Senior nursing students' using a paper-based approach and clinical rotations within the learning environment will have a positive behavioral intention to use an Electronic Health Record (EHR).

Definition of Terms

Academic Education Solution (AES) – Cerner's Academic Education Solution (AES) is a full clinical information system (CIS) developed to support learning environments and classroom instruction. AES is an integrated, authentic experience into curricula through the context of an Electronic Health Record (EHR).

Behavioral Intention (BI) – The degree to which a person has formulated conscious plans to perform or not perform some specified future behavior (Venkatesh, 2010).

Clinical Information System (CIS) – A comprehensive, integrated information system designed to manage the administrative, financial and clinical aspects of a hospital. This encompasses paper-based information processing as well as data processing machines. (Hospital Information System, 2010).

Clinical Rotation – A period in which a nursing student is in the clinical part of his/her education, usually the second through the last semester year of school. The nursing student is given various clinical assignments with the goal of gaining experience in multiple clinical settings prior to entering the workforce. (e.g. operating room, medical-surgical, emergency, ICU, labor and delivery, pediatrics, community health, home health, long term care, etc.,).

Electronic Health Record (EHR) – There are many definitions of an electronic health record. For the purpose of this study, we will be using the following definition from Dick, Steen, and Detmer which best describes the information technology systems explored in this study. That said, I have also provided several other definitions that are not necessarily inaccurate or less credible.

Primary Patient Record - A primary patient record [or electronic health record (EHR)] is used by health care professionals while providing patient care services to review patient data or document their own observations, actions, or instructions. (Dick, Steen, & Detmer, 1997)

Alternative Definitions:

Electronic Health Record (EHR): An electronic health record integrates all elements of a patient's health history, including medications, lab work, x-rays, scans, EKGs, medical diagnoses, and more. EHRs are accessible at any secure station in any VA medical facility. (U.S. Department of Veterans Affairs, 2009)

Electronic Health Record (EHR): An aggregate electronic record of health-related information on an individual that is created and gathered cumulatively across more than one health care organization and is managed and consulted by licensed clinicians and staff involved in the individual's health and care. (Community HealthCare Association of the Dakotas, 2011)

Electronic Health Record - An electronic health record (EHR) (also electronic patient record (EPR) or computerized patient record) is an evolving concept defined as a systematic collection of electronic health information about individual patients or populations. It is a record in digital format that is capable of being shared across different health care settings, by being embedded in network-connected enterprise-wide information systems. Such records may include a whole range of data in comprehensive or summary form, including demographics, medical history, medication and allergies, immunization status, laboratory test results, radiology images, vital signs, personal stats like age and weight, and billing information. (Wikimedia Foundation Inc., 2011)

Electronic Health Record - (EHR) Repository of Information about the patient's health available in a computer-readable format. (T Beale). (The International Society for Telemedicine & eHealth, 2011).

Patient Record System - A clinical information system dedicated to collecting, storing, manipulating, and making available clinical information important to the delivery of patient care. The central focus of such systems is **clinical data** and not financial or billing information. Such systems may be limited in their scope to a single area of clinical information (e.g., dedicated to laboratory data), or they may be comprehensive and cover virtually every facet of clinical information pertinent to patient care (e.g., computer-based patient record systems) (Dick, Steen, & Detmer, 1997, Introduction, Page 56).

Learning Environment – The place and setting where learning occurs; it is not limited to a physical classroom, skills lab, or simulation lab and includes the characteristics of those settings.

Nursing Practice – Nursing is the protection, promotion, and optimization of health and abilities; prevention of illness and injury; alleviation of suffering through the diagnosis and treatment of human responses; and advocacy in health care for individuals, families, communities, and populations (American Nursing Association, 2010)

Paper-Based Approach – a method in nursing practice that uses hand written communication to document care, conduct care planning, and communicate with other clinicians (e.g. results, orders, and assessments).

Perceived Ease of Use (PEOU) – The degree to which a person believes that using a particular system would be free of effort (Davis, 1989).

Perceived Usefulness (PU) – The degree to which a person believes that using a particular system would enhance his or her job performance (Davis, 1989).

Technology Acceptance Model (TAM) – No definition for TAM currently exists in the literature, however, for the purpose of this study, TAM is an adaptation of the Theory of Reasoned Action (TRA) and in research has compared favorably with methods like Theory of Reasoned Action (TRA) and the Theory of Planned Behavior (TPB). TAM looks at a person's behavioral intention (BI) to use technology, which is determined by measuring the perceived usefulness (PU) and perceived ease of use (PEOU) of a particular technology or information system. As a backup to this definition, Wikipedia defines TAM as an information systems theory that models how users come to accept and use a technology (Technology Acceptance Model, 2010).

CHAPTER 2

LITERATURE REVIEW

Overview

This study examines the effect of a learning environment using an Electronic Health Record (EHR) on undergraduate nursing students' BI to use an EHR. The following chapter develops a justification for the questions posed in this study by reviewing the literature on the reinvention of the health care system through information technology, reviewing the importance of developing nursing informatics competencies as a critical facilitator of the success of this reinvention, reviewing the absence of literature in the area of BI to use information technology, and an overview of the an information systems theory that models how users come to accept and use a technology.

The chapter begins by explaining a national effort to address the growing complexity of health care by providing access to new and emerging technologies that foster innovation and improve the quality of patient care by decreasing medical errors and increasing efficiencies. Next a review of the literature that addresses the development of nursing informatics competencies is presented. This includes an overview of the importance of integrating information literacy alongside computer literacy in order to prepare nursing students for the work force. This is followed with a section addressing the absence of literature in regard to the BI to use an EHR. The chapter concludes by reviewing the Technology Acceptance Model (TAM) and the

reason TAM has been chosen as the examination method to get at an undergraduate nursing student's BI to use an EHR.

Reinvention of the Health Care System

In the past decade, national attention has been given to the importance of information technology and clinical information systems' ability to decrease medical errors and increase efficiencies important to providing direct patient care. Organizations such as the Institute of Medicine (IOM), the American Academy of Nursing (AAN), and the Office of the National Coordinator for US Department of Health and Human Services have encouraged healthcare systems, hospitals, and clinicians in all health care settings to purchase, implement, adopt, and use information technology. The goal is to address the growing complexity of health care by fostering innovation and improving the quality of medical care given to all people (Institute of Medicine, 2001). In addition to organizations, "health care experts, policymakers, payers, and consumers consider health information technologies, such as an electronic health record (EHR) and computerized provider order entry (CPOE), to be critical to transforming the health care industry" (Chaudhry, Wang, Wu, Maglione, Mojica, Roth, Morton, & Shekelle, 2006, p. 742).

In 2010, Dr. David Blumenthal and the Office of the National Coordinator for US Department of Health and Human Services has allocated billions of federal dollars, to be distributed over the next 5 years, to Information Technology (HITECH Act, 2010). As a result, these technologies will be available to clinicians and in use within healthcare settings. Availability of new and emerging technologies is only one part of the solution to the problem of providing quality throughout the continuum of care. While research

has shown concrete improvements in both the quality of patient care and evidence based outcomes, how exactly health care providers reproduce these results on a national level remains somewhat of a mystery (Chaudhry et al. 2006). Dollars and access alone will be unable to produce these results. In order to achieve results, it will take the proper utilization of these technologies in context to drive the improvements that key stakeholders are anticipating. Central to these improvements is the use of an Electronic Health Record (EHR). With the funding and availability gaps closing, policy makers and nursing educators turn their attention to the development of nursing informatics competencies and the acceptance of information technology; technology that the Institute of Medicine (2001) suggests will be the key to reinventing the health system.

The Development of Nursing Informatics Competencies

One of the key recommendations highlighted in IOM's 2001 report, *Crossing the Quality Chasm*, was to implement information technology into the clinical education of future health professionals. Institutions of higher education began to ask the question, what is the best way to build a CIS base that integrates the teaching of nursing informatics competencies? Before this question could be answered, nursing informatics competencies would need to be developed. Professional organizations like the IOM and the NLN suggested that basic informatics concepts need to be taught alongside the basic science concepts in order to produce nurses who are ready for 21st century care planning. McNeil et al. (2003) documented that guidelines for the inclusion of informatics content in nursing education were developed by the American Association of Colleges of Nursing (AACN), the American Nurses Association (ANA), and the Pew Health Professions

Commission. Multiple sources highlight the importance of making sure that nurses are prepared for informatics practice (Carty & Rosenfield, 1998; Connors et al., 2002; Gassert, 1998; McNeil et al. 2003; McNeil and Odom, 2000; & Staggers et al., 2001).

Carty and Rosenfield (1998) conducted a study on the status of nursing and information technology in nursing education. A survey research design was employed with 190 schools, fifty-percent of the 347 schools that were targeted. The population represented associate, baccalaureate, and advanced degree programs proportionately in comparison with national statistics. The findings indicated that while schools had access to computers and educational technology, the majority of schools lacked adequate finances, personnel, and strategic plans for the implementation of technology. Additionally, less than thirty-three percent (33%) integrated nursing informatics in curricula and out of 190 schools, only 19 offered nursing informatics as a separate course.

Gassert (1998) highlighted the concern that nurses were not prepared for the digital environments that they were entering, especially when it came to the management of information through technology. The paper presented five (5) key strategies meant to address and enhance this lack of preparation. The strategies included integrating core informatics concepts into nursing curricula, the preparation of specialized skills in nursing informatics, enhancing both education and practice through nursing informatics projects, preparing nursing faculty in informatics, and increasing collaboration in the area of nursing informatics. The impact on patients was discussed. Data was presented that support the recommendations from the National Advisory Council on Nurse Education and Practice (NACNEP) and the US Department of Health and Human Services, Division of Nursing.

McNeil and Odom (2000) presented an emergence of nursing informatics education in the US as the focus went from computer literacy to information literacy over the course of about 25 years. The major suggestion was to integrate informatics concepts alongside computer skills in teaching and learning. The paper reviewed the many definitions of nursing informatics over the years, highlighted the recommendations for competency development from leading organizations such as the American Nurses Association (ANA) and NACNEP, and discussed the role of the Federal government and regulating bodies such as JACHO on driving the impact on the practice of informatics in healthcare. The central theme seemed to be suggestions for redesigning undergraduate nursing programs with what McNeil and Odom (2000) called “essential curricular components,” (Introduction, p. 32). Essential components included two key concepts that still exist in nursing education today, (1) that information literacy and computer literacy exist together and (2) that emerging technologies must be reflected in the content.

Staggers and Gassert (2001) conducted a review of empirical studies over a 15 year period and concluded that a “comprehensive list of competencies to guide the integration of [nursing informatics] into nursing curricula” was lacking (p. 304). They further suggested that the integration of nursing informatics into nursing education has been a slow process. Like many others, it was suggested that informatics competencies would be valuable in order to determine the educational needs for all nurses.

In contrast to some of the other literature up to this point, Connors et al. (2002) describes “the development, implementation, and initial outcomes of an innovative academic-business venture that aims to provide future nurses with the unique skill set required to function in a fully automated health care system” (p. 229). The authors

suggest that in order to teach information literacy vs. computer literacy, curriculum content should include virtual case studies that help students “think in a data driven mode that, in turn, provides the foundation for evidence-based practice” (p. 230). Connors et al. (2002) further suggest that if educators create a central learning environment using a CIS base, then clinical data management concepts can be taught through applications within that CIS. The focus would be on gathering, retrieving, analyzing data for use in decision making and creating quality in patient care. The article concludes that by “designing a program based on the incorporation of applied informatics into the educational curriculum,” (Conclusions and Implications, p. 232) the School of Nursing is preparing students for the workforce while increasing their understanding of the role informatics plays in improving the delivery of patient care. Further, the project required educators to stretch their thinking and their teaching methods in order to make room for advanced technologies within the curriculum.

McNeil et al. (2003) reported findings from survey based research that employed 266 deans and directors of baccalaureate and higher nursing programs in the United States. Many of the baccalaureate nursing programs addressed computer literacy skills, rather than information literacy skills. The study provided more evidence of the need to include nursing informatics “concepts, skills, and tools” in professional nursing education (Conclusions and Recommendations, p. 348). In order to prepare graduates for the workforce, McNeil et al. writes “timely information for effective decision making,” (Abstract section, p. 341) is required and information technology used to support nursing practice “must be integrated into nursing program curricula” (Abstract section, p. 341). The ultimate challenge according to McNeil is to close the gap between education and

practice by looking for opportunities, extending creative partnerships, and by solving limitations in the areas of funding and faculty development.

Warren et al. (2010) suggested that in order to prepare students for the digital environments in which they are entering “nursing students must master basic informatics concepts and information technology competencies” (Introduction section, para. 1). Unless opportunities are available for students to use EHR technologies as they learn their clinical skills, important competencies will not be developed. Students need the opportunity to demonstrate psychomotor skills while developing communication and clinical judgment skills. This pedagogical approach to teaching nursing techniques has been outlined by the University of Kansas, School of Nursing (Warren, 2010). Students need hands-on access to these technologies including an EHR in order to learn. The literature suggests that future clinicians will become both competent and proficient in the use of informatics if they have hands-on access to new and emerging technologies and are educated on CIS such as an EHR.

The Absence of Research on the Behavioral Intention to Use

All of the studies focused on the need for nursing informatics competencies and HCIT to be integrated into teaching and learning. The studies show that while educators place varying degrees of importance on the teaching of nursing informatics competencies, few of them doubt that these competencies and skills are important. Many discuss providing access to these technologies including an EHR as an essential component to teaching and learning. However, none of these studies address the importance of technology acceptance or the BI to use these technologies nor do they suggest outright

where this access needs to occur, whether that be on clinical rotation or upstream in the classroom, skills lab, or simulation lab. This is an obvious gap reflected in the literature as it pertains to nursing education. Even though there is national agreement that nursing informatics will, as Gessert (1998) suggests, "better prepare the nursing work force to *adopt and use* [emphasis added] information technology," (p. Conclusions p. 267), very little research has followed up on the impact the learning environment has had on students' acceptance and BI to use these technologies including an EHR. In addition, even though interest in clinician use of EHRs is high, few studies have actually sought to document acceptance of EHR technology or clinicians BI to use. Holden and Karsh (2010) may have conducted the most comprehensive review of research focused on assessing clinicians' BI to use HCIT. They analyzed 20 studies published on or before July 2008 that used quantitative assessments of the TAM to focus on clinicians' acceptance (i.e. BI to use) HCIT for patient care. Out of all of these studies, only one focused on an EHR.

Reviews of recent research have shown that the actual use of these technologies is determined by the level of acceptance and clinicians' BI to use (Holden & Karsh, 2010; & Yarbrough & Smith, 2007). However, few studies have focused on the BI to use an EHR, which is central to the reinvention discussed by the IOM and other national organizations. Additionally, the literature suggests that future clinicians become both competent and proficient in the use of informatics if they have hands-on access to new and emerging technologies and are educated on CIS such as an EHR. There is a lack of research in general in regard to informatics acceptance or the intention to use informatics in the workplace (Holden & Karsh, 2010). Finally, there is a lack of research in regard to

student perceptions of the value of having an Electronic Health Record (EHR) to teach nursing practice in the classroom, skills lab, or simulation lab. This study plans to aid in filling these current gaps.

Methodological Review

Technology Acceptance Model (TAM)

In order to address the intent of this examination, I chose a survey research methodology because of the economy of this design and the ability to more rapidly collect the data. In regard to a theoretical model, I used the survey design known as the Technology Acceptance Model (TAM) (Davis, 1989; Davis, Bagozzi, & Warshaw, 1989). TAM was the best option to drive the data collection and research design. The focus was on user responses to survey items to help explain why a particular technology is accepted. TAM is an adaptation of the Theory of Reasoned Action (TRA). There are really three fundamental reasons that led me to select TAM over TRA. First, TRA and its theoretical extension Theory of Planned Behavior are meant to be generally applied and both assert that the factors influencing behavior do so indirectly through the influence of attitude (A), subjective norm (SN), or their relative weights (Davis et al., 1989). TRA further “mediates the impact of uncontrollable environmental variables and controllable interventions on user behavior” (Davis et al. 1989, p. 984). On the other hand, TAM is specifically “tailored for modeling user acceptance of information systems” (Davis et al. 1989, p. 985). TAM provides a foundation for analyzing the impact of “external factors on internal beliefs, attitudes, and intentions” (Davis et al. 1989, p. 985). This was useful

in this study since we were specifically concerned with clinical information systems as they relate to BI. Second, TAM omits TRA's subjective norm (SN) as a determinant of BI, one of the least understood aspects of TRA (Fishbein & Ajzen, 1975). Finally, TAM is an adaptation, perhaps even an evolution of TRA. Based on research by Venkatesh and Davis (2000), “TAM compares favorably with alternative models such as the Theory of Reasoned Action (TRA) and the Theory of Planned Behavior (TPB),” (p. 186). TAM is just as strong if not stronger in being able to give me the results needed to answer my research questions.

Venkatesh and Davis (2000) point out that many empirical studies show that “TAM consistently explains a substantial proportion of the variance (typically about 40%) in usage intentions and behavior” (Introduction, p. 186). TAM suggests that two specific behavioral beliefs, perceived ease of use (PEOU) and perceived usefulness (PU), determine an individual's attitude which in turn influences BI to use information technology. PU is defined as the extent to which a person believes that using the system will enhance his or her job performance, and PEOU is defined as the extent to which a person believes that using the system will be free of effort. PU is the dominant variant. Figure 2.0 shows a graphical representation of Davis' Technology Acceptance Model.

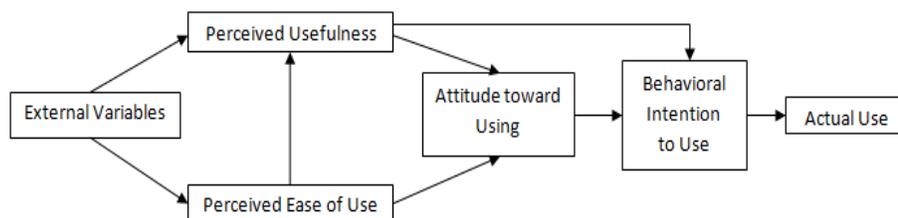


Figure 2.0 Davis' TAM

Summary

The literature has provided the direction for the research questions presented in this study. It helped in highlighting the importance of both health information technology and the use of information technology. Second, in reviewing key literature in the field of nursing education, I have found that a gap exists in regard to technology acceptance and the BI to use HCIT. In addition, in reviewing studies in the healthcare field that have looked at BI, we have found another gap when it comes to the BI to use an EHR. Finally, there is a lack of research studies that cover student perceptions regarding the value of having an Electronic Health Record (EHR) to teach nursing practice in the classroom, skills lab, or simulation lab. This study presents a topic that has yet to be examined; produces data on the effect of a learning environment using an EHR on undergraduate nursing students' BI to use an EHR; and extends the current discussion in regard to technology acceptance by researching undergraduate nursing students' BI to use an EHR and their perception regarding the value that access to an authentic EHR brings to the classroom, skills lab, or simulation lab.

CHAPTER 3

METHODOLOGY

This study explores the effect of a learning environment using an Electronic Health Record (EHR) on senior undergraduate nursing students' behavioral intention (BI) to use an EHR. I accomplished this by collecting data on the BI to use as the determinant of use in senior undergraduate nursing students enrolled in programs of study at accredited Schools of Nursing. I collected these data from two sources: (1) Schools of Nursing that bring an authentic EHR experience into the curricula through the use of Cerner's Academic Education Solution (AES) in order to teach nursing practice and; (2) a School of Nursing that uses a paper-based approach to teach nursing practice. I investigated if a difference exists in the BI to use an EHR between junior and senior undergraduate nursing students educated in a learning environment using an EHR. Finally, I investigated the perceptions that junior and senior undergraduate nursing students hold in regard to their behavioral intention to use an EHR and their perception regarding the value that access to an authentic EHR brings to the classroom, skills lab, or simulation lab. The focus is on the nursing students' perceptions of their behavioral intention to use an EHR on their clinical rotations and in practice. This study examined the effect a learning environment using a CIS base through the context of an EHR has on undergraduate nursing students' BI to use an EHR and the undergraduate nursing students' perceived behavioral intention to use an Electronic Health Record (EHR) in the learning environment on clinical rotations and on practice.

Schools

Participants in this study were undergraduate nursing students from three (3) accredited Schools of Nursing located in the United States. Two (2) of these schools bring an authentic CIS experience into the curricula through the context of an Electronic Health Record (EHR) using Cerner's Academic Education Solution (AES) in order to teach nursing practice, while the other one (1) School of Nursing uses a paper-based approach to teach nursing practice. For all three (3) schools, I included both male and female participants who were either seniors or juniors. A brief description of each school is below.

School #1 brings an authentic CIS experience into the curricula through the context of an Electronic Health Record (EHR) in order to teach nursing practice. School #1 is part of a large university offering more than 200 degrees and certificates including nursing degrees. The institution has conferred thousands of master's degrees, tens of thousands of bachelor's degrees, tens of thousands of associate degrees, and thousands of certificates. There are close to fifty thousand alumni. During the 2010–11 academic year, close to fifteen thousand students of diverse ages, races, and nationalities were enrolled and about 64% of that population attended full time. The school has close to four hundred full-time faculty members and another four hundred adjunct faculty.

School #2 brings an authentic CIS experience into the curricula through the context of an Electronic Health Record (EHR) in order to teach nursing practice. School #2 is part of a public research university and the largest university in the state with tens of thousands of students across campuses. Campuses are located in several locations across the state. The university also has a Medical Center and Hospital that are located in close

proximity to the school. The school ranks in the top twenty as a popular University in the United States as of 2008 and ranks in the top 15 in the nation for study abroad involvement with nearly one-third of students participating.

School #3 is using a paper-based approach to teach nursing practice. School#3 is part of a multi-campus public research university with campuses and facilities throughout the state. The university has a focus on teaching, research and public service. The university offers undergraduate, graduate, professional and continuing education offered through resident instruction and online delivery. The university also has a Medical Center and Hospital that are located in close proximity to the school. The university ranked in the top 15 of public universities nationally and enrollment is close to one hundred thousand graduate and undergraduate students, across multiple campuses making it one of the largest universities in the United States. There is also a large focus on diversity and international education.

Clinical Information Systems Base

The Schools of Nursing that bring an authentic CIS experience into the curricula through the context of an Electronic Health Record (EHR) in order to teach nursing practice will do so through the use of Cerner's Academic Education Solution (AES). AES is a full clinical information system (CIS) adapted to support classroom instruction. This solution brings an integrated, authentic CIS experience into curricula through the context of an Electronic Health Record (EHR). The AES community of schools has proven models for education and learning and the AES system is in use at 40 higher education institutions today; fifty-percent (50%) of these institutions are using AES to

support the teaching and learning of nursing practice. AES brings clinical experience, academic experience, industry experience, and evidenced based clinical research and best practice to nursing curricula for the purpose of preparing students for the digital environments that they are entering.

Note: The School #3 (paper-based approach to teach nursing practice) provided clinical rotations for their undergraduate nursing students so that they learn about EHRs in real-time in a clinical setting with live patients. The technology available to students in this clinical setting is Cerner's Powerchart EHR solution. This is the same solution that is used as the foundational technology for Cerner's Academic Education Solution (AES). While the code level and configuration will be slightly different, one is designed for academic use and the other is designed for clinical use, the solutions are very similar in both feature functionality and capability.

Participants

As we have previously discussed, participants in this study were undergraduate nursing students from three (3) accredited Schools of Nursing. Two (2) of these schools bring an authentic CIS experience into the curricula through the context of an Electronic Health Record (EHR) using Cerner's Academic Education Solution (AES) in order to teach nursing practice, while the other one (1) School of Nursing uses a paper-based approach to teach nursing practice. All schools also provide access to an EHR on clinical rotations.

The intent was to include at least 50 participant juniors and seniors from School #1 and School #2 for a total of 200 and at least at least 50 participant seniors from School #3. This would have been a total of 250 participants. The study actually employed 56 undergraduate nursing students: 23 juniors and 12 seniors from School #1 for a total of 35; 1 junior and 10 seniors from School #2 for a total of 11; and 10 seniors from School #3. It is important to note that 8 of the seniors from School #1 were moved to the paper based condition because they were actually taught through a paper-based approach similar to the approach used at School #3. I realized this after an interview with one participant senior at School #1 who said that she did not have any experience with the EHR in the classroom, simulation lab, or skills lab. After discovering that this anomaly existed within the participant base and data set at School #1, I went back to all participants at School #1 and asked them what type of learning experience they actually had. All participants responded and clarified the learning experience that they actually had with an additional 7 participants reporting back that they only had learning experiences provided through a paper-based approach. The data collected from these 8 participant seniors was included in the data with the seniors from School #3, making a total 18 students who learned nursing practice through a paper-based approach. Students were recruited from nursing classes during the fall 2010 and spring 2011 semesters.

Participants were selected using a mix of sampling procedures. In the fall of 2010, I started out using random sampling techniques. I had difficulty recruiting participants randomly, so I began to review other sampling procedures that would complement the study and widen the participant pool without impacting the strength of the methodology. Starting in the spring of 2011, I switched my sampling procedure to

criteria-based sampling method per Patton (2002, p.238) that used the following criteria: undergraduate nursing student; between the ages of 18 and 65; EHR access in the classroom & clinical rotation or EHR access on clinical rotation only; male or female; junior or senior; studying at School#1, 2, or 3. At the two schools that bring an authentic clinical information system experience into the curricula through the context of an Electronic Health Record (EHR), I conducted two samples, one sample of junior undergraduate nursing students and one sample of senior undergraduate nursing students. It is expected that since participants are being selected from accredited Schools of Nursing, meet specific criteria, and are enrolled in programs of study that they will have similar levels of prior knowledge. Additional detail about the sampling procedures is provided in the following “Sampling Procedures” section.

Data Sources

Self-Administered Questionnaire

This study used a survey research design to test RQ1 and RQ2. A survey design gave me the ability to more rapidly collect the data and study the large populations at multiple locations rather than a smaller group of individuals at one location. This allowed me to apply the results and draw conclusions in a more generalized manner. For the questionnaires, I used the TAM survey design, which was specifically “tailored for modeling user acceptance of information systems” (Davis et al., 1989, p. 985) in order to investigate the BI of use. Figure 2.0 shows a graphical representation of Davis’ Technology Acceptance Model.

The nature of the survey was a questionnaire and was cross-sectional. I included undergraduate nursing students in two unique environments, one that brings an authentic CIS experience into the curricula through the context of an EHR using Cerner's Academic Education Solution (AES) to teach nursing practice and one that uses a paper-based approach to teach nursing practice. I also used a between-subjects design looking at each group only once at a moment in time. At the two (2) schools that bring an authentic clinical information system experience into the curricula through the context of an Electronic Health Record (EHR), I included undergraduates at two different points in the academic career, seniors and juniors. Additional information on the scales and reliability of the TAM instrument is provided in the following "Instrument" section.

Interviews

In order to answer RQ3 and RQ4, I used Interviews to document the impact of an EHR on undergraduate nursing students' perceived behavioral intention to use an EHR on both clinical rotations and in practice. I also summarized participants' perceptions regarding the value of having an Electronic Health Record (EHR) to teach nursing practice in the classroom, skills lab, or simulation lab. The Interviews had a mix of open-ended and forced-response questions. Questions were answered by participants at each of the three (3) schools. Interviews were conducted with both senior undergraduate nursing students and junior undergraduate nursing students.

Variables

Independent Variables

There are two independent variables in the study, the type of learning model and the year. The type of learning model has two levels: (a) use of an Electronic Health Record (EHR) to teach nursing practice and (b) use of a paper-based approach to teach nursing practice. There second independent variable is year and that has two levels: (a) Junior (b) Senior.

Dependent Variable

The dependent variable in the study is behavioral intention (BI). Behavioral intention has two indicators “Perceived Usefulness” (PU) and “Perceived Ease of Use” (PEOU). This is in accordance with the TAM theoretical model where PU and PEOU are used jointly to determine behavioral intention.

Instruments

Self-Administered Questionnaire

For the self-administered questionnaires, I used an adaption of the instruments provided by the TAM methodology (Davis, 1989). The instrument had items and measures of the dependent variable. There were items or measurements of the two indicators of the dependent variable, Perceived Usefulness (PU) and Perceived Ease of Use (PEOU). Each item was measured on a 7-point Likert scale with anchors ranging from 1 to 7 (1 = strongly disagree and 7 = strongly agree). PU and PEOU were used

jointly to determine BI. For the measurements used on this questionnaire, Cronbach's Alpha was used to test the instrumentation used in this study. For PU, Cronbach's Alpha was measured at .943. If any of the items measuring PU were deleted, reliability would decrease. For PEOU, Cronbach's Alpha was measured at .837. One item, PEOU2 (interaction with an EHR does not require a lot of mental effort) was not as consistent as the other items. If PEOU2 was deleted or removed it would increase the reliability to .874. In general, this was in line what we expected. In past studies, Cronbach's Alpha ranged from 0.87 to 0.98 across studies and time periods for these instruments. For PEOU, Cronbach's Alpha ranged from 0.86 to 0.98 across studies and time periods. Items in each area of BI measurement were scored through the generation of the mean score of all responses within that area.

As previously discussed, I collected data from two sources, schools that bring an authentic EHR experience into the curricula and schools that use a paper-based approach to teach nursing practice. TAM protocol required that the questions on the self-administered questionnaires be as specific as possible in regard to the information system used. In order to structure these questions correctly we used two unique self-administered questionnaires.

For the Schools of Nursing that bring an authentic EHR experience into the curricula, Self-Administered Questionnaire #1 was used. On this instrument we used the words *Academic Education Solution (AES)/EHR* as the specific description of the information system (see Appendix A for Self-Administered Questionnaire #1). Sample questions from Self-Administered Questionnaire #1 are displayed in Table 3.0.

Table 3.0

Self-Administered Questionnaire #1 Sample Questions

<p>1. Using the Academic Education Solution (AES)/EHR improves my performance as I practice.</p> <p>1 = strongly disagree 2 = moderately disagree 3 = somewhat disagree 4 = neutral (neither disagree nor agree) 5 somewhat agree 6 = moderately agree 7 = strongly agree.</p>	<p>5. My interaction with the Academic Education Solution (AES)/EHR is clear and understandable.</p> <p>1 = strongly disagree 2 = moderately disagree 3 = somewhat disagree 4 = neutral (neither disagree nor agree) 5 somewhat agree 6 = moderately agree 7 = strongly agree.</p>
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For the Schools of Nursing that use a paper-based approach to teach nursing practice, the survey instrument was developed to include the specific information system that the undergraduate nursing students use for clinical rotations to be included (see Appendix B for Self-Administered Questionnaire #2). In all cases, this system was Cerner's PowerChart application. Sample questions from Self-Administered Questionnaire #2 are displayed in Table 3.1.

Table 3.1

Self-Administered Questionnaire #2 Sample Questions

<p>1. Using the <i>Cerner Powerchart system</i> improves my performance as I practice.</p> <p>1 = strongly disagree 2 = moderately disagree 3 = somewhat disagree 4 = neutral (neither disagree nor agree) 5 somewhat agree 6 = moderately agree 7 = strongly agree.</p>	<p>5. My interaction with the <i>Cerner PowerChart system</i> is clear and understandable.</p> <p>1 = strongly disagree 2 = moderately disagree 3 = somewhat disagree 4 = neutral (neither disagree nor agree) 5 somewhat agree 6 = moderately agree 7 = strongly agree.</p>
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Interviews

For the interviews, a standard, structured interview protocol was used with each participant to gain a deeper understanding of the students' perceptions of the importance and usefulness of EHR technology being integrated into their nursing curricula. I gathered information on the undergraduate nursing students' thoughts to enhance the study and inform the quantitative findings. The focus of the interviews was on the perceived behavioral intention to use an Electronic Health Record (EHR) on clinical rotations and in practice (RQ3). This helped to guide our understanding of the perceived value a learning environment that provides an EHR experience may have on the behavioral intention to use an EHR on clinical rotations and in practice (RQ4). A better understanding of the perceptions that nursing students have in regard to the value of a learning environment using an EHR will help nursing educators make better decisions in regard to the inclusion of an EHR in the learning environment. A natural extension of inclusion is where to include, the classroom, the skills lab, the simulation lab, on a clinical rotation, or some combination of all four.

These interviews were conducted with undergraduate students from the schools participating in the study. The protocol had a mix of open-ended questions and forced-response questions. The questions were the same for both junior and senior students at all Schools #1, #2, and #3 (see Appendix C for the interview script). Students at Schools #1 and #2 had access and experience with an EHR in a classroom, skills lab, or simulation lab as well as on clinical rotation. Students at School #3 and 8 seniors from School #1 were taught nursing practice through a paper-based approach and had access to an EHR on clinical rotation only. All students had the opportunity to apply their skills

and competencies in clinical rotations and in practice. The key differentiator was having access to an EHR when learning nursing practice in the classroom, skills lab, or the simulation lab. Therefore, the questions in the interview focused on their perceptions of the effect a learning environment using an Electronic Health Record (EHR) has on undergraduate nursing students' behavioral intention (BI) to use an EHR. I recorded the school that each participant was attending as well as the responses. Sample Interview questions are displayed on the next page in Table 3.2.

Table 3.2

Sample Interview Questions

Sample Question – junior	Sample Question – senior
<p>1. Do you feel that having an Electronic Health Record (EHR) in the learning environment has an impact on the perceived usefulness experienced when using an EHR on clinical rotations? Y / N</p> <p>1. If yes, why?</p> <p>2. If no, why?</p>	<p>2. Do you feel that having an Electronic Health Record (EHR) in the learning environment has an impact on the perceived usefulness experienced when using an EHR on clinical rotations? Y / N</p> <p>3. If yes, why?</p> <p>1. If no, why?</p>

Variables, Research Questions, and Instruments / Data Sources

Table 3.3 on the next page shows the relationship between the variables, research questions, and instruments / data sources.

Table 3.3

Self-Administered Questionnaire #1 Sample Questions

Variable Name	Research Question	Instruments / Data Sources
Behavioral Intention	1. What effect does a learning environment using an Electronic Health Record (EHR) have on senior nursing students' behavioral intention to use an EHR?	Self-Administered Questionnaire Perceived Usefulness(1,2,3,4); Perceived Ease of Use (5,6,7,8)
Behavioral Intention	1a. Is there a difference in the behavioral intention to use an Electronic Health Record (EHR) between junior and senior students' educated in a learning environment using an EHR?	Self-Administered Questionnaire Perceived Usefulness(1,2,3,4); Perceived Ease of Use (5,6,7,8)
Behavioral Intention	2. What effect does a learning environment using a paper-based approach and clinical rotations have on senior nursing students' behavioral intention to use an EHR?	Self-Administered Questionnaire Perceived Usefulness(1,2,3,4); Perceived Ease of Use (5,6,7,8)
Behavioral Intention	3. What is the impact on perceived behavioral intention to use an Electronic Health Record (EHR) on clinical rotations and on practice?	Interviews – Mix of demographic information, forced-response, and open-ended questions
Behavioral Intention	4. What is the perceived value of having an Electronic Health Record (EHR) to teach nursing practice in the classroom, skills lab, or simulation lab?	Interviews – Mix of demographic information, forced-response, and open-ended questions

Main Study Procedures

Recruitment

Participants were recruited by the PI with permission of the institutions of higher education that participated in this study. Both institutions of higher education and participants are blinded for the purposes of reporting results. Participants were students enrolled in program of study at Schools of Nursing. A time and place outside of class was arranged for all sites. Initial contact was made by the Principal Investigator (PI) through email. Interested participants were asked to confirm their involvement and asked to be present at a specific time and location to participate. Informed consents and self-administered questionnaires were provided by the PI at that time and location, mostly over email and phone. The self-administered questionnaires were paper-based and were completed following an introduction by the PI and the signing of informed consent. The PI planned to be in person to distribute the informed consents to each of the students in the classroom/lab and planned to remain in the classroom/lab as participants completed the informed consent and paper-based self-administered questionnaire. However, a common time and place for groups of participants was challenging to coordinate. So the alternative recruitment methods described below in the section “Alternative Recruitment Methods” became the default. Informed consent forms were collected by the PI, and the self-administered questionnaires were also collected by the PI through a combination of U.S. mail and email. One hundred percent (100%) of the total participant population (56 total participants) signed the informed consent and completed the paper-based questionnaire. Fifty-five percent (55%) of the total participant population (31 of 56 total participants) agreed to also participate in an interview. Of that population, forty-six

percent (46%) of those interviewed (22 of 47 total participants) were at School #1 (EHR) or School #2 (EHR) and ninety percent (90%) of the population (9 of 10 total participants) were at School #3 (Paper-Based Approach). Three of the seniors interviewed at School #1 were taught nursing practice through a paper-based approach. Their interview data was included with the data from the participants at School #3. During the interview, participants were asked to share their perceptions of their BI to use an EHR on a clinical rotation and in practice. The interviews occurred over the phone at varying times and after the collection of the self-administered questionnaire by the PI. All participants were given the option of participating in the follow-up interview and those that did participate did so voluntarily. Participants who did not volunteer completed their participation with the completion of the self-administered questionnaire.

Sampling Procedures

Two sampling procedures were used for the completion of this study, one was a systemic random sample and the other was criteria based sampling method per Patton (2002, p.238).

In the fall of 2010, a systemic random sampling technique was used. In order to get the sample, I started with a list of all students eligible for the study. The list of names was provided by Nursing Department administration. I did not see the list prior to selecting the first name. I closed my eyes and pointed to a name, whichever name my finger was on served as the first random element. I then selected every second name until I completed the entire list. I had difficulty recruiting participants randomly and although the preferred way of sampling, I began to review other sampling procedures that would complement the study and widen the participant pool without impacting the strength of

the methodology.

In the spring of 2011, I switched to a criteria based sampling method per Patton (2002, p.238). I used the following criteria: undergraduate nursing student; between the ages of 18 and 65; EHR access in the classroom & clinical rotation or EHR access on clinical rotation only; male or female; junior or senior; studying at School#1, 2, or 3 in order to select participants. Nursing students that met the criteria were eligible to participate in the study and volunteered.

Inclusion / Exclusion Criteria

Students who were enrolled as an undergraduate nursing student at one of the schools participating in this study were eligible to participate. Students were either randomly selected in the fall 2010 semester or they volunteered on the spring of 2011 provided they met certain criteria as described in the previous “Sampling Procedures” section. Students who did not attend one of the schools participating in this study or who did not meet the criteria as defined were excluded from this study and were not eligible to participate in either the surveys or the interviews.

Alternative Recruitment Methods

Email was used when participants were not available or unable to come on the day that the informed consents were distributed. The PI emailed the consent form and the self-administered questionnaire which was then completed and emailed back to the PI. The email included the verbal script in the body of the email and study instructions for completion of the study. Email addresses were provided by the institutions of higher education that participated in the study and followed the security protocols and guidelines

outlined at that institution for contacting students with the opportunity to participate in research. Requests were sent in email. The email message disclosed the purpose of the study and asked for voluntary participation in both the completion of the self-administered questionnaire and the follow-up interview.

Self-Administered Questionnaire

Participants at the accredited Schools of Nursing were selected using the sampling procedures as they were described above in the “Sampling Procedures” section and were recruited as they were described above in the “Recruitment” section. Questionnaires were only administered to students who signed the informed consent. Extra credit was not provided to students and no grading was given for performance as it related to the study activities.

Each participant was given a paper-based self-administered questionnaire that had items and measures of the dependent variable. Each item was measured on a 7-point Likert scale as described above in the “Instruments” section. The timeline for survey administration was between the beginning and the middle of the semester after instruction had begun in the fall and spring semesters of 2011. The informed consents and self-administered questionnaires were provided through email. The self-administered questionnaires were paper-based.

The participants were enrolled in a program of study, and their professors were made aware that the study was being conducted. However the professors neither discussed the study in class nor did they answer questions or make comments about the questionnaires nor did they interfere with survey completion. Informed consent forms were collected over email and U.S. mail by the principal investigator as were the self-

administered questionnaires.

Once the study was complete, the results were sent to each participant including a thank you for their participation in the study.

Interviews

It was originally the intention of the PI to hold focus groups at a specific place and time at all schools participating in the study. However, student schedules made this difficult, and it became clear early on that interviews would be a better way to both collect the data and protect the confidentiality of the participants. As I have previously described in the sections on “Data Sources,” “Instruments,” “Sampling Procedures,” and in the above “Recruitment” section, the interviews consisted of participants from all three schools and were conducted with both senior and junior undergraduate nursing students. All participants who completed an informed consent and self-administered questionnaire were eligible to participate in the interview. Interviewees volunteered to participate and the interviews were only conducted with those who volunteered.

The interviews were conducted over the phone. The interviews occurred after the self-administered questionnaire had been completed. Interviews were recorded (audio only). Participants who volunteered to be part of the interview were told in advance, prior to completing the self-administered questionnaire that they had the option of participating in a follow-up interview. Those participants who did not volunteer for the interview completed their participation with the completion of the questionnaire. Those who did volunteer for the interview were given a choice to either be contacted by the PI or to call into a separate phone conferencing line set up to protect personal information. The interviews took place after the completion of the questionnaires. Interviews

followed a standard script and were conducted over the phone by the PI. Interviews had a mix of open-ended and forced-response questions.

Once the study was complete, the results were emailed to each participant including a thank you for their participation in the study.

Data Security

Survey data were collected by paper. No personal identifiable information was kept after the data had been coded. A unique key was created for each participant and stored in a document that was destroyed after data is collected and de-identified. All de-identified data was stored on a hard drive in the principal investigator's home and will be completely destroyed after 5 years. No references will be made as to where the data is kept.

The Interviews were audio recorded. Data were stored on a laptop computer initially and then transferred to a secure hard drive. Only the principal investigator has access to the recordings. The recordings were transcribed and coded by the principal investigator only. The recordings will be destroyed within six (6) months of the completion of the study. This provides time for the recordings to be transcribed and coded and for the research reports and findings to be written up and communicated. Once the data is captured, analyzed, and summarized in the form of a thesis, there will be no need to keep the recordings.

Data Analysis of Criterion Measures

Hypotheses

This study sought to test the following hypotheses as described in Chapter 1:

1. (H1) Senior nursing students' using an Electronic Health Record (EHR) within the learning environment will have a positive behavioral intention to use an Electronic Health Record (EHR).
 - a. (H0) There will be no significant difference between the behavioral intention to use an Electronic Health Record (EHR) between junior and senior nursing students' educated in a learning environment using an EHR.
2. (H2) Senior nursing students' using a paper-based approach and clinical rotations within the learning environment will have a positive behavioral intention to use an Electronic Health Record (EHR).

Analysis of Criterion Measures

Data analysis of the self-administered questionnaires focused on the quantitative data produced. As discussed in the previous "Instruments" section, each item was measured on a 7-point Likert scale as described above in the "Instruments" section. Scoring produced a mean for each BI measurement. So I had a mean for the indicator Perceived Usefulness and a mean for the indicator Perceived Ease of Use. The correlation between these measurements helped me to determine the level of relationship and whether it was statistically significant at $p \leq .05$.

All criterion measures were analyzed via SPSS version 19.

Descriptive Statistics for the Self-Administered Questionnaire

The measure of central tendency was dependent on the distribution of data. The measure of variability was focused on variance, standard deviation, and range. I looked for symmetry in the data, whether positively skewed, negatively skewed, or symmetrical. Whether the distribution was severely positively or negatively skewed, was based on the guideline of ± 2.0 skewness in either direction rendering the results “not fairly normal” (Field, 2007). The Kurtosis (whether the curve is normal, flat, or peaked) was also observed. The main descriptive statistics observed were the measures of central tendency and variability.

As discussed in both the “Participants” and “Data Sources” sections, participants in this study were selected based on several criteria. As discussed in the “Sampling Procedures” section, two sampling methods were used.

Actual age of the participants varied between 19 and 49. The mean age of all participants was 26.27 and the median was 23. The majority of participants were 21 years old (19.6%) and the standard deviation between ages was almost eight years. This is illustrated in Figure 3.0 and Figure 3.1.

		Age
N	Valid	56
	Missing	0
	Mean	26.27
	Median	23.00
	Mode	21
	Std. Deviation	7.705
	Minimum	19
	Maximum	49

Figure 3.0 Descriptive Statistics (Age)

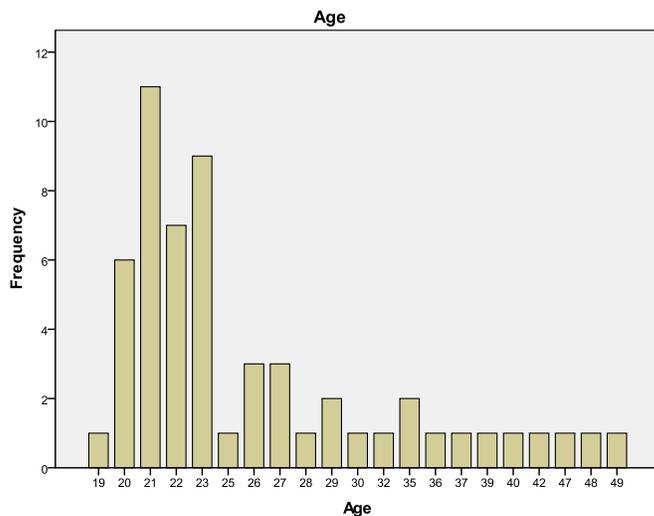


Figure 3.1 Frequencies (Age)

Five (8.9 %) of participants were male and 51 (91.1%) were female. 24 (42.9%) of the participants were juniors and 32 (57.1%) were seniors.

38 (67.9%) of the participants studied at either School #1 or School #2 and had access to an EHR in the classroom, skills lab, and in the simulation lab in addition to access to an EHR on clinical rotations. 18 (32.1%) of participants studied at either School #1 or School #3 and had access to an EHR on clinical rotation only.

Of the 38 students that had access to an EHR in the classroom, skills lab, and in the simulation lab, 24 (63.2%) were juniors and 14 (36.8%) were seniors. 27 (71.1%) attended School #1 and the remaining 11 (28.9%) students attended School #2.

Of the 18 participants who accessed an EHR on clinical rotations only, all (100%) were seniors. Eight (44.4%) attended School #1 and the remaining 10 (55.6%) attended School #3.

A mix of 16 (28.6%) juniors and seniors from School #1 and School #3 were randomly selected for this study in the fall of 2010. The remaining 40 (71.4%) of

participants were selected using a criteria based sampling method in the spring of 2011.

Inferential Statistics for the Self-Administered Questionnaire

I first ran a simple regression analysis to get the correlation and find any relationships among the unique variables. The regressions were Perceived Usefulness (PU) and Perceived Ease of Use (PEOU), which were used jointly to determine Behavioral Intention (BI). I included demographics in the regression since demographics like age and gender are connected theoretically to BI and may be a predictor of intention, for example, school (experience) can be predictor of BI. The grouping variable for RQ1 and RQ2 was learning model (EHR or Paper-Based) and the demographics included were age, gender, and school. The grouping variable for RQ1a was year (Junior or Senior) and the demographics included were age, gender, and school. Finally, I realized that including the demographic data might contribute to collinearity or multicollinearity. I reviewed the data for any indication of collinearity or multicollinearity.

The study produced a limited $N=56$ resulting in low power. According to Tabachnick and Fidell (2007) researchers generally should not conduct regression analyses for less than 100 cases. This is the most recent formula for computing the number of cases. However, using Tabachnick and Fidell's old standard of $50 + 8$ multiplied by the number of independent variables used in the regression, the $N=56$ is on the border. In this case, we were close to the minimum number of cases needed to achieve an appropriate power. While I was aware that regression analysis has a standard for number of cases, I was at the lower end of the recognized standards. I wanted to analyze the data using a regression to see if any relationships among the unique variables

could be found.

In addition to the simple regression analysis, I reviewed the data from two separate groups: (1) Schools of Nursing using Cerner's AES in order to teach nursing practice and; (2) the School of Nursing that uses a paper-based approach to teach nursing practice. I used a t-test to see if the means of these two groups were statistically different from one another. This also gave me the difference between their means relative to the spread or variability of their scores. This helped to determine significance of the results.

Analysis of the Interview Data

To analyze the undergraduate nursing students' perceived value regarding an EHR in the learning environment on clinical rotations and on nursing practice, I summarized the findings in a report that helped to inform and potentially answer RQ3 and RQ4. The goal of data analysis was to gain a deeper understanding of student perceptions of the importance and usefulness of EHR technology being integrated into their nursing curricula. In order to do this I followed the following steps. I conducted interviews, recorded the data (audio only), and then listened to review the data and capture notes. As I listened, I coded the data and identified general themes across the respondents. I listened for specific comments that were only made by one or two participants in addition to the general themes. I also listened and took notes on any specific themes within the following distinct populations – the school; the year (junior or senior); and the learning environment (EHR access in the classroom & clinical rotation or HER access on clinical rotation only). This process aided me in the interpretation of the data. After interpreting the data, I detailed the qualitative findings in a summary report.

This report relates the impact on perceived behavioral intention to use an Electronic Health Record (EHR) in the learning environment on clinical rotations and on practice. It also relates student perceptions regarding the value in having an EHR to teach nursing practice in the classroom, skills lab, or simulation lab. I used the qualitative findings to inform the statistical findings or any inferences made by analyzing the quantitative data.

CHAPTER 4

RESULTS

Introduction

The purpose of this study was to explore the effect of a learning environment using an Electronic Health Record (EHR) on undergraduate nursing students' behavioral intention (BI) to use an EHR. Participants were 56 undergraduate nursing students, juniors and seniors, from three (3) accredited Schools of Nursing, all of whom were included in the analysis of the data. Participants in this study completed a self-administered questionnaire that had items to assess the perceived usefulness and the perceived ease of use of an EHR in order to determine their BI to use an EHR and to address RQ1 and RQ2. Participants were also given the option to participate in a follow-up interview further elaborate on the utilization of an EHR and to address RQ3 and RQ4.

Quantitative data from the self-administered questionnaires were analyzed using SPSS 19. Qualitative data from the interviews were summarized. The goal of data analysis was to determine the effect of a learning environment using an Electronic Health Record (EHR) on undergraduate nursing students' Behavioral intention (BI) to use an EHR. Additionally, I sought to gain a deeper understanding of student perceptions regarding the value of EHR technology being integrated into the nursing curricula.

This chapter reports the results of statistical and qualitative analysis to answer the research questions proposed in Chapter 1.

Participants: Undergraduate Students at Schools of Nursing

Participants in this study were undergraduate nursing students from three accredited Schools of Nursing (SON). School #1 and School #2 bring an authentic CIS experience into the curricula through the context of an Electronic Health Record (EHR) to teach nursing practice. School #3 uses a paper-based approach to teach nursing practice. Eight participants from School #1 were taught through a paper-based approach. That data were included with the data from School #3 and is shown in Table 4.1. As previously indicated in the “Variables” section, one independent variable is the type of learning model used to teach nursing practice. Thus there are 38 students in one level of the independent variable learning model and 18 students in the second level of the independent variable learning model.

The two indicators of the dependent variable, perceived usefulness (PU) and perceived ease of use (PEOU), were measured on a 7-point Likert response scale as described above in the “Instruments” section. The response scale for individual items ranged from a value of 1 (strongly disagree) to a high of 7 (strongly agree). The scores for PU and PEOU individual items and the summated Likert scores from each type of learning model were compared to determine whether the groups were comparable. These scores are shown in Table 4.0 and Table 4.1.

Table 4.0

Descriptive Statistics for Students Using an EHR to Learn Nursing Practice

	N	Minimum	Maximum	Mean	Std. Deviation
PU1 (improves performance)	38	2	7	5.26	1.35
PU2 (increases productivity)	38	1	7	4.92	1.50
PU3 (enhances my effectiveness)	38	2	7	5.26	1.37
PU4 (useful in my practice)	38	1	7	5.39	1.53
PU Total	38	7	28	20.84	5.40
PEOU1 (clear and understandable)	38	2	7	4.63	1.44
PEOU2 (does not require a lot of effort)	38	2	7	4.37	1.42
PEOU3 (easy to use)	38	2	7	4.82	1.45
PEOU4 (easy to get it to do what I want)	38	1	7	4.82	1.49
PEOU Total	38	8	27	18.63	4.66
Valid N	38	XX	XX	XXX	XXX

Note: Each item was measured on a 7-point Likert scale with anchors ranging from 1 to 7 (1 = strongly disagree; 2 = moderately disagree; 3 = somewhat disagree; 4 = neutral; 5 = somewhat agree; 6 = moderately agree; and 7 = strongly agree).

Table 4.1

*Descriptive Statistics for Students Using a Paper-Based Approach to Learn Nursing**Practice*

	N	Minimum	Maximum	Mean	Std. Deviation
PU1 (improves performance)	18	1	7	5.28	1.364
PU2 (increases productivity)	18	1	7	5.89	1.491
PU3 (enhances my effectiveness)	18	1	7	5.56	1.381
PU4 (useful in my practice)	18	3	7	6.28	1.018
PU Total	18	6.00	28.00	23.0000	4.82640
PEOU1 (clear and understandable)	18	1	7	5.28	1.526
PEOU2 (does not require a lot of effort)	18	2	7	4.89	1.779
PEOU3 (easy to use)	18	3	7	5.17	1.200
PEOU4 (easy to get it to do what I want)	18	4	7	5.33	.907
PEOU Total	18	13.00	27.00	20.6667	4.66527
Valid N	18				

Note: Each item was measured on a 7-point Likert scale with anchors ranging from 1 to 7 (1 = strongly disagree; 2 = moderately disagree; 3 = somewhat disagree; 4 = neutral; 5 = somewhat agree; 6 = moderately agree; and 7 = strongly agree).

As can be seen from the data, the total mean score for PU was 20.8 for students using an EHR to learn nursing practice and 23.0 for students who were using a paper-based approach to learn nursing practice. This indicates that the mean score was slightly higher (2.2 points) for students who were using a paper-based approach to learn nursing practice. The total mean score for PEOU was 18.6 for students using an EHR to learn nursing practice and 20.7 for students who were using a paper-based approach to learn nursing practice. This indicates that the mean score was slightly higher (2.1 points) for students who were using a paper-based approach to learn nursing practice. The standard deviations for the combined responses within the areas PU and PEOU are similar across learning models. The standard deviations for all individual items are similar across learning models as well except for the item PEOU3 (an EHR is easy to use). For PEOU3, there is a .722 difference in the standard deviation between students using an EHR to learn nursing practice and students using a paper-based approach to learn nursing practice. The deviation is higher for the variant PEOU3 in the paper-based approach.

In order to more clearly articulate the differences in the total mean score for all responses, we can look at each survey item and the mean score for that item individually. For PU1, *using an EHR improves my performance in practice*, the mean score is 5.26 (EHR) compared to 5.28 (paper). For PU3, *using an EHR enhances effectiveness in practice*, the mean score is 5.26 (EHR) compared to 5.56 (paper). So the variants PU1 and PU3 are similar across learning models. For PU2, *using an EHR in practice increases productivity*, the mean score is 4.92 (EHR) compared to 5.89 (paper). For PU4, *an EHR is useful in practice*, the mean score is 5.39 (EHR) compared to 6.28 (paper). Regarding PU, the variants PU2 (*increases productivity*) and PU4 (*useful*) together

determine almost all of the difference across the learning models. For PEOU2, *interaction with an EHR does not require a lot of mental effort*, the mean score is 4.37 (EHR) compared to 4.89 (paper). For PEOU3, *an EHR is easy to use*, the mean score is 4.82 (EHR) compared to 5.17 (paper). For PEOU4, *it is easy to get an EHR to do what I want it to do*, the mean score is 4.82 (EHR) compared to 5.33 (paper). So the variants PEOU2, PEOU3, and PEOU4 are similar across the learning models. For PEOU1, *interactions with an EHR is clear and understandable*, the mean score is 4.63 (EHR) compared to 5.28 (paper). Regarding PEOU, the variant PEOU1 (*EHR is clear and understandable*) determines more of the difference across the learning models than other variants.

In general, the summated mean scores for all respondents and the mean score for individual items and the respective standard deviations are fairly consistent across both learning models. There was an observation I observed about the BI variables. Although fairly normally distributed, the distribution of responses was definitely toward the upper end of the Likert response scale. This is not unusual when one examines responses to Likert type response scales which some refer to as having a restricted range. This in part may be attributed to the relatively small number of participants which subsequently has some implications for the power of the analysis.

Behavioral Intention to Use: Statistical Analysis

There are two research questions focused on the determination of behavioral intention. To answer the first, I examined the effect a learning environment using an Electronic Health Record (EHR) had on senior nursing students' behavioral intention (BI) to use an EHR; and whether there was a difference or variance in the behavioral

intention to use an EHR between junior and senior students' educated in a learning environment using an EHR. The survey scores of seniors and juniors at the two schools that bring an authentic CIS experience into the curricula through the context of an EHR were examined. To answer the second research question, I examined the effect a learning environment using a paper-based approach and clinical rotations had on senior nursing students' behavioral intention to use an EHR. The survey scores of seniors only were examined.

As discussed in the above section on "Inferential Statistics for the Self-Administered Questionnaire" (Chapter 3), a simple regression analysis was used to determine the relationship among PU and PEOU, which equals BI. A t-test was used to assess if the means of the two groups, schools using an EHR to teach nursing practice and schools using a paper-based approach to teach nursing practice, were statistically different from one another. This yielded the difference between the means relative to the spread or variability of their scores.

Using an EHR or a Paper-Based Approach to Teach Nursing Practice

For RQ1 and RQ2, a simple regression analysis was used to determine the relationship between the independent and dependent variables. The independent variable was the learning model and had two levels, an EHR approach or a Paper-Based Approach to teaching nursing practice. The dependent variable was behavioral intention (BI) which is assessed by examining the indicators perceived usefulness (PU) and perceived ease of use (PEOU). In addition to independent variables, demographics were also added into the regression. The demographics included were age, gender, school, and learning model. Multiple linear regressions were applied in the data analysis. Because of the

relatively small number of cases considering the number of independent variables there was also a review for collinearity and/or multicollinearity, since age and gender may be highly correlated with PEOU.

When these data were reviewed together and the indicator was perceived usefulness (PU), the R^2 value was .082 and the adjusted R^2 value -.054, so predictability or explanation of variance in PU was very low. This large amount of slippage ($R^2 = .082$ with an adjusted $R^2 = -.054$) is likely partially explained by the low number of participants employed in the study. For the overall significance of the model, I reviewed the analysis of variance for the 32 seniors. The F value (.604) and the p value (.663) showed that the variables were not statistically significant in predicting or explaining variability in perceived usefulness. When looking at the coefficients, the p values showed no statistical significance in predicting or explaining behavioral intention. The independent variables had high tolerance above .8 across the board, so the variance inflation factor (VIF) was relatively low. The tolerance and VIF values are within acceptable ranges (Tabachnick and Fidell, 2007) thus there were no issues related to collinearity. Figure 4.2 shows that the histogram of the residuals is relatively symmetric and Figure 4.3 shows acceptable agreement with the ideal cumulative probability line. The residuals were fairly normally distributed. In summary, the independent variables in this regression showed no influence on the indicator PU.

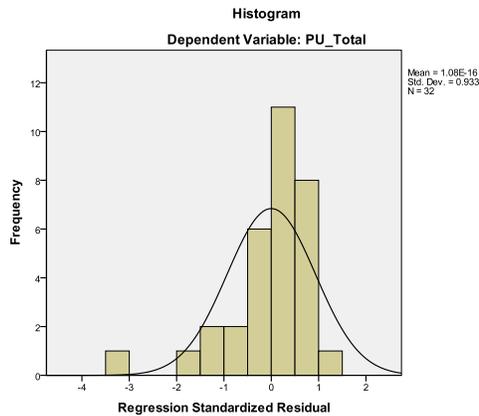


Figure 4.2 Histogram: DV Perceived Usefulness (PU)

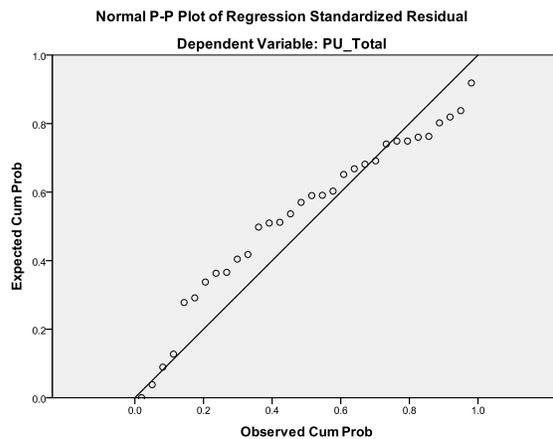


Figure 4.3 P-Plot: DV Perceived Usefulness (PU)

When these data were reviewed together and the indicator was perceived ease of use (PEOU), the R^2 value was .036 and the adjusted R^2 value -.106, so predictability or explanation of variance in PU was very low, almost nonexistent. The large amount of slippage ($R^2 = .036$ with an adjusted $R^2 = -.106$) is likely partially explained by the low number of participants employed in the study. For the overall significance of the model, I reviewed the analysis of variance for the 32 seniors. The F value (.254) and the p value (.904) showed that the variables were not statistically significant in predicting or

explaining variability in perceived ease of use. When looking at the coefficients, the p values showed no statistically significant variables in predicting or explaining behavioral intention. The independent variables had high tolerance above .8 across the board, so the variance inflation factor (VIF) was relatively low. The tolerance and VIF values are within acceptable ranges (Tabachnick and Fidell, 2007) thus there were no issues related to collinearity. Figure 4.4 shows that the histogram of our residuals is relatively symmetric and Figure 4.5 shows acceptable agreement with the ideal cumulative probability line. Our residuals were fairly normally distributed. In summary, the independent variables in this regression showed no influence on the indicator PEOU.

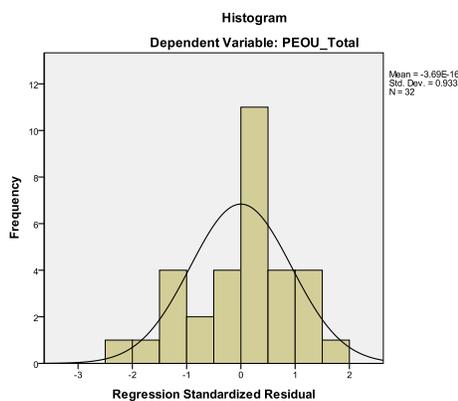


Figure 4.4 Histogram: DV Perceived Ease of Use (PEOU)

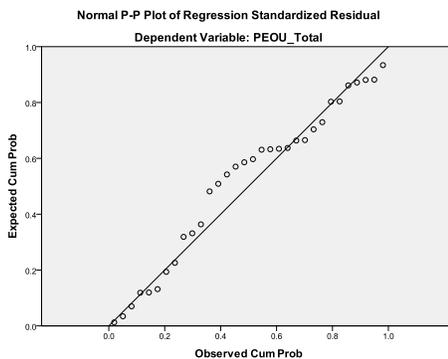


Figure 4.5 P-Plot: DV Perceived Ease of Use (PEOU)

For the t-test for RQ1 and RQ2 I examined the responses from seniors in the two

different learning models (EHR and Paper-Based), the grouping variable was learning model (EHR or Paper-Based) and the test values were usefulness (PU1; PU2; PU3; PU4;), and ease of use (PEOU1; PEOU2; PEOU3; PEOU4;), and age. As you can see from Table 4.2, there were no statistically significant relationships between learning model and any of the BI indicators. Regarding the hypotheses H1 and H2 presented in Chapter 1, the data in this case did not predict behavioral intention and the hypotheses proposed are not supported by the data using these 32 participants.

Table 4.2

T-Test – Seniors BI to Use an EHR

Intention to Use and Perceived Usefulness Indicator		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
Intention to Use and Perceived Ease of Use Indicator									Lower	Upper
Age	Equal variances assumed	.030	.864	-.109	30	.914	-.357	3.271	-7.038	6.324
	Equal variances not assumed			-.112	29.826	.912	-.357	3.196	-6.885	6.171
PU1 (improves performance)	Equal variances assumed	.919	.345	1.870	30	.071	.794	.424	-.073	1.660
	Equal variances not assumed			1.964	29.481	.059	.794	.404	-.032	1.620
PU2 (increases productivity)	Equal variances assumed	.130	.721	-.863	30	.395	-.460	.533	-1.550	.629
	Equal variances not assumed			-.862	27.964	.396	-.460	.534	-1.554	.634
PU3 (enhances my effectiveness)	Equal variances assumed	.073	.789	.461	30	.648	.230	.499	-.789	1.249
	Equal variances not assumed			.460	27.664	.649	.230	.501	-.796	1.257

PU4 (useful in my practice)	Equal variances assumed	1.124	.298	-.678	30	.503	-.278	.409	-1.114	.558
	Equal variances not assumed			-.658	24.141	.517	-.278	.422	-1.149	.594
PEOU1 (clear and understandable)	Equal variances assumed	.819	.373	.017	30	.987	.008	.480	-.973	.989
	Equal variances not assumed			.017	29.737	.986	.008	.459	-.931	.947
PEOU2 (does not require effort)	Equal variances assumed	.481	.494	-1.270	30	.214	-.746	.587	-1.945	.453
	Equal variances not assumed			-1.303	29.884	.203	-.746	.573	-1.916	.424
PEOU3 (easy to use)	Equal variances assumed	.020	.890	-.052	30	.959	-.024	.461	-.965	.918
	Equal variances not assumed			-.051	25.618	.960	-.024	.470	-.992	.944
PEOU4 (easy to get it to do what I want)	Equal variances assumed	2.284	.141	-.312	30	.757	-.119	.381	-.898	.660
	Equal variances not assumed			-.300	22.882	.767	-.119	.397	-.941	.702

Note: Each item was measured on a 7-point Likert scale with anchors ranging from 1 to 7 (1 = strongly disagree; 2 = moderately disagree; 3 = somewhat disagree; 4 = neutral; 5 = somewhat agree; 6 = moderately agree; and 7 = strongly agree).

The Difference or Variability in BI to use an EHR between Junior and Senior Students' Educated in a Learning Environment Using an EHR

For RQ1a, a simple regression analysis was used to determine the relationship between the independent and dependent variables. The independent variable in this case was year (Junior or Senior). The dependent variable was behavioral intention (BI) which is assessed by examining the indicators perceived usefulness (PU) and perceived ease of use (PEOU). In addition to independent variable, demographics were also added into the regression. The demographics included were age, gender, and school. Multiple linear regressions were applied in the data analysis. Because of the relatively small number of cases considering the number of independent variables there was also a review for collinearity and/or multicollinearity, since age and gender may be highly correlated with PEOU. The main goal of RQ1a is to determine if there was a difference or variance in the behavioral intention to use an Electronic Health Record (EHR) between junior and senior students' educated in a learning environment that applies a learning model using an EHR.

When these data were reviewed together and the indicator was perceived usefulness (PU), the R^2 value was .269 and the adjusted R^2 value .181, so predictability or explanation of variance in PU was very low. This large amount of slippage ($R^2 = .269$ with an adjusted $R^2 = .181$) is likely partially explained by the low number of participants in the study. For the overall significance of the model, I reviewed the analysis of variance for the 38 students educated in a learning environment using an EHR. The F value (3.039) and the p value (.031) showed that the variables were significant in predicting or explaining variability in perceived usefulness. As seen in Table 4.2 the p

value for age is .038, suggesting that the relationship for age is significant. When looking at the coefficients, the p values for gender, school, and year showed no statistically significant variables in predicting or explaining behavioral intention. The independent variables of age and gender had a high tolerance above .9, so the variance inflation factor (VIF) was relatively low. The tolerance and VIF values are within acceptable ranges (Tabachnick and Fidell, 2007) thus there were no issues related to collinearity.

Table 4.3

Coefficients of the Indicator Perceived Usefulness (PU)

Model	t	Sig.	Collinearity Statistics	
			Tolerance	VIF
1 (Constant)	3.925	.000		
Age	-2.167	.038	.952	1.050
Gender	-1.638	.111	.972	1.029
School	.136	.892	.483	2.068
Year	1.733	.092	.484	2.066

Figure 4.6 shows that the histogram of the residuals is relatively symmetric and Figure 4.7 shows an acceptable agreement with the ideal cumulative probability line. The residuals were fairly normally distributed. In summary, the independent variables in this regression showed no influence on the indicator PU with the exception of age. There was a significant relationship between the age of the student and the perceived usefulness of the EHR when examined within the context of gender, school and year.

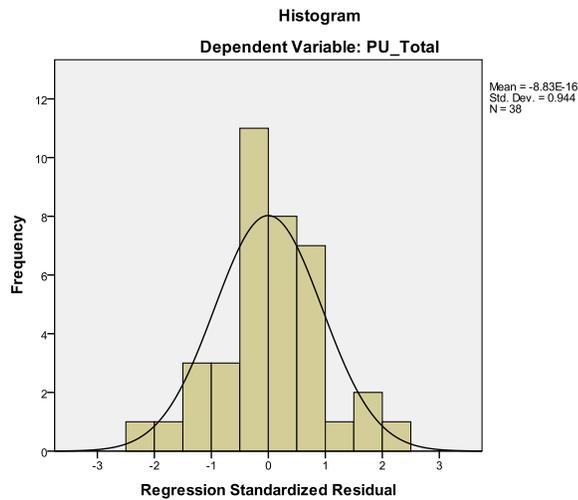


Figure 4.6 Histogram: DV Perceived Usefulness (PU)

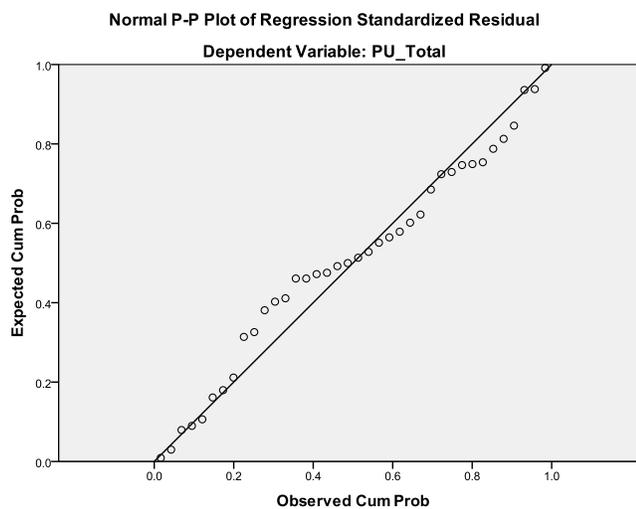


Figure 4.7 P-Plot: DV Perceived Usefulness (PU)

In order to explore the relationship between the independent variable year and the indicator perceived usefulness further, I conducted a one-way ANOVA without controlling for the other variables included in the previous regression analysis. As you can see from Table 4.4, the F value (5.033) and the p value (.031) showed that year was significant in predicting or explaining perceived differences in usefulness (PU).

Table 4.4

ANOVA – Year and Perceived Usefulness (PU)

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	132.362	1	132.362	5.033	.031
Within Groups	946.690	36	26.297		
Total	1079.053	37			

a. Predictors: (Constant), Year

b. Indicator: PU Total

Note: Each item was measured on a 7-point Likert scale with anchors ranging from 1 to 7 (1 = strongly disagree; 2 = moderately disagree; 3 = somewhat disagree; 4 = neutral; 5 = somewhat agree; 6 = moderately agree; and 7 = strongly agree).

Table 4.5 shows the summated means and the summated standard deviation values for the twenty-four juniors and for the fourteen seniors in the study. The summated means for the twenty-four juniors in the study was 19.4. The summated means for the fourteen seniors in the study was 24.3. This showed that the PU variables were significantly higher in predicting or explaining perceived usefulness and behavioral intention to use an EHR in the senior population. The summated standard deviation value for the twenty-four juniors was 5.3. The summated standard deviation value for the fourteen seniors in the study was 4.8. This showed that there was less deviation among the BI variables in the senior population.

Table 4.5

Summated Means and Standard Deviation Values Year and Perceived Usefulness

	N	Minimum	Maximum	Mean	Std. Deviation
Juniors	24	7.00	28.00	19.4167	5.29082
Valid N	24				
Seniors	14	12.00	28.00	23.2857	4.82667
Valid N	14				

a. Predictors: Year

b. Indicator: PU Total

Note: Each item was measured on a 7-point Likert scale with anchors ranging from 1 to 7 (1 = strongly disagree; 2 = moderately disagree; 3 = somewhat disagree; 4 = neutral; 5 = somewhat agree; 6 = moderately agree; and 7 = strongly agree).

When these data were reviewed together and the indicator was the summated score for perceived ease of use (PEOU), the R^2 value was .119 and the adjusted R^2 value .013, so predictability was very low and the overall regression model was not statistically significant. The model F value (1.118) and p value (.365) showed that the variables were collectively as a group not significant in predicting or explaining variance in ease of use. Not surprising when looking at the coefficients for any of the predictor variables, the p values showed no significant variables in predicting behavioral intention. To be sure that the regression equation results were not influenced by non-normality of residuals Figure 4.8 shows that the histogram of our residuals is fairly symmetric and Figure 4.9 shows an acceptable agreement with the ideal cumulative probability line. Our residuals were fairly normally distributed. In summary, the independent variables in this regression, including year, showed no influence on the indicator PEOU.

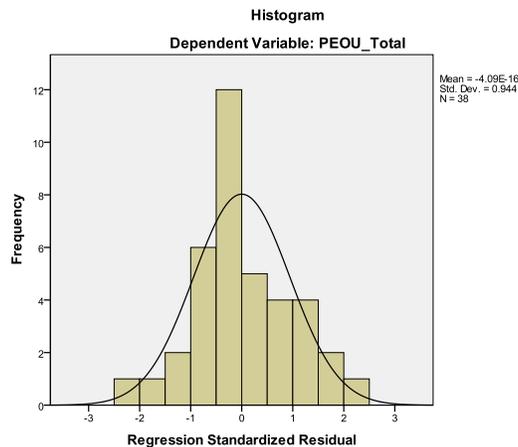


Figure 4.8 Histogram: DV Perceived Ease of Use (PEOU)

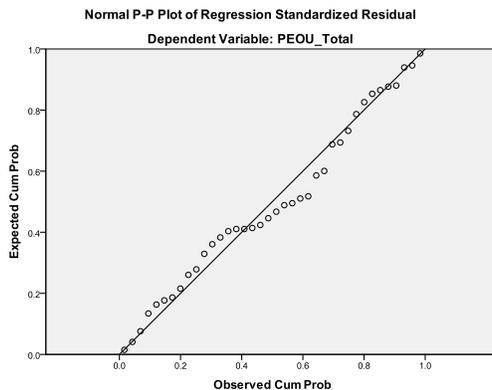


Figure 4.9 P-Plot: DV Perceived Ease of Use (PEOU)

This next analysis examines each BI indicator item for any differences between responses by whether the student was a junior or senior and not accounting for any of the other predictor variables entered previously in the regression analysis. For the t-test for RQ1a, I examined if any difference existed between juniors and seniors educated in a learning environment using an EHR. The grouping variable was year and the test values were perceived usefulness, perceived ease of use. As you can see from Table 4.6, there was a significant difference in regard to PU1 and PEOU1. Regarding the null hypothesis

(H0) presented in Chapter 1, the data analysis results does not support that hypothesis.

There was a significant difference in several BI indicator items use an EHR between junior and senior students' educated in a learning environment using an EHR. Table 4.7 shows the summated means and the summated standard deviation values for the twenty-four juniors and for the fourteen seniors in the study. For all the BI variables in the study, the summated means were significantly higher in predicting or explaining behavioral intention to use an EHR in the senior population and there was less deviation in regard behavioral intention to use an EHR for seniors.

Table 4.6

Difference in the Behavioral Intention to Use an EHR Between Junior and Seniors

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
PU1 (improves performance)	Equal variances assumed	1.979	.168	-3.140	36	.003	-1.280	.408	-2.106	-.453
	Equal variances not assumed			-3.469	35.023	.001	-1.280	.369	-2.029	-.531
PU2 (increases productivity)	Equal variances assumed	.039	.845	-1.633	36	.111	-.804	.492	-1.801	.194
	Equal variances not assumed			-1.614	26.336	.119	-.804	.498	-1.827	.219
PU3 (enhances my effectiveness)	Equal variances assumed	.028	.867	-1.855	36	.072	-.827	.446	-1.732	.077
	Equal variances not assumed			-1.798	24.803	.084	-.827	.460	-1.776	.121
PU4 (useful in my practice)	Equal variances assumed	.172	.681	-1.924	36	.062	-.958	.498	-1.968	.052
	Equal variances not assumed			-2.025	31.637	.051	-.958	.473	-1.923	.006
PEOU1 (clear and understandable)	Equal variances assumed	4.241	.047	-2.252	36	.031	-1.036	.460	-1.969	-.103
	Equal variances not assumed			-2.464	34.482	.019	-1.036	.420	-1.890	-.182

PEOU2 (does not require effort)	Equal variances assumed	.123	.728	.742	36	.463	.357	.481	-.619	1.333
	Equal variances not assumed			.736	26.616	.468	.357	.485	-.639	1.354
PEOU3 (easy to use)	Equal variances assumed	.907	.347	-1.064	36	.294	-.518	.486	-1.505	.469
	Equal variances not assumed			-1.077	28.325	.291	-.518	.481	-1.502	.467
PEOU4 (easy to get it to do what I want)	Equal variances assumed	1.883	.179	-1.273	36	.211	-.631	.496	-1.636	.374
	Equal variances not assumed			-1.356	32.595	.185	-.631	.465	-1.578	.316

Note: Each item was measured on a 7-point Likert scale with anchors ranging from 1 to 7 (1 = strongly disagree; 2 = moderately disagree; 3 = somewhat disagree; 4 = neutral; 5 = somewhat agree; 6 = moderately agree; and 7 = strongly agree).

Table 4.7

Means and Standard Deviation Values Year and BI Variables

Juniors	N	Minimum	Maximum	Mean	Std. Deviation
PU1 (improves performance)	24	2	7	4.79	1.351
PU2 (increases productivity)	24	1	7	4.63	1.439
PU3 (enhances my effectiveness)	24	3	7	4.96	1.268
PU4 (useful in my practice)	24	1	7	5.04	1.574
PEOU1 (clear and understandable)	24	2	7	4.25	1.511
PEOU2 (does not require effort)	24	2	7	4.50	1.414
PEOU3 (easy to use)	24	2	7	4.63	1.469
PEOU4 (easy to get it to do what I want)	24	1	7	4.58	1.586
Valid N	24				
Seniors	N	Minimum	Maximum	Mean	Std. Deviation
PU1 (improves performance)	14	4	7	6.07	.917
PU2 (increases productivity)	14	2	7	5.43	1.505
PU3 (enhances my effectiveness)	14	2	7	5.79	1.424
PU4 (useful in my practice)	14	3	7	6.00	1.301
PEOU1 (clear and understandable)	14	3	7	5.29	1.069
PEOU2 (does not require effort)	14	2	6	4.14	1.460
PEOU3 (easy to use)	14	2	7	5.14	1.406
PEOU4 (easy to get it to do what I want)	14	3	7	5.21	1.251
Valid N	14				

Note: Each item was measured on a 7-point Likert scale with anchors ranging from 1 to 7 (1 = strongly disagree; 2 = moderately disagree; 3 = somewhat disagree; 4 = neutral; 5 = somewhat agree; 6 = moderately agree; and 7 = strongly agree).

Behavioral Intention to Use: Interview Summary

To answer RQ3 and to explore the impact of an Electronic Health Record (EHR) in the learning environment on behavioral intention to use an EHR, I asked two questions. The first, “Do you feel that having an Electronic Health Record (EHR) in the learning environment has an impact on the perceived usefulness experienced when using an EHR on clinical rotations?” and the second “Do you feel that having an Electronic Health Record (EHR) in the learning environment has an impact on the perceived ease of use experienced when using an EHR on clinical rotations?” I also asked participants why they said yes or no. I explored both learning environments, the schools that bring an authentic CIS experience into the curricula through the context of an EHR in order to teach nursing practice and schools using a paper-based approach to teach nursing practice. School #1 also had a few students who were seniors and who only had access to an EHR on clinical rotations, so we included their interview data in with the schools that used a paper-based approach.

Behavioral Intention to Use in Schools Using a Paper-Based Approach to Teach Nursing Practice

For participants who were in the learning environment that used a paper-based approach to teach nursing practice, three participants did not clarify whether there was an impact on their perceptions or at least their responses were not very clear. Rather than assume one way or the other, I have highlighted this as no data. As you can see from Table 4.8, seven of thirteen total participants thought there was an impact on their perceived usefulness (PU) and eight of thirteen thought there was an impact on their

perceived ease of use (PEOU). For School #3, one participant failed to clarify one way or the other. Six of nine participants thought there was an impact on their PU and six of nine thought there was an impact on their perceived ease of use (PEOU). At School #1, three participants failed to clarify one way or the other. One participant thought there was an impact on their PU and one did not. Two participants thought there was an impact on their PEOU.

Table 4.8

Behavioral Intention to Use: Access to an EHR on Clinical Rotation Only

Behavioral Intention to Use: Access to an EHR on Clinical Rotation Only	School #1		School #3		
	Yes	No	Yes	No	No Data
Having an Electronic Health Record (EHR) on clinical rotation has an impact on the perceived usefulness of an EHR?	1	1	6	2	3
Having an Electronic Health Record (EHR) on clinical rotation has an impact on the perceived ease of use of an EHR?	2	0	6	2	3

In regard to PU, four of the participants that had no opinion before use, afterward thought it would be useful. One participant thought it would only be faster and that the technology would act as an accelerator. After use, that participant realized that it actually helped with organization of data, legibility, and efficiency. One participant thought it would be useful and afterwards thought it was even more useful. All four participants who thought that access did not change their PU thought that it would be useful and it was useful.

In regard to PEOU, three participants thought it would be easy, and it ended up being hard. Four participants thought it would be hard and it ended up being easier than

they thought. The two participants that had no change in PEOU, thought it would be easy and it was easy for them. One participant clarified that they have used many systems since their first use and ease of use varies depending on the system being used. So while in general their perception of an EHR is that it is easy, when they encounter a more difficult system that perception changes for the moment.

Behavioral Intention to Use in Schools that Bring an Authentic CIS Experience into the Curricula through the Context of an EHR in Order to Teach Nursing Practice

For participants presented with an authentic CIS experience through the context of an EHR when learning nursing practice, all participants clarified the impact on their perceptions. As you can see from Table 4.9, ten of eighteen participants thought there was an impact on their perceived usefulness (PU) and sixteen of eighteen thought there was an impact on their perceived ease of use (PEOU).

Table 4.9

Behavioral Intention to Use: Access to an EHR in the Classroom and on Clinical Rotation

Behavioral Intention to Use: Access to an EHR in the Classroom and on Clinical Rotation	School #1 (EHR)		School #2 (EHR)		Total	
	Yes	No	Yes	No	Yes	No
Having an Electronic Health Record (EHR) in the learning environment has an impact on the perceived usefulness of an EHR?	4	6	6	2	10	8
Having an Electronic Health Record (EHR) in the learning environment has an impact on the perceived ease of use of an EHR?	10	0	6	2	16	2

For School #1, four of ten participants thought there was an impact on their PU and ten of ten thought there was an impact on their PEOU. For School #2, six of eight participants thought there was an impact on their PU and six of eight thought there was an impact on their PEOU.

In regard to PU, five of the participants had no opinion or were unsure of the usefulness and afterward thought it would be useful. One participant thought it would not be useful and after use thought it would be useful. Four of the participants thought that it would be useful and found that it was even more useful than originally thought. Eight participants thought that it would be useful and it was useful.

In regard to PEOU, four participants thought it would be easy and it ended up being hard. Eleven participants thought it would be hard, and it ended up being easier than they thought. Two participants thought it would be easy, and it was easy for them. One participant had no perception and wasn't very aware of EHRs and had no thoughts one way or the other, after use she thought it was easy.

Perceived Value of an EHR used to Teach Nursing Practice

To answer RQ4 and to explore the perceived value of having an Electronic Health Record (EHR) to teach nursing practice in the classroom, skills lab, or simulation lab, I summarized the interview data that were offered by students when discussing their perceptions or usefulness and ease of use. All participants at all schools regardless of age, gender, learning model, year (junior or senior), or experience agreed that there was value in having an Electronic Health Record (EHR) to teach nursing practice integrated within the school curricula (classroom, skills lab, and simulation lab). This would be in addition to any time on clinical rotation. They pointed out that the best way to

experience an EHR would be to have that experience in the classroom, skills lab, or simulation lab first. The main reasons were safety of the environment and the ability to make mistakes without the anxiety and stress of being in a live patient environment. Two general themes emerged in regard to the value of integrating an EHR within the curricula. The first was increased competency, which included time to practice, more time to learn, the chance to make mistakes, an increase in understanding, an increase in knowledge and skill set, preparedness, and relevance to the workplace. The second was an increase in comfort level, which included decreased stress, reduced anxiety, and an increase in confidence levels. These themes will be explored in more detail in the following sections titled “Increased Competence” and “Increased Comfort Level.”

Increased Competence

The first theme that emerged was increased competency, which included time to practice, more time to learn, the chance to make mistakes, an increase in understanding, an increase in knowledge and skill set, increased preparedness, and relevance to the workplace.

The most fundamental value of having an EHR in the learning environment was the addition of time to practice, learn, and make mistakes. Many students made a point to say that using an EHR once or twice a week in clinical rotation was not enough to prepare them for the workforce. They needed more time with the system. Those students who only had access to an EHR on clinical rotation said that it would have been good to have access in the classroom, skills lab, and simulation lab. One student provided the example that the first day on rotation, they were unable to provide patient care because they had to figure out how to find patient information and chart in the system. Most

students felt that having the EHR in the classroom is helpful because it provides more practice with the technology and helps them identify what you will be required to chart. The more time to practice, the more chances they perceived they would have to make mistakes without being concerned about disrupting patient care. Almost every student made a point to say that the more time you spend with an EHR the better. It can also save time on task and provide more time for instruction. One student who had access to EHRs on their clinical rotation said that when they came back to a paper-based approach in the simulation lab, the professor and the students lost valuable time on the simulation due to the paper-based approach. The simulated patient was on different medications and the student wanted a computer chart so that they could look up the kind of medication the patient is on and get access to the reference data to know more about the medication. Instead of using an EHR, the students had to look up in a book or external PDA and this was more time consuming. So the suggestion was that the EHR not only gives students more time to practice with a system, it may save valuable class time as well. The more time to learn these technologies is also important due to the complexity of the systems. It is not something you can learn in a day or even a week. The EHR also helps accelerate learning making the learning of concepts, rules, and procedures more efficient and faster. The amount of data that you have access to and the structure (organization) helps with learning. One student said that “if I did not have an EHR to learn on, I just wouldn't get the information as quick as I could. Learning on an EHR is easier. It is more organized than paper and sometimes the paper cases are less comprehensive.” Another student said that the easiness comes with time and that you learn over time. Practice is important and so is access to a learning environment that gives several practice opportunities to help

with the transition from the classroom to the clinical rotation. The general consensus was that if students are learning on paper, they are probably not as prepared for their clinical rotation. The access to an EHR in the classroom, skills lab, or the simulation lab provides you time to practice, learn, make mistakes, and maneuver in an electronic environment. It makes it easier.

The next point that the participants made was that having access to an EHR in the classroom helped students to increase their understanding, to develop a more comprehensive knowledge base, and to advance their skill sets. In the classroom, students felt they had the opportunity to dive deeper and understand more than if you only had access on clinical rotations. It gave them a chance to review as they performed their assessments, what exactly they should be looking for and what is necessary to watch for and to document. When used as a part of a simulation, the EHR allowed for interactions with the record in the context of patient care. This was important because it allowed for the learning of feature functionality as they practiced providing care. A few students discussed learning how to write the nursing notes and where to write them. Their point was that with an EHR, you aren't always sure where to put your narrative note, so learning where to do that is critical to being a care provider. Having access to an EHR in a classroom environment helps to advance those types of skill sets in several ways, through charting assessments, writing progress notes, entering care plans, viewing a MAR (medical administration record), interacting with a MAR, administering and recording medications. These are just a few examples that reflect what students would be doing in clinical practice. Since most hospitals are using clinical systems today, access in a learning environment helps to prepare students for charting on clinical rotations. It

increases competence in the way they chart. One student mentioned that she learned on paper and used an EHR in practice. She said that "... learning on the EHR would have given me more experience to the importance of charting electronically. Rather than just clicking check boxes, you need to also document why. If you say within normal limits, you need to say what that means and if you choose not to give a medication and you need to document why you decided not to give a medication. You do this on paper as well. You just don't do this the same way on paper." Another student said that if a student learns on paper, they may not be used to providing the amount of description required by electronic systems. If they are unaware of that responsibility and do not document, the hospital may lose quality points from organizations that track and report. Documentation is critical in an EHR world. If you learn on paper, you may or may not be educated in the type of narrative that is expected in the electronic world where information is so readily available and accessible. Still another student made the point that the way in which you chart is different when using the electronic compared to paper. "When learning on an EHR, you will learn what things to include when using it, like what to chart where. With an EHR you need to check boxes and write a description of what you did and why. This isn't the same when learning to document or do care planning on paper." In addition to advancing skill sets, there is value in learning other things about the EHR. Decision support for example, students may come across a medication that is new or unfamiliar to them. With an EHR, they learn that there are tabs that will give you the references for the medication, the definitions, the adverse effects, the side effects, and other information that helps you to be more informed. You also have access to a lot of information with an EHR, like all the medications a patient is taking at a glance. Information is organized in

more helpful ways. So you have the ability to learn more at a single time or at the same time. If you do not have access to an EHR until your clinical rotation, all of this can be quite overwhelming. One response that I received focused on how an EHR helped students develop their standardized nursing language. The participant said that “it helps you communicate better within standardized practice. It improves communication among healthcare professionals. With all the information that is available, it can help you with definitions and healthcare acumen. The standardized nursing language within the record helps me learn.” Learning how to correctly document the patient's information in a standardized way is really important. Many students made the point that the correct and safe way today is through the use of an EHR. A few more said that if you learn on paper, you are not necessarily learning the correct way. Knowing how the EHR works and how detailed the documentation needs to be, prior to your clinical rotation, is very helpful.

Having an EHR in the learning environment is also a good experience because it prepares students for the workplace. When they do not have access, the learning curve is steeper. Students said that having access in the simulation lab was helpful in learning how to use an EHR and in decreasing the level of difficulty. One student said that “it was better to learn first and have access to EHRs before being thrown into it in a clinical practicum or practice. You are better prepared.” Having access to EHRs prior to clinical rotations provides valuable experiences. The more experiences over time, the more useful the system will become. Another student said that it was important to get the feel of documenting in an EHR. “Since I learned in class, I was able to apply it in the clinical setting. Without this experience with EHRs in the simulation lab setting or classroom, my clinical rotation would be more difficult. The background and experience with EHRs

has been a big help.” A few students mentioned that if they had had access to an EHR prior to the clinical rotation, the orientation may have been a little faster and that would have helped make the transition from the classroom to the clinical rotation easier. Many students made the point that the more time spent learning an EHR or figuring out the technology on a clinical rotation, the less time spent taking care of the patient. “If you are introduced to the EHR in the learning environment, you are better prepared to enter clinical. It would be very hard to manage your patients on a clinical rotation until you have learned the EHR.” Another student said that “without access to the EHR in the simulation lab and skills lab, they would have lost clinical time on rotations. We would have needed longer orientation time at hospitals to learn ... where to find things, what we needed to find, what we should have access to, what we shouldn't have access to as students. I wouldn't be able to take care of two patients this early in my practicum if I didn't know how to find what I needed in the EHR or how to document.” Without experience with an EHR, students felt that they wouldn't be as prepared. One student said “I would like to see it used in all of the classes, because it gets you a little more familiar with that type of thing and gets you prepared to go out in the clinical rotations. It is a good learning tool.”

Finally, the students I interviewed made reference to the relevance of paper vs. the EHR. Even the students who learned on paper and thought that paper made for “okay” learning made a strong point that it wasn't really relevant to what they were experiencing on clinical environment. As one student said, “It is a little frustrating as a student to learn one way (paper) and then get out into clinical practice and see that everyone is doing something quite different.” Another student mentioned that “it was

nice to be exposed to the EHR as a student in the classroom because it helped with the transition and rolled over to the clinical environment (relevance & context) and was more natural.” Students noticed that using paper in the learning environment is a bit of disconnect from the work environment. “Learning on paper you are naturally learning bad habits, so learning through the context of an EHR and tools that are currently available in the workplace are important to learning the right way to practice care today.” Some students felt that they were given more of an understanding of what to expect in the clinical environment if they learned on an EHR. “It is where all healthcare is going and where most healthcare facilities are today, so it is important to give students the opportunity to work with it ... this will give students the ability they will need in the workplace.” Another student said that it was extremely helpful in their learning because it provided experience with the same types of technologies that will be available to us in the workplace. “Students like us who are exposed to an authentic EHR can pick up and use EHRs regardless of system pretty quickly or at least quicker than students who haven't had that learning experience.” One student stated that they were aware health systems are moving to 100% electronic. She was concerned that if students were taught on paper, they could get used to charting or writing narratives on paper and then they may not want to use an EHR because they are used to paper and therefore prefer paper. “It may be hard to break that paper habit when you move to the workplace and they are using an EHR.” Another student said that they would not have preferred to learn on paper and then have to learn the EHR on a clinical rotation. “It is hard enough to go from one EHR format to another when I move from unit to unit or from one hospital to another. I cannot even imagine learning on paper, not even ever seeing an electronic

record, and then being put on a unit and them saying this is an EHR and here is how we chart. Having access in a learning environment helped to make my learning more real.”

Increased Comfort Level

The second theme was an increase in comfort level, which included decreased stress, reduced anxiety, and an increase in confidence levels.

In regard to decreased stress level and reduced anxiety. Students who learned nursing practice through a paper-based approach mentioned that the first couple times they were on the floor in the clinical environment, there was a tendency to get caught up and overwhelmed with becoming familiar with e-charting. The predominant feedback was that if they could have seen it beforehand and used it they would not have been as overwhelmed. It would allow for more time to be spent on patient care instead of struggling with a computer system. Having access in the simulation lab or skills lab would decrease stress levels because the rotation is pretty stressful already without having to learn a new technology or tool. Earlier access leads to more comfort with the solution. When you get the opportunity to learn in the classroom or simulation lab, you are learning in a safe environment, you can ask questions without worrying about patient privacy, you can experience the navigation without concern for HIPPA or patient privacy. Students who had access to an EHR in the classroom or simulation lab said that moving to the clinical rotation was less stressful and the anxiety level was manageable. They were not sure that would be true if they hadn't been familiar with an EHR. One student said that "... if I was thrown into a clinical environment with an expectation to document electronically and was expected to be using a system that I have never used, I would be very anxious, and nervous ... especially knowing it is a legal document. I would not feel

comfortable at all." Many thought it would have been even more overwhelming for them if they did not have access or previous exposure with an EHR in a lab environment.

Several students also commented that the access to the EHR in the classroom took some of the pressure off of learning how to work with an EHR. It was easier for them to pick-up in a classroom environment versus a clinical environment. In the clinical environment a lot of other things are going on that would make it more difficult to learn a new technology. Students felt that when they were first beginning to use an EHR, it was frustrating, confusing, and overwhelming. Over time, they would become more familiar with the EHR as a tool, and it was less frustrating and less overwhelming. Students felt that these feelings of frustration were best experienced in a learning environment and would have been inappropriate or unprofessional in a clinical setting. If feelings of frustration were experienced in the clinical environment that can lead to poor performance and a poor overall experience and that is not good in a patient care setting on a practicum.

In addition to the reduced anxiety and decreased stress levels, having more experience with an EHR will naturally boost confidence. Students felt the added access and practice of an EHR in a simulation lab helped with the ease of use because they would have a better idea of where to find things or where to look for things. The interaction and hands on experience provides value because working with the technology gets easier over time. A few students said that having the experience in the simulation environment gave them more exposure to an EHR as a system and increased their confidence with using an EHR. When they headed into the clinical rotation and practicum they were already familiar with how the systems worked.

Additional Comments

There were two additional points made, however they were only made by a few participants. The first was in regard to the way that an EHR can help with critical thinking and cognition. The second was that any value is tied to the type of EHR system. The later point is perhaps the more salient as it was mentioned by at least five participants.

The first point in regard to critical thinking was made by one participant. She took a great deal of time discussing the value that the EHR provided in regard to critical thinking and in helping you to think in processes. The point was in regard to organization of data and the way information is structured and stored. An EHR organizes information in a way that helps you to think in terms of body systems. When you are completing nursing diagnoses, electronic systems lead you through the process - so it provides a type of scaffolding of check boxes for the professional. The participant felt very strongly that if they had not had the EHR, they would have missed out on some developing thought patterns or it would have taken her longer to organize thoughts in a way that was efficient. An EHR helped this student think along a certain line and move methodically through systems. Finally, the participant contrasted an electronic system with paper and said that they did have a few classes that used paper and that paper did not provide this same experience. The EHR was more comprehensive and holistic for them - everything was in one place and structured in a way that helped with critical thinking and understanding.

The second point was that any value of having an EHR in the learning environment is tied to the type of EHR system. Five different participants discussed the

importance of the system on the value. When the classroom or simulation experience uses a system that is very similar to the clinical system that is used on a rotation, the experience becomes more valuable. Students are able to jump right into a clinical practicum because they already understand the structures of the system and how it works. On the other hand, it can be confusing having different EHRs in the learning environment and on clinical rotation. When the EHR used in the classroom is different than the EHR in the clinical environment and on the units, learning in a standardized way becomes more difficult. You get used to doing things one way in one environment and then see them a different way in another environment. Long term, this is okay as students realize they will work at different hospitals and on different units that will have differences in their clinical systems. However, when beginning to learn, the closer the EHR match from the classroom to the clinical environment the better for the learning experience. The more unlike the systems are from each other the more difficult the transition from the classroom to the clinical rotation or practice might be. Additionally, the way the system is configured is important. When the system is a good representation of what is out in the workplace, then having that type of system in a classroom or simulation lab is very beneficial. However, if the system in the classroom is implemented poorly or not supported by the IT staff it can lead to a negative perception and that perception may have a negative impact on the perception of usefulness or ease of use of EHRs in general. When students go from one hospital to another they recognize fairly quickly that some EHR systems are easier and other systems are harder to use. When they are easy, students had a more positive perception of the EHR as a technology; likewise, when they are hard or poorly supported, students' perception leaned toward the negative.

CHAPTER 5

DISCUSSION

The purpose of this study was to explore the effect of a learning environment using an Electronic Health Record (EHR) on undergraduate nursing students' Behavioral intention (BI) to use an EHR. A total of 56 undergraduate nursing students from three (3) accredited Schools of Nursing were utilized in this study. Each completed a self-administered questionnaire that had items to assess their perceived usefulness (PU) and perceived ease of use (PEOU) of an electronic health record (EHR) in order to determine their behavioral intention to use an EHR. In addition, fifty-five percent (55%) of the population (31 of 56 total participants) participated in a follow-up interview where they were asked to share their perceptions and their behavioral intention to use an EHR on clinical rotations and in practice. This chapter begins by summarizing the results and discussing the effect of a learning environment using an Electronic Health Record (EHR) on the dependent variable BI. The chapter closes with a discussion of findings, limitations, and recommendations for future research.

Summary of Results

Regarding the surveys, the mean scores for all the survey responses and the mean score for individual items on the questionnaire and their standard deviations were consistent across both learning models. The normal distribution was toward the upper end of the Likert scale. This reduced the variability due to the restricted range of responses across all participants surveyed. A t-test assessed if the mean responses from

the participants from the two groups educated through different learning models (EHR and Paper-Based) were statistically different from one another. The statistical analysis of the data did not predict or explain behavioral intention for either factor PU or PEOU.

In regard to any differences in the behavioral intention to use an EHR between junior and senior students' educated in a learning environment using an EHR, the independent variable year and the indicator perceived usefulness were examined through one-way ANOVA. The results showed that year was significant in predicting usefulness (PU). A t-test assessed the means of these two groups (Juniors and Seniors) to examine if they were statistically different from one another. There was a statistically significant difference between the BI to use an EHR between junior and senior students' educated in a learning environment using an EHR with senior students reporting a higher BI score.

Regarding the interviews, there was a reported impact to PU and PEOU for the majority of the participants interviewed. Based on those interviews and in all cases, participants reported that their behavioral intention to use an EHR was strong. Two general themes emerged in regard to the value of integrating an EHR within the curricula. The first was increased competency and the second was an increased comfort level. There were two additional points made, however they were only made by a few participants. The first was in regard to the way that an EHR can help with critical thinking and cognition. The second was that any value is tied to the type of EHR system and how that system is both implemented and supported within the learning environment.

Findings

A Learning Environment Using an EHR and the Effect on Behavioral

Intention to Use an EHR

As discussed in Chapter 2, there is a lack of prior research to indicate or inform the findings in this study. Not only does a gap exist in regard to technology acceptance and the BI to use HCIT in the work place (Holden & Karsh, 2010), few if any studies have used TAM methodology or its theoretical extensions to predict the behavioral intention of nurses to use an Electronic Health Record (EHR). So there were no previous conclusions available to review against the findings. The literature does support the use of TAM methodology both within and outside of the field of healthcare in order to explain usage intentions and behavior (Venkatesh & Davis, 2000) and is specifically “tailored for modeling user acceptance of information systems” (Davis et al., 1989, p. 985). TAM suggests that two specific behavioral beliefs, perceived ease of use (PEOU) and perceived usefulness (PU), determine an individual's attitude which in turn influences BI to use information technology. PU is the dominant variant.

Regarding the effect of a learning environment using an EHR on senior nursing students' behavioral intention to use an EHR, there were no significant relationships between learning model and any of the BI indicators. The hypothesis (H1) presented in Chapter 1 was not supported using the 32 participants and the data in this case did not predict BI.

Regarding any differences in the behavioral intention to use an EHR between junior and senior students' educated in a learning environment using an EHR, the year (Junior or Senior) was significant in predicting both usefulness and ease of use.

Regarding the null hypothesis (H0) presented in Chapter 1, the data do not support that hypothesis. There was a significant difference between the BI to use an EHR between junior and senior students' educated in a learning environment using an EHR with senior students reporting a higher BI score.

A Learning Environment Using a Paper-Based Approach and the Effect on Behavioral Intention to Use an EHR

Regarding the effect of a learning environment using a paper-based approach and clinical rotations on senior nursing students' behavioral intention to use an EHR, there were no significant relationships between learning model and any of the BI indicators. The hypothesis (H2) presented in Chapter 1 was not supported using the 32 participants and the data in this case did not predict BI. There is a lack of prior research to indicate or inform the findings in this study. So there were no previous conclusions available to review against the findings.

The Reported Impact on Perceived Behavioral Intention to Use an EHR on Clinical Rotations and on Practice

In the majority of cases, regardless of learning model, students thought it was either easy to use an EHR in practice or that an EHR was useful in practice. In most cases, the reported student perceptions of usefulness (PU) and their perceptions of the ease of use (PEOU) leaned strongly in the direction of an EHR being both useful and easy to use on clinical rotations and in practice. In a few cases, the reported student perceptions of the ease of use (PEOU) ended up being that the EHR was harder to use

than previously thought. There were no identifiable themes within the following distinct populations – school, year, or learning model.

For students who learned nursing practice through a Paper-Based Approach, there was a reported impact to PU and PEOU for the majority of the participants interviewed. For PU, the reported perception was that an EHR was useful. The EHR was either easier than they thought or more useful, having a positive impact on the behavioral intention to use. For PEOU, 40% of the respondents' perceptions were that an EHR was harder than they previously had thought and this had a negative impact on the behavioral intention to use, meaning that they were less eager to use in a clinical setting. The remaining 60% of participants thought it would be hard, and it ended up being easier than they thought or thought it would be easy, and it was easy for them. In general, the reported PU and PEOU had a positive impact on behavioral intention to use. In one case a participant clarified that ease of use varies depending on the system being used. She had access to several EHR systems while on clinical rotation and in general her perception of an EHR is that it is easy; however, when she encountered a more difficult system that perception changed for that situation.

For students who learned nursing practice through the context of an EHR in the learning environment (classroom, skills lab, or simulation lab), there was a reported impact to PU and PEOU for the majority of the participants interviewed. For PU, that perception had a positive impact on the behavioral intention to use, meaning that it either was easier than they thought, useful, or more useful. For PEOU, 22% of the respondents' thought using an EHR was harder than they previously had thought. This had a negative impact on the behavioral intention to use an EHR. The remaining 78% of participants

thought it would be hard, and it ended up being easier than they thought, or they thought it would be easy, and it was easy for them. In general, the reported PU and PEOU had a positive impact on students' behavioral intention to use, meaning that it either was easier than they thought or more useful.

The Perceived Value of Having an EHR to Teach Nursing Practice in the Classroom, Skills lab, or Simulation Lab

As discussed in Chapter 4 in the “Perceived Value of an EHR used to Teach Nursing Practice” section, regardless of demographics or learning model, participants agreed that there was value in having an Electronic Health Record (EHR) integrated within the school curricula (classroom, skills lab, and simulation lab) in order to teach nursing practice. This would be in addition to any time on clinical rotation. Participants also suggested that experience with an EHR should occur prior to any clinical rotation. Students felt that this is safer and provides an environment in which they can make mistakes and learn the technology without having the added pressure of managing the care of patients. I identified two general themes within the responses on the value of integrating an EHR within the curricula. The first was increased competency and the second was an increase in comfort level, which included decreased stress, reduced anxiety, and an increase in confidence levels.

Regarding an increased competence, there is literature to suggest that future clinicians should become both competent and proficient in the use of informatics (Connors et al 2002; Institute of Medicine, 2001; McNeil et al. 2003; & Warren et al. 2010). The literature suggests that students need hands-on access to these technologies

including an EHR in order to learn. Future clinicians will become both competent and proficient in the use of informatics if they have hands-on access to new and emerging technologies and are educated on CIS such as an EHR (Warren et al. 2010). The feedback from the interviews supported the literature in regard to hands-on access. Participants commented that having access to the EHR in classroom, skills lab, or the simulation lab is authentic, it is realistic and is more true to what will be experienced as a professional in the workplace. Many students commented that the access to an EHR in the classroom will make them more competent on clinical rotations and in practice. Having access to an EHR helps students grow competencies by providing time to learn, time to practice, and a place to make mistakes in a safe environment. Other studies have supported this feedback and suggest that people who have more education [and experience] in a particular area are better able to learn and continue to learn from experience (Lleras-Muney & Lichtenberg, 2002). In general, students felt that the true benefit was clear once they were out in the clinical setting. They were better prepared and felt like they had an increased understanding as well as a knowledge and skill set that were relevant to the workplace. This supports the conclusions of Connors et al. (2002), when they state that by creating a central learning environment using a CIS base through the context of an EHR, educators are preparing students for the workforce while increasing their understanding of the role informatics plays in improving the delivery of patient care. As one student put it, “you would never want to document and provide patient care with just paper. It really doesn't make a lot of sense to learn on paper today.”

Having access to an EHR in the classroom made it significantly easier for the majority of students and increased their comfort level. The earlier access prior to a

clinical practicum helped to decrease stress, reduce anxiety, and increase confidence. The added experience with the functionality and knowing where to look for information and documentation were keys to their success on clinical rotation and in practice. EHRs are large multi-faceted, multi-tabbed, information systems. Being able to navigate to find certain information is important when providing patient care or managing the care of multiple patients. Participants pointed out more than once that students who haven't used an EHR before clinical practicum would likely lose confidence, experience an increase in anxiety, and experience added stress in an already stressful and overwhelming environment.

A few additional points were made, however they were only made by a few participants. The first point was regarding the impact of EHR technology on developing critical thinking skills and cognitive thought processes. The second point was that the value of the EHR in the learning environment whether it be in the classroom, skills lab or simulation lab was related to type of EHR presented and how well it was implemented and supported.

Regarding critical thinking, one student felt that the way data was organized, structured, stored, and presented in an EHR helped her to think in terms of body systems. The technology provided a type of scaffolding for her as a learner. The participant felt that this helped in the development of thought patterns and helped with the organization of thoughts in a holistic and systemic way, which was important when thinking about the body as a system in the context of patient care.

Regarding the type of system, the closer the system matches the EHR used on clinical rotations, the better and easier it is for students to transition into a clinical

practicum. This will allow more time to be focused on patient care rather than having to learn the unique intricacies and structures of the system and/or how it works.

Additionally, it is confusing to have many different EHRs in the learning environment and/or on clinical rotation. When the EHR is different, learning becomes more difficult. While students recognize that they will work at different hospitals and on different units that will have different clinical systems in practice, a beginning learner needs consistency. The closer the EHR match from the classroom to the clinical environment the better for the learning experience.

Additionally, the way the system is implemented and supported is important. A system may be a good representation of what is actually in the workplace. However, if the system has bugs or isn't working properly this can lead to a negative perception and a lower behavioral intention to use. Also, if the system is not supported by the IT staff this can have a similar impact. Students recognize that some EHR systems are easier and other systems are harder to use. The main point is that when you are learning, you want a system that is complex enough to represent authenticity and a system that operates well enough to facilitate a positive experience.

Instructional Recommendations

The conclusions of this study can be offered as suggestions for improving the education of nursing students. The design and the scope of the study included three schools of nursing within three separate university systems. There were several common themes that were found across the schools regardless of the age or year (Junior or Senior) of the student participants. It is my belief that these themes are fundamental and should be considered by all schools of nursing in the United States.

Provide Experiences with an EHR Prior to Clinical Rotation

Many schools provide EHR experiences through clinical assignments and periodic rotations. This is helpful; however, there are several challenges with thinking that clinical rotations alone will adequately prepare students for the digital environments that they are entering. Scheduling rotations is becoming a challenge as concerns around patient safety and regulations around patient privacy continue to grow. The ability to experience information systems in any meaningful way is reduced as hands on access to the technology is limited due to federal laws and regulations. In addition, if the clinical environment is the first place where students experience these technologies – the learning often comes late in the educational process and is at risk of common distractions, anxiety, and stress of working with a live patient. Clinical rotations are rarely at the same location; therefore nursing students are often presented with a new clinical information system or EHR every time they arrive at their new assignment. These assignments occur over several years as students work to complete their nursing education. The lack of continuity inherent in scheduling rotations at several disparate locations over years hinders the clinical experience and can be frustrating for the student and can negatively impact the learning process and behavioral intentions to use EHRs.

For a more optimal learning experience, schools should look to provide access to an EHR in a safe environment and throughout the learning curriculum so that informatics concepts are integrated into courses and lessons plans. This will provide time to practice, more time to learn, and the chance to make mistakes in a safe environment. The more time and experience with an EHR, the better prepared students will be for the clinical setting. Multiple sources highlight the importance of making sure that nurses are

prepared for informatics practice (Carty & Rosenfield, 1998; Connors et al., 2002; Gassert, 1998; McNeil et al. 2003; McNeil and Odom, 2000; & Staggers et al., 2001). Based on the results and the findings presented in this study, faculty members at schools of nursing should consider implementing EHRs to support student preparation. EHR implementation in the classroom, skills lab, or simulation lab will likely lead to an increase in understanding, an increase in knowledge and skill set, an increase in competence, and will serve to better prepare nursing students for nursing practice. It is also important to provide one type of system to provide continuity. The consistency of one type of system is needed when students are first learning. The early access may also help control the stress and anxiety a student may feel when entering the clinical environment for the first time. They presumably then might have an increased confidence and comfort level when working with this technology.

Technologies should be as close to the real live environment as possible and need to be implemented correctly and supported. Access to the same technologies available in the workplace setting will create an educational foundation upon which to build over time. This will also be more relevant to the workplace. If the technology is not implemented accurately or is not supported, this can leave both students and faculty feeling frustrated and rather than improving the learning environment, could serve to be disruptive to learning. Nursing students need the access to up-to-date technologies and an EHR that integrates informatics into the curricula. Otherwise, important competencies are missed. This is not to say that paper charting has to go away completely; rather, the findings from this study suggest that we need to find room for the EHR to be available to students as they learn.

The technologies suggested in the results and findings of this study can be expensive. There are time constraints and other resource limitations that could prove to become barriers to the acquisition, implementation, and the adoption of a CIS base or the integration of an EHR into curricula. When a big bang approach is not possible, nursing programs should look to implement these technologies by starting small and moving to integrate over time. Programs should review the multiple simulation technologies and options that are available to them selecting the ones that seem most appropriate for their specific circumstance. Nursing educators should embrace constraints. Educators are inspired professionals by nature. That inspiration can take on many forms and move in many directions. Constraints allow educators to prioritize inspiration. Big ideas can become reality much quicker when constraints regarding time, budgets, and resources, are embraced. This allows us to feed our inspirations rather than give up. When we move forward, even in the face of adversity, we begin to drive creativity and innovation in teaching and learning practice. That innovation is critical to the future of education and in the context of this study, the reinvention of healthcare.

While guidelines for the inclusion of informatics content in nursing education have been developed by the American Association of Colleges of Nursing (AACN) (1998), the American Nurses Association (ANA) (2001), and the Pew Health Professions Commission, these guidelines do not yet include the recommendation for access to EHR technologies in the classroom, skills lab, or simulation lab. The findings from this study suggest that we might need recommended pathways for educators to review in as part of their consideration to include EHR technologies in the classroom.

Limitations

There were five main limitations of this study. The first limitation was low sample size. As discussed in Chapter 3, “Participants” section, the intent was to include at least 50 juniors and seniors from School #1 and School #2 for a total of 200 and at least 50 seniors from School #3. This would have been a total of 250 participants. The actual N=56 was much lower than anticipated. This had an impact on the researcher’s ability to produce recommended levels of statistical power to analyze the survey data. The second limitation was that the study included a few students who were already registered nurses (RNs) and who used EHRs in the workplace. This may have had an impact on the results since their experiences would have been more varied than that the typical undergraduate student. Third, the instructional techniques at the three schools in this study were not controlled. Classroom, skills lab, and simulation lab experiences as well as experiences on clinical rotations vary. We can assume, since these institutions are accredited that some standards are in place, however they are also unique schools and the experiences of the students may end up being different from one school or another. Fourth, Schools #1 and #2 used Cerner’s Academic Education Solution to bring an authentic clinical information system experience into the curricula through the context of an Electronic Health Record (EHR). Results may differ on other EHR systems or EHR-simulation programs. Since the data were collected from participants who had access to an authentic EHR vs. a simulated EHR, the results should not be generalized to simulated EHRs. The results are best understood in the context of providing an authentic EHR experience into the curricula. Finally, investigator bias cannot be completely eliminated from the process. The investigator is also an employee of Cerner, which is a healthcare

company. The researcher's work at this healthcare company provides a unique perspective. There is no way to be completely objective about the participants, the process, and the outcomes. That said, there are also positive factors that arise from this combination of Cerner employee and researcher. The researcher has a deeper knowledge of the healthcare field and the challenges facing healthcare today.

Future Research

Future research should be conducted on the effect of a learning environment using an Electronic Health Record (EHR) on undergraduate nursing students' Behavioral intention (BI) to use an EHR and on the value of an EHR in the classroom, simulation lab, or skill slab.

This is the first study of hopefully many that take a look at nurses and their behavioral intention to use EHRs. The TAM methodology used in this study has been successful in helping researchers understand behavioral intention in many fields including healthcare. However, this is the first time anyone has looked at registered nurses or nursing students. I believe that it would be valuable to examine different populations to add to the already existing literature that seeks to understand how best to promote EHR adoption. This study employed nursing students at three nursing schools over a period of about six months. Future research on undergraduate nursing students behavioral intention to use an EHR should consider including more nursing schools over a longer period of time in order to get a larger population and a N=120 or 150. In addition, if another researcher were to explore the difference between senior and junior undergraduate students, a direction hypothesis could be considered, based on what I have found in this study.

This is also one of few studies to apply a qualitative approach in regard to is the perceived value of having an Electronic Health Record (EHR) available in the classroom, skills lab, or simulation lab in order to teach nursing practice. This theme on value emerged naturally from interview questions on participants' perceived ease of use and perceived usefulness of an EHR. The results from all three schools, all ages, seniors and juniors, and both learning models (EHR vs. Paper-Based Approach) were consistent and informed the instructional recommendations made earlier in this chapter. Those interviewed had a great deal to say about how they learned and how they were best educated, so that was encouraging. Because this feedback generated so many instructional recommendations, it would be very valuable to extend this portion of the research to either further validate the researcher's results and findings or to find new recommendations. Two additional future directions might be to discuss these findings with nurse educators to gain a deeper understanding of their experiences and interpretations. It would be interesting to explore parallels in the way students would like to learn and why and the way faculty members would like to instruct and why. Faculty members have experience beyond that of the student, and so their opinion on these matters is critical and might help to better inform the results and findings. In addition, I made mention in the "Limitations" section, that a limitation was the ability to generalize results to other EHR systems, especially simulated systems. A natural extension of this research would be to conduct a similar study with one of the many simulated EHRs available today.

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APPENDIX A: SELF-ADMINISTERED QUESTIONNAIRE #1

Self-Administered Questionnaire as developed by Foley (2010) and adapted from Venkatesh, V. and Davis, F.D. (2000)

Self-Administered Questionnaire #1

Note: To be with schools that bring an authentic clinical information system experience into the curricula through the context of an Electronic Health Record (EHR) using Cerner's Academic Education Solution (AES) in order to teach nursing practice.

Instructions: Complete each item on this questionnaire by selecting only one number between 1 and 7. Clearly indicate your choice by placing an X on the line provided. (1 = strongly disagree and 7 = strongly agree).

Perceived Usefulness

1. Using the Academic Education Solution (AES)/EHR improves my performance as I practice.

1 = strongly disagree ____

2 = moderately disagree ____

3 = somewhat disagree ____

4 = neutral (neither disagree nor agree) ____

5 = somewhat agree ____

6 = moderately agree ____

7 = strongly agree ____

2. Using the Academic Education Solution (AES)/EHR in my practice increases my productivity.

1 = strongly disagree ____

2 = moderately disagree ____

3 = somewhat disagree ____

4 = neutral (neither disagree nor agree) ____

5 somewhat agree ____

6 = moderately agree ____

7 = strongly agree ____

3. Using the Academic Education Solution (AES)/EHR enhances my effectiveness in my practice.

1 = strongly disagree ____

2 = moderately disagree ____

3 = somewhat disagree ____

4 = neutral (neither disagree nor agree) ____

5 somewhat agree ____

6 = moderately agree ____

7 = strongly agree ____

4. I find the Academic Education Solution (AES)/EHR to be useful in my practice.

1 = strongly disagree ____

2 = moderately disagree ____

3 = somewhat disagree ____

4 = neutral (neither disagree nor agree) ____

5 somewhat agree ____

6 = moderately agree ____

7 = strongly agree ____

Perceived Ease of Use

5. My interaction with the Academic Education Solution (AES)/EHR is clear and understandable.

1 = strongly disagree ____

2 = moderately disagree ____

3 = somewhat disagree ____

4 = neutral (neither disagree nor agree) ____

5 somewhat agree ____

6 = moderately agree ____

7 = strongly agree ____

6. Interacting with the Academic Education Solution (AES)/EHR does not require a lot of my mental effort.

1 = strongly disagree ____

2 = moderately disagree ____

3 = somewhat disagree ____

4 = neutral (neither disagree nor agree) ____

5 somewhat agree ____

6 = moderately agree ____

7 = strongly agree ____

7. I find the Academic Education Solution (AES)/EHR to be easy to use.

1 = strongly disagree ____

2 = moderately disagree ____

3 = somewhat disagree ____

4 = neutral (neither disagree nor agree) ____

5 somewhat agree ____

6 = moderately agree ____

7 = strongly agree ____

8. I find it easy to get the Academic Education Solution (AES)/EHR to do what I want it to do.

1 = strongly disagree ____

2 = moderately disagree ____

3 = somewhat disagree ____

4 = neutral (neither disagree nor agree) ____

5 somewhat agree ____

6 = moderately agree ____

7 = strongly agree ____

APPENDIX B: SELF-ADMINISTERED QUESTIONNAIRE #2

Self-Administered Questionnaire as developed by Foley (2010) and adapted from Venkatesh, V. and Davis, F.D. (2000)

Self-Administered Questionnaire #2

Note: To be used with schools using a paper-based approach to teach nursing practice.

Instructions: Complete each item on this questionnaire by selecting a number between 1 and 7 (1 = strongly disagree and 7 = strongly agree).

***Perceived Usefulness**

1. Using the Cerner Powerchart system improves my performance as I practice.

1 = strongly disagree ____

2 = moderately disagree ____

3 = somewhat disagree ____

4 = neutral (neither disagree nor agree) ____

5 = somewhat agree ____

6 = moderately agree ____

7 = strongly agree ____

2. Using the Cerner Powerchart system in my practice increases my productivity.

1 = strongly disagree ____

2 = moderately disagree ____

3 = somewhat disagree ____

4 = neutral (neither disagree nor agree) ____

5 = somewhat agree ____

6 = moderately agree ____

7 = strongly agree ____

3. Using the Cerner Powerchart system enhances my effectiveness in my practice.

1 = strongly disagree ____

2 = moderately disagree ____

3 = somewhat disagree ____

4 = neutral (neither disagree nor agree) ____

5 = somewhat agree ____

6 = moderately agree ____

7 = strongly agree ____

4. I find the Cerner Powerchart system to be useful in my practice.

1 = strongly disagree ____

2 = moderately disagree ____

3 = somewhat disagree ____

4 = neutral (neither disagree nor agree) ____

5 = somewhat agree ____

6 = moderately agree ____

7 = strongly agree ____

***Perceived Ease of Use**

5. My interaction with the Cerner Powerchart system is clear and understandable.

1 = strongly disagree ____

2 = moderately disagree ____

3 = somewhat disagree ____

4 = neutral (neither disagree nor agree) ____

5 = somewhat agree ____

6 = moderately agree ____

7 = strongly agree ____

6. Interacting with the Cerner Powerchart system does not require a lot of my mental effort.

1 = strongly disagree ____

2 = moderately disagree ____

3 = somewhat disagree ____

4 = neutral (neither disagree nor agree) ____

5 = somewhat agree ____

6 = moderately agree ____

7 = strongly agree ____

7. I find the Cerner Powerchart system to be easy to use.

1 = strongly disagree ____

2 = moderately disagree ____

3 = somewhat disagree ____

4 = neutral (neither disagree nor agree) ____

5 = somewhat agree ____

6 = moderately agree ____

7 = strongly agree ____

8. I find it easy to get the Cerner Powerchart system to do what I want it to do.

1 = strongly disagree ____

2 = moderately disagree ____

3 = somewhat disagree ____

4 = neutral (neither disagree nor agree) ____

5 = somewhat agree ____

6 = moderately agree ____

7 = strongly agree ____

APPENDIX C: INTERVIEW SCRIPT AND INTERVIEW QUESTIONS

Interview Script and Questions as developed by Foley (2010)

Interview Script and Questions for both Senior and Junior Undergraduate Nursing Students

approx 10 minutes for Interview

I'd like to ask you a few questions about your perception regarding the value an Electronic Health Record (EHR) in the learning environment. This Interview last approximately 10 minutes. There is no right or wrong answer to these questions; however your honest feedback would be most helpful and appreciated. Your answers will be kept confidential and the data will only be used within the context of this study. Your responses, along with those of other participants, will be used to help answer one of the research questions in this study.

Demographics

- 1. Record the school that the participants are from.**

Clinical Rotations

- 2. Do you feel that having an Electronic Health Record (EHR) in the learning environment has an impact on the perceived usefulness experienced when using an EHR on clinical rotations? Y / N**
 - If yes, why?
 - If no, why?
- 3. Do you feel that having an Electronic Health Record (EHR) in the learning environment has an impact on the perceived ease of use experienced when using an EHR on clinical rotations? Y / N**
 - If yes, why?
 - If no, why?

4. Do you feel that having an Electronic Health Record (EHR) in the learning environment has an impact on the perceived usefulness experienced when using an EHR in your future practice? Y / N

- **If yes, why?**

- **If no, why?**

5. Do you feel that having an Electronic Health Record (EHR) in the learning environment has an impact on the perceived ease of use experienced when using an EHR in your future practice? Y / N

- **If yes, why?**

- **If no, why?**

APPENDIX D: QUOTES

School #1 - Seniors

"We had access to an EHR in the learning environment and I wish we would have learned more in the learning environment about the EHR - how to chart and how to look up the histories. The more access the better." - *Senior, School #1, Access to an EHR in the Curricula*

"An EHR in a learning environment is very valuable and I am very glad that our school has brought it into the simulation practice. As a nursing student, it helps you develop your standardized nursing language, it helps you communicate better within standardized practice. It improves communication among healthcare professionals." - *Senior, School #1, Access to an EHR in the Curricula*

"The sooner faculty can give access to EHRs to students the better." - *Senior, School #1, Access to an EHR in the Curricula*

"Time plays an important role in learning the technology and systems as well. The more practice with EHRs the better." - *Student, School #1*

Paraphrase - EHR in the simulation lab or skills lab is authentic, it is realistic and is more true to what we will be experiencing in the workplace. It prepares us for digital environments. It also provides more time to learn these technologies which is important as they are often complex. - *Senior, School #1, Access to an EHR on Clinical Rotation Only*

School #1 - Juniors

"I think that having access to an EHR in the classroom or in the simulation lab is very valuable. If it wasn't there, then we would kind of be going in blind when it comes to working with electronic health records. I would like to see it used in all of the classes, because it gets you a little more familiar with that type of thing and gets you prepared to go out in the clinical rotations. It is a good learning tool." - *Junior, School #1, Access to an EHR in the Curricula*

"When you are first starting out as a nurse, is a good to learn on the same tools and technologies that you will encounter on clinical rotation. Also, by having access in the learning environment you can practice ... this allows for a safe environment which leads to reduced stress, reduced anxiety, and increased confidence when you do actually make it out into the clinical setting." - *Junior, School #1, Access to an EHR in the Curricula*

School #1 – Juniors (cont.)

"Learning how to correctly document the patient's information in a standardized way is really important. The correct and safe way today is through the use of an EHR. If you learn on paper, you are not necessarily learning the correct way. Also, if I was thrown into a clinical environment with an expectation to document electronically and was expected to be using a system that I have never used, I would be very anxious, and nervous ... especially knowing it is a legal document. I would not feel comfortable at all." - *Junior, School #1, Access to an EHR in the Curricula*

School #2 – Seniors

"Having an EHR in the simulation lab gives us more of an understanding of what to expect in the clinical environment. It is important to give students the opportunity to work with it ... this will give students the ability they will need in the workplace." - *Student, School #2, Access to an EHR in the Curricula*

"When the system used in the simulation lab or skills lab is the same as the system on clinical rotation, it is more valuable. When they are different it is a little more hard. It still gives you a good idea of what you are looking for and where to look. However, when different health facilities use different electronic health systems it becomes a little more confusing." - *Student, School #2, Access to an EHR in the Curricula*

"Learning on an EHR helps our behavioral intention to use since we haven't had the option to use anything but electronic health records. Faculty were purposefully trying to introduce us to this format, layout, model ... because health systems are moving to 100% electronic. If you use paper, you could get used to charting or writing narratives on paper and then you may not want to use an EHR because you are used to paper and therefore prefer paper. It may be hard to break that paper habit when you move to the workplace and they are using an EHR." - *Student, School #2, Access to an EHR in the Curricula*

"I would not have preferred to learn on paper and then have to learn the EHR on a clinical rotation. It is hard enough to go from one EHR format to another when I move from unit to unit or from one hospital to another. I cannot even imagine learning on paper, not even ever seeing an electronic record, and then being put on a unit and them saying this is an EHR and here is how we chart." - *Student, School #2, Access to an EHR in the Curricula*

"Without access to the EHR in the simulation lab and skills lab, we would have lost clinical time on rotations. We would have needed longer orientation time at hospitals to learn - where to find things, what we needed to find, what we should have access to, what we shouldn't have access to as students. I wouldn't be able to take care of two patients this early in my practicum if I didn't know how to find what I needed in the HER or how to document." - *Student, School #2, Access to an EHR in the Curricula*

School #2 – Seniors (cont.)

"It's not like writing on a piece of paper. You need to know do a click on the little piece of paper icon or the little spy glass ... and doing it the wrong way leads to misinformation or a lack of information to the physicians - because they do not know how to find it the way you charted it." - *Student, School #2, Access to an EHR in the Curricula*

"From a skill and capability perspective , I was prepared to use an EHR and so I could spend more time with patients. When I finally got to practical application, I could just apply." - *Student, School #2, Access to an EHR in the Curricula*

"With repeated exposure there is both understanding and improved competence with the functionality. If you are just thrown into it, there will be added stress and anxiety. The EHR could be so overwhelming that you may not learn or know as much about the electronic health record." - *Student, School #2, Access to an EHR in the Curricula*

School #2 – Juniors

"Without access to an authentic EHR in a simulation lab prior to the clinical rotation, we would have spent a lot more time looking through the chart on rotation and figuring that out. Rather than spending time with the patient and doing the hands on care, we would have been concerned with the technology. We would not have know anything about an EHR, where to find certain things or where to document." - *Student, School #2, Access to an EHR in the Curricula*

School #3 – Seniors

"Your first couple times on the floor you get so caught up and overwhelmed with becoming familiar with e-charting. If you could see an EHR or have access beforehand you would not be as overwhelmed and you could spend time on more important things instead of struggling to learn the computer system." - *Student, School #3, Access to an EHR on Clinical Rotation Only*

VITAE

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Educational Background

- B.S. Education - Bloomsburg University, December 1997
- M.S. Instructional Technology – Bloomsburg University, December 1999
- D.Ed. Instructional Systems – The Pennsylvania State University, August 2011

Current Areas of Research and Teaching Interest: The use of electronic medical records (EMRs) and electronic health records in education and the value that academic EMRs & EHRs can provide to students as they advance to clinical practice.

Design and Development of Instructional Materials: Shawn designs learning solutions for Cerner to address education, knowledge, and skill transfer challenges that aim to advance health care workforces and improve the health behaviors of our communities.

Educational Philosophy

“Education should improve your life and the life of those around you.”

Shawn’s educational philosophy is to foster cultures of learning within authentic and real-world environments that serve to influence the adoption of healthy behaviors that will ultimately improve our lives. He believes in using active and collaborative learning strategies that focus on the learner and that build a dynamic learning environment and community. Learning environments should be flexible and focus on mastery and longitudinal assessment, giving learners many chances to achieve success through specific actions that define overall performance and outcomes.

Recent Publications & Academic Papers

Foley, Shawn (May 2011). *The effect of a learning environment using an Electronic Medical Record (EMR) on undergraduate nursing students’ Behavioral Intention (BI) to use an EMR: A Dissertation in Instructional Systems.* The 7th Annual Faculty Development Workshop, University of Kentucky, College of Nursing, Lexington, KY.

Certificates

Pennsylvania Department of Education Level 1 Teaching Certification (Elementary K-6)