High Fidelity Nursing Using Electronic Health Record Systems: Impact on Critical Thinking in Nursing Practice

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Michele L. Miller

MSN, Albany State University, 2008
BSN, University of West Georgia, 2005
ADN LaGrange College, 1995

This dissertation, "High Fidelity Nursing Using Electronic Health Records Systems: Impact on Critical Thinking," by Michele Lynn Miller, is approved by:

Dissertation Committee Chair

James L. Pate, Ph.D.
Professor of Curriculum, Leadership, and Technology

Committee Members

Steven E. Downey, Ph.D.
Associate Professor of Curriculum, Leadership, and Technology

Gerald R. Siegrist, Ed. D.
Professor of Curriculum, Leadership, and Technology

Associate Provost For Graduate Studies and Research

Becky K. de Cruz, Ph.D., J.D.
Professor of Criminal Justice

Defense Date December 5th, 2018

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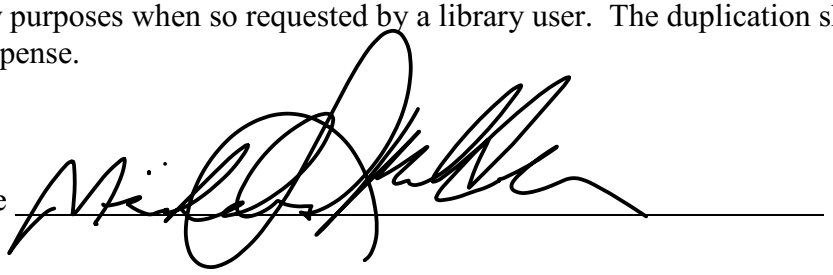
Signature 

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ABSTRACT

Since Florence Nightingale changed the way the world viewed nursing, the nursing profession has continued to advance and change daily. It can be challenging for nurses to keep up with changes in policies, standards, and advances in nursing technology. This is also a challenge for nursing programs. One thing that has not changed in the nursing education field is the need for students to have proficient critical thinking skills. Durmaz Edeer & Dicle, (2015) stated, "proficiency in thinking skills is an essential requirement of today's nurses who are having to make knowledgeable, confident, and effective decisions regarding health in a complex and changing environment" (p. 2).

Teaching documentation using the nursing process and paper-based documents has been instrumental in helping students develop critical thinking, clinical reasoning and clinical judgement. The mandate of Electronic Health Record System placed on Healthcare facilities created an added challenge for nursing programs to transition to the new system while continuing to help student develop critical thinking skills.

The purpose of this study was to determine if the implementation of electronic health records system into nursing programs had an impact on the development of Associate Degree nursing student's critical thinking skills. The theoretical frameworks by Paul & Elder, Blooms taxonomy and the nursing process used in this study supported the nursing program's curriculum for teaching critical thinking, clinical reasoning and judgement skills.

A causal-comparative research design was used to explore the relationship between student's critical thinking scores and the type of documentation taught at the

Associate Degree nursing level. Archived data was collected from the Clinical Judgement and Clinical Reasoning & Critical Thinking section of the Health Education Systems, Inc (HESI) exams.

Analysis of the data included are the Wilcoxon test, Mann-Whitney U test, and Kruskal-Wallis H test, and ANCOVA. The independent variable was the type of documentation students were taught in their perspective programs. The dependent variables were exam scores from the section of the HESI exams for Clinical Judgement and Clinical Reasoning & Critical thinking. When the Fundamental scores were incorporated as a covariate, the results revealed there was an impact on critical thinking of student taught with Electronic Health Records.

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I hope both Dr. Pate and Dr. Gibson enjoy their well-deserved retirement and know without them I could not call myself Dr. Miller. Thank you all for your patience and understanding throughout this process.

DEDICATION

This is dedicated to my family for supporting me through my “final degree”.
My husband Mike, children Tony, Melissa and Jonathan.

I love you and thank you from the bottom of my heart.

CHAPTER I

INTRODUCTION

The nursing profession has been in existence since before Florence Nightingale changed the way the nursing profession is viewed. Nightingale is credited with bringing the profession into the modern world. While the nursing profession continues to change and evolve daily, Nightingale set the standards for patient care the world now enjoys. One thing that has not changed in nursing is the need for nurses to think critically and use sound clinical reasoning skills. Durmaz Edeer & Dicle (2015) wrote, "Proficiency in thinking skills is an essential requirement of today's nurses who are having to make knowledgeable, confident, and effective decisions regarding health in a complex and changing environment" (p.6).

Critical thinking is a higher level of thinking which requires nurses to assess the evidence, explore assumptions, know when to question an assumption, decipher fact from fiction, define and set goals, find value when the value is not evident and evaluate conclusions (Secginli, Erdogan, & Monsen, 2013). Critical thinking in nursing combines the properties of critical reflection, reasoning, and judgment to make the critical clinical decisions required of nurses (Benner, Hughes, & Sutphen, 2008).

Critical thinking, like all nursing skills, is a learned and practiced skill student take from the nursing program into practice (Scriven & Paul, 2006). Strong critical thinking skills are the backbone of sound clinical reasoning, judgment, and clinical decision-making. Critical thinking

is taught throughout the nursing curriculum but begins in the first nursing course as students learn the nursing process. The nursing process expands, and critical thinking develop as students learn to perform patient assessments and document the findings.

Critical thinking is one of the most important skills for nursing students to develop to be able to provide quality patient care (Wlodyga, 2010). It is the responsibility of the faculty to assist nursing students in the development of critical thinking skills and move students from an entry-level critical thinker to a higher-level critical thinker (Chabeli, 2007). The critical thinking process is closely related to clinical reasoning and problem solving, both of which are necessary for good clinical decision-making in patient care. The skill of critical thinking is a logical, systematic reasoning approach taught to students through the nursing process (Yildirim, & Ozkahraman, 2011).

The goal for nurse educators is to graduate well-prepared entry-level nurses into the workforce. Nursing faculty must prepare the nursing student to meet workplace needs, including electronic documentation. The change from paper-based documentation to an Electronic Health Record Systems (EHRS) for documentation has not been an easy transition for nursing programs. Some nursing programs may decide to delay making this transition (Mahon, Nickitas, & Nokes, 2010). Nurse educators continue to search for innovative teaching strategies which represent real-life clinical situations to effectively develop critical thinking and clinical decision-making in patient care using an EHRS (Moody, Slocumb, Berg, & Jackson, 2004). Electronic documentation system uses a drop down and click format which provides no visual connection with other sections in the system. This format may create a deficit in development of the student's critical thinking skills. Paper-based documentation allows students to visually see all items and allows them to make the connection between critical points such as patient

demographic information, medications, and lab values. These connections are important due to changes in lab values may be related to certain medication or medication dosing may be calculated based on a patient's height, weight, or body mass index. This information may be difficult to locate in some EHRS. Nursing students may find that no two EHRS in healthcare facilities they visit for clinical rotations are the same. Due to the limited research, the impact of EHRS on the development of the student's critical thinking skills is still unknown.

Some of the current EHRS available for academic use have formatting which makes locating information extremely difficult and often contain items not relevant to nursing students (Baillie, Chadwick, Mann, & Brooke-Read, 2012). The current EHRS on the market are designed for commercial use in hospitals or physician offices. Nurse educators are concerned about the effect new teaching methods using EHRS may have on student's development of critical thinking and reasoning skills (Benner et al., 2008). Benner et al. (2008) suggest most nursing faculty do not have the time to measure the impact an EHRS may have on learning and developing critical thinking and clinical reasoning.

Furthermore, there is controversy surrounding the idea that critical thinking is a teachable skill. McCarthy (2003) provided insight into learning critical thinking: "Critical thinking can be influenced by a person's attitude, philosophical perspective, and preconceptions." (p. 211). Clinical reasoning is not a linear process, but often can be conceptualized as a series or spiral of linked and ongoing clinical encounters (McCarthy, 2003).

The key, according to Benner et al. (2008), is for nursing students to understand the EHRS is much more than learning to access data or input data. It also requires student to have a clear understanding of the importance of accurate legal documentation with each mouse click. Nursing faculty believe students must have the opportunity to navigate an EHRS early in their

nursing program. The faculty should set assessment guidelines for evaluation of a student's knowledge when documenting through the EHRS. The student must be able to assess a patient's situation, recognize a change from baseline, and correlate lab value changes with medication side effects and disease processes. Adequate critical thinking skills, clinical judgment, and clinical reasoning behaviors should be noted based on the student's assessment and documentation using the EHRS.

Detail documentation of a patient's care in the chart is a vital part of the continuity of care and is a legal document which can be submitted as evidence in court. The patient's chart is evidence of the care provided to a patient and the notes in the chart are the steps used to achieve positive patient outcomes (Evatt, Ren, Tuite, Reynolds, & Hravnak, 2014). Documentation by nurses was traditionally long handwritten notes in a patient's paper chart. In the early 1980's the lengthy handwritten documentation was replaced with charting by exception (CBE) (Heron, 2014). The CBE method is like a checklist and the nurse was only required to make a narrative note if a patient had a change from the baseline assessment. The goal of CBE was for nurses to spend less time documenting and more time providing direct patient care (Mahon, et al. 2010).

The push toward replacing CBE with Electronic Health Record System (EHRS), a system used to document nursing notes on the computer, began in 2004 with a mandate for all public and private healthcare providers to start implementing the system. This government mandate was performed in multiple phases over a ten-year period with a financial incentive for the providers, called Meaningful Use (Shea, Reiter, Weaver, Thornhill, & Malone, 2015). The Meaingful Use criteria tied the implimenation and use of EHRS to Medicaid and Medicare reimbursement payments for all healthcare providers. As each phase was complete, the healthcare providers funding was increased for providing care to

Medicaid or Medicare patients. The goal of the Meaningful Use incentive program was to improve efficiency, safety, and quality of care by improving coordination among healthcare providers, pharmacies, and other medical facilities (Shea, et al., 2015).

The nursing education system was not mandated to teach using and electronic medical records. In order to keep up with the changes in healthcare, the programs started moving toward EHRS selection and implementation into the curriculum. They did not know the impact these System would have on the development of student critical thinking skills and clinical decision-making.

Statement of Problem

The largest group today of EHRS users in healthcare are nurses. Learning documentation is the first step toward the development of the student's critical thinking skills. The problem this study addressed was if this move from paper documentation to electronic documentation had an impact on the development of a student's critical thinking skills. Paper-based documentation has been used for decades in nursing curriculum for the development of critical thinking skills (Mahon, et al. 2010). The research indicates that paper documentation does help with the developed critical thinking skills in nursing students (Mahon, et al. 2010). Today, it is also important for the students to understand the use of electronic documentation is more than just selecting an item from the drop-down list; they must also understand how each item selected may connect with another assessment item in the system. According to the Quality and Safety Education for Nurses, in 2010, there remains a gap between informatics instruction and meeting informatics competency in most nursing programs. This study hopes to determine the best methods of teaching documentation for development of critical thinking in nursing.

Purpose of Study

The purpose of this study is to determine if there is a relationship between the use of electronic and paper-based nursing documentation methods in the development of nursing students' critical thinking skills. The study explores whether a difference exists between the critical thinking scores of nursing students taught using paper-based documentation and those taught using electronic documentation in the nursing programs. This study hopes to determine if the adoption and implementation of electronic documentation System impact the Clinical Judgement and Clinical Reasoning & Critical thinking scores of associate degree nursing students.

For this study, critical thinking means the ability to analyze and evaluate information gathered from a patient's chart. The critical thinker can gather relevant information, assess the information, formulate the next question clearly, and communicate effectively with others about the problem. Clinical reasoning indicates the student has moved to a higher level of thinking and can synthesize information as to why a problem exists (Bloom, Krathwohl, & Masia, 1984). The final step is clinical decision-making, which involves a resolution to the problem.

The limited research on the impact of the transition from paper-based to electronic documentation has led to these research questions:

Research Questions

Research Question 1. Is there a significant difference between the scores each student earned on his/her Health Education System, Inc. (HESI) fundamental exam versus the exit exam for Clinical Judgement, Clinical Reasoning, and Critical Thinking?

H1: There is a significant difference between the student scores earned on the HEIS fundamental exam versus the exit exam for Clinical Judgement, Clinical Reasoning, and Critical Thinking.

H0: There is not a significant difference between the student scores earned on the HEIS fundamental exam versus the exit exams for Clinical Judgement, Clinical Reasoning, and Critical Thinking.

Research Question 2. Is there a significant difference on the fundamental exam scores in Clinical Judgement, Clinical Reasoning and Critical thinking between students completing Fundamental of Nursing in programs teaching electronic documentation and those teaching the use of paper-based documentation?

H1: There is a significant difference between fundamental exam scores in Clinical Judgement, Clinical Reasoning, and Critical thinking between groups completing Fundamental of Nursing in programs teaching electronic documentation versus those teaching paper-based documentation.

H0: There is not a significant difference between fundamental exam scores in Clinical Judgement, Clinical Reasoning, and Critical Thinking exam between groups completing Fundamental of Nursing in programs teaching electronic documentation versus those teaching paper-based documentation.

Research Question 3. Is there a significant difference in the exit exam scores on the Clinical Judgement, Clinical Reasoning, and Critical Thinking between groups graduating from programs teaching electronic documentation versus those teaching paper-based documentation after controlling for fundamentals exam scores?

H1: There is a significant difference in the exam scores in Clinical Judgement, Clinical Reasoning, and Critical Thinking between groups graduating from programs teaching electronic documentation versus those teaching paper-based documentation after controlling for fundamentals exam scores.

H0: There is a not a significant difference in the exam scores in Clinical Judgement, Clinical Reasoning, and Critical thinking between groups graduating from programs teaching electronic documentation versus those teaching paper-based documentation after controlling for fundamentals exam scores.

Significance of Study

The use of technology will continue to advance in nursing. The demographics of nursing students are will continue to be more diverse than in previous decades (Heller, Oros, & Durney-Crowley, 2014). The age of nursing students, as well as nursing faculty has continued to increase. The changes in documentation are significant changes for many of the older nursing students and nursing faculty (Chabeli, 2007).

Nursing educators recognized challenges as they started the transition from paper to electronic documentation. The educator must develop methods to assess the effect this change will have on student development of critical thinking. The assessment tool used should not only include a way to assess critical thinking and clinical decision-making but also the level of comfort the student has with technology. Chabeli (2007) emphasized the importance of the nurse educator and the role they play in identifying core cognitive critical thinking skills as students work to develop and improve critical thinking throughout the nursing program.

There are nursing programs in which students do not have access to any type of electronic documentation system until they reach the clinical rotation part of their program. This is often in the second semester of the nursing program. This may severely limit the time students have to learn proper use of an EHRS. They are then expected to have a solid working knowledge when entering the workplace. The use of an EHRS can be signigicantly decreased even more if the clinical site prohibits student from having access to the EHRS due to security policies. This restriction might mean access to the patient records can only be obtained with a clinical instructor present. Most nursing programs have a 10 to 1, student to instructor ratio in the clinical setting.

As the number of nursing programs increase, the number of nursing programs seeking clinic space for the student's hands-on clinical experiences at each facility also increases. The more updated nursing programs have Human Patient Simulation (HPS) labs with access to an EHRS. This allows students an opportunity to practice patient care and electronic documentation, in a safe environment. This may help with development of the student's critical thinking and decision-making skills (Kaddoura, 2010). Early access to an EHRS in both the classroom and simulation lab settings to facilitate a student's learning is important for preparing them for the workforce.

This study looks to determine if students who use electronic documentation have the same level critical thinking as those using paper-based documentation. If there proves to be a significant negative impact on development of critical thinking skills, it could change the current path of nursing programs seeking to transition from paper-based documentation to an EHRS. If the results indicate no significant impact on the development of critical thinking skills with the use of electronic documentation, the nurse educator may want to revisit the curriculum and

consider introducing electronic documentation earlier and provide frequent use of the system to better prepared students to enter the workforce.

Theoretical Framework

The complex concept of critical thinking can be difficult to understand. Nurse educators must continuous assessment the students' critical thinking skills. Assessment of these skills is often done by direct observation and evaluation of documentation. The theoretical framework incorporated in this study is the Paul & Elder (2009) model of critical thinking (Figure 1), Benjamin Bloom's theory of learning domains (Figure 2) and the nursing process (Figure 3).

The Paul & Elder (2009) model of critical thinking has three elements leading to well-developed critical thinking skills. This model believes critical thinking begins with an element of reasoning or parts of our thoughts. This part of the model indicates the process of critical thinking starts with a purpose, a question, a problem to solve, an assumption, or a point of view (Paul & Elder, 2009). The reasoning process may be based on data, information or evidence collected which may be expressed and shaped by concepts and ideas. These elements of reasoning can only be applied if the person has the ability to ask questions based on intellectual standards which included nine factors used to evaluate ideas or thoughts. In other words, they must be able to ask the right questions for clarity, accuracy, precision, relevance, depth, breadth, logic, significance and fairness in order to evaluate elements of reasoning. Critical thinking develops with the application of reasoning and validation of intellectual standards which is based on development of intellectual traits. The Paul & Elder model is not a linear process, intellectual traits are developed individually and over time.

Paul & Elder (2009) developed their critical thinking concept model by introducing it to the students in their classrooms. They wanted students to develop stronger reasoning skills systematically through the elements of reasoning, intellectual traits, and standards. This model points out two aspects of critical thinking needed to accomplish a higher level of critical thinking. The idea was, to reach this higher level of thinking you must understand each of the three parts making up the model. Paul & Elder state, "Critical thinking is that mode of thinking about any subject, content, or problem in which the thinker improves the quality of his or her thinking by skillfully taking charge of the structures inherent in thinking and imposing intellectual standards upon them" (p. 126).

Paul & Elder (2009) supports the idea that the student's critical thinking skills develop over time. The student must develop intellectual standards by asking the right questions for clarification and by obtaining relevant and significant information before they can move to applying reasoning skills. These elements of reasoning allow one to work toward developing intellectual traits. As the nursing students cycle through the Paul & Elder model multiple times, their critical thinking skills develop and their clinical reasoning becomes sharper (Figure 1). Nursing students become more confident and enjoy more autonomy as they develop better critical thinking skills.

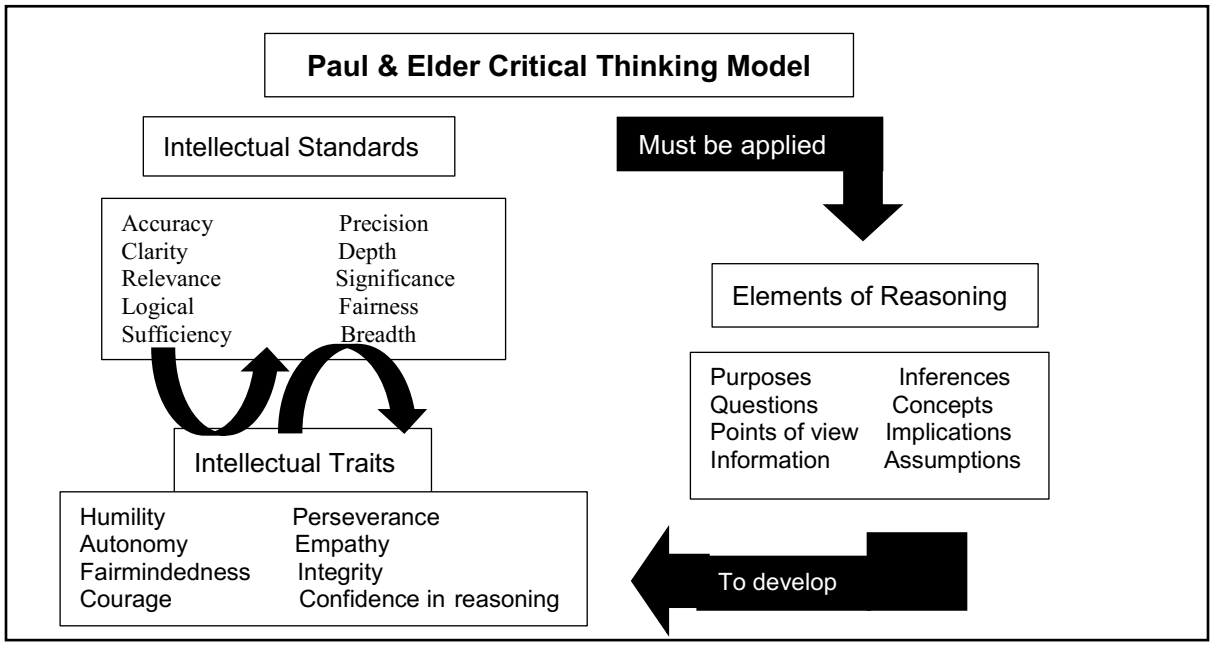

Figure 1 Paul & Elder Critical Thinking Model (Paul & Elder, 2009)

Bloom's taxonomy is a framework developed by Benjamin Bloom and his collaborators to represent the three domains of learning (Bloom, et. al, 1984). These domains consist of Cognitive (thinking), Affective (feeling), and Psychomotor (physical skills) with the cognitive domain often used by nursing faculty to help students in the development of critical thinking skills (Figure 2). The cognitive learning domains corresponding to mental skills consist of six levels arranged in order of increasing cognition at a higher level of thinking (Su & Osisek, 2011). Students obtain a higher level of thinking as they move toward the top of the pyramid. Bloom's original theory is still used in many nursing programs today (Su & Osisek, 2011). In 2001 a student who studied with Bloom, Lorin Anderson, worked with Blooms' partner David Krathwohl to revise the theory (Anderson, Krathwohl, & Bloom, 2001).

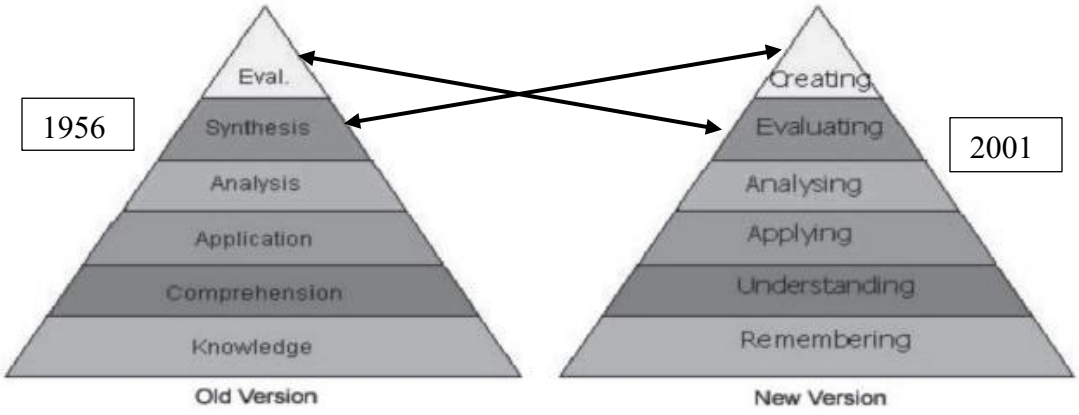

Figure 2 Bloom's Taxonomy & Krathwohl's revised model (Anderson, Krathwohl, & Bloom, 2001).

Nursing programs may still use the nursing process to help student develop critical thinking skills. The five-step process is the framework for thinking through problems and helps to organize the student's critical thinking skills. The steps include (a) assessment; (b) diagnosing (c) planning; (d) implementation; and (e) evaluation. The process is depicted in figure 3. The nursing process correlates very well with Bloom's levels leading to a higher level of critical thinking. Bloom's taxonomy begins with gaining knowledge. In this model, the decision-making process is the nursing or scientific process.

The nursing process is based on a theory developed by Ida Jean Orlando (Alligood, 2014). The first phase of the nursing process is the assessment phase, where the nurse gathers information about the patient. The nursing process correlates well with both Bloom's knowledge level and Paul & Elder's intellectual standard where the students ask questions to gain insight. The diagnosis phase allows the student to put together information gathered to make an educated judgment on the actual or potential health problem of the patient. The diagnosis phase works well at the comprehension level where students interpret facts they have learned. Planning is the third phase of Orlando's nursing process; the nursing student must plan for correcting the

problem (Alligood, 2014). While analysis and synthesis come after application in Bloom's taxonomy, the nursing student must analyze and synthesize during the diagnostic and planning phases of the nursing process. The implementation phase is where nursing students implement their plan. The nursing process's implementation phase is similar to Bloom's application level where the student applies or uses the knowledge they have gained. The student, using Bloom's theory, is asked to go beyond knowledge to analyze and synthesize the problem to come up with a theory or predict an outcome. Evaluation is the final phase of both the nursing process and Bloom's taxonomy.

Critical thinking requires the ability to recognize a problem. The nurse must use his/her clinical reasoning to think through possible solutions to the problem and gather evidence to support the solution while evaluating possible alternatives (Jeong, 2015). Building on the fact, she/he must make important clinical decisions and be able to communicate to others on his/her team and implement a solution all within minutes if not seconds (Jeong, 2015).

The nursing process is often used to start the development of student critical thinking skills. Paper-based documentation has supported the nursing process in development of these skills for years (Jeong, 2015). The use of the nursing process as a teaching method for paper-based documentation allows the student to assess the patient, develop a nursing diagnosis, plan and implement treatment of the problem, and later to evaluate whether the problem was resolved. The development of these skills may be impacted by technology in the form of EHRS, since the informatics of the System are formatted differently, making it more difficult for nursing students to analyze and synthesize data in an organized manner.

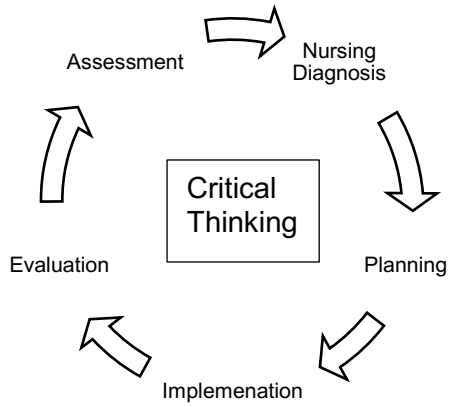

Figure 3 Nursing Process for Development of Critical Thinking (Bulson & Bulson, 2011)

Summary of Methodology

This study utilizes a causal-comparative design of research to find a relationship between documentation teaching methods and critical thinking scores of Associate degree nursing students. Health Education System, Inc. (HESI) is an exam used by many nursing programs to assess student competencies and evaluate achievement of curricular outcomes including critical thinking skills. The instrument for this study is the HESI critical thinking exam which is part of the student's program on the fundamental specialty exam and exit exam. A nurse can have strong critical thinking skills but not be able to apply the skill to problem-solving and make clinical decisions. The HESI fundamental exam with Clinical Judgement and Clinical Reasoning and Critical Thinking areas was administered to Associate Degree registered nurse students upon completing fundamentals and again before exiting the program. This study used archived HESI exam data from four associate degree nursing programs, one in Alabama, one in Georgia and two in Florida. The four participating programs of nursing fell in one of two categories; the programs taught students to document with paper-based forms or taught with electronic documentation.

Study Limitations

The major limitation of this study was the fact there is no definitive instrument to measure critical thinking skills. This study chose to measure the critical thinking skills based on the type of documentation taught in nursing programs. It used the student's critical thinking portion of the HESI test from two exams, the fundamental end of term exam and the pre-graduation exit exam. The sample size was a limitation of this study based on the number of associate degree nursing programs in the tri-state area qualified to participate in the study. In an effort to overcome this limitation, the four nursing programs qualifying were also chosen based on similarities of each program's admission criteria, curriculum and type of documentation taught.

The four programs meeting all qualification had small student groups, so the study used several cohorts from each program. There is no manipulation of the HESI scores during the collection of the data. One limitation of this study is it used retrospective data and the researcher must depend on the recordkeeping of someone else. The researcher did not have access to individual student information other than exam scores from the HESI's fundamental and exit exams. Other limitations in this study included the absence of data from other variables which may impact the student's critical thinking skills such as the student's GPA, experience with EHRS, and past medical related experience. These variables were not available at the time the data was gathered. This study may also be limited by the fact that students develop critical thinking over time and at a different pace. So, at graduation each student's critical thinking skills may be at different level of higher thinking.

Definition of Terms

The following definitions of the terms are for the convenience of the reader in the context of this study. Some terms have multiple definitions, and some terms in nursing such as the terms clinical judgment, problem-solving, decision making, and critical thinking tend to be used interchangeably (Tanner, 2006).

Charting by Exception (CBE). A method of charting designed to minimize time making notes; notes are documented only if there is a deviation from a patient's baseline or expected outcome (Murphy, 2003).

Clinical Decision Making. A process involving the collection of data and analysis of the patient's information to make a judgment regarding what intervention to implement and when to implement (Goldberg, 2015).

Clinical Judgement. A part of critical thinking development that involves identifying, prioritizing, and continuously evaluating complicated, rapidly changing patient problems and solutions (Kossman, Bonne, Kim, 2013).

Clinical Reasoning. A process used by healthcare professionals begin to recognize a problem, collect information about the problem, develop a plan a resolve to the problem, implement a plan, and evaluate to see if the intervention worked to resolve the problem, if not they must revise the plan (Hopkins, 2007).

Critical thinking. The ability to engage in reasoned discourse with intellectual standards such as clarity, accuracy, precision, and logic, and to use analytic skills with a fundamental value orientation that emphasizes intellectual humility, intellectual integrity, and fair-mindedness (Dowden, 2002).

Electronic Health Record System (EHRS). A computerized system used in healthcare facilities which allow providers to track data over time, identify patients who are due for preventive visits and screenings, monitor how patients measure up to certain parameters and improve the overall quality of care in practice (Trotter & Uhlman, 2011).

Health Education System, Inc. (HESI). A company which provides exams and study materials to help prepare the nursing student for their professional licensure exam (Zweighaft, 2013).

Human Patient Simulation Labs (HPS). Mannequins which resemble and respond like a living person. This environment offers the student the opportunity to use high fidelity technology and clinical based scenarios to learn to communicate with each other, patients and families, develop team building skills, and apply hands-on care in a safe environment (Alinier, Hunt, & Gordon, 2004).

National Council Licensure Examination (NCLEX). A nationwide examination for the licensing of nurses in the United States since 1994 and Canada since 2015 ("NCLEX & Other Exams," 2018).

Nursing Informatics. Nursing informatics is a specialty which integrates nursing science, computer science and information science to manage and communicate data, information, and knowledge in nursing practice (Anderson, 2011).

Nursing Process. A scientific-problem solving model using the steps of assessment, nursing diagnosis or problem identification, planning, implementation, and evaluation in a step-by-step process to plan care for patients (Yildirim & Ozkahraman, 2011).

Summary

This chapter presents an introduction, purpose, and significance of the problem and includes the theoretical framework and definition of terms for a better understanding of this study. The nursing process is taught early in the nursing curriculum and has served as the basis for the development of critical thinking skills. Critical thinking skills development in nursing is the foundation for learning to communicate, problem solve, and use clinical judgment in practice. The transition to EHRS documentation may have an impact on the development of critical thinking and clinical reasoning for good clinical decision-making in newly graduated nurses. Nursing is a high stakes career with a frequent need for high stake decision to be made.

Chapter two is the review of literature related to electronic health records, healthcare facilities' experiences with EHRS, nursing faculty and programs' experiences with EHRS, students' experiences with EHRS, and critical thinking and clinical decision making.

Chapter three describes the methodology and how the study was mapped out. It discusses the selected participants and how the data was collected and managed. This chapter addresses the validity and reliability of the HESI critical thinking on the fundamental and exit exams. It will identify some indicators which may threaten the validity and reliability of the study including internal and external factors. This chapter discusses sample sets, data collection, and analysis procedures.

Chapter four presents the results of the study including the result related to the three research questions. Chapter five is a summary and a discussion of the conclusions from the study. Also are discussed recommendations for further research.

CHAPTER II

REVIEW OF LITERATURE

Introduction

Technology is changing rapidly in the nursing field. The most recent change in nursing is the use of Electronic-Based documentation of patient care. Paper documentation has come to an end in almost all healthcare facilities (Hsiao, Hing, & Ashman, 2014). There are nursing programs that have not made the change to an EHRS in their curriculum. The goal to make this change would be to help prepare nursing students for use of the EHRS in practice. This study investigated the influence the transition to EHRS had on critical thinking scores of students graduating from programs using only electronic documentation. The keywords used in this search were electronic health records system, critical thinking, nursing curriculum, associate nursing, nursing, clinical reasoning, decision-making, and human patient simulation labs.

There were few studies located relate to the development of critical thinking of nursing students after the transition to EHRS in the nursing curriculum. The review of literature focused on how the EHRS transition impacts nursing, healthcare facilities, nursing faculty, nursing students and the development of critical thinking and clinical decision-making skills.

Electronic Health Record System

Over the past thirty years, technology has become a large part of nursing. The technology has advanced, from large electronic machine on a pole to deliver a precise dose of intravenous fluid to a small hand-held device to scan information on a patient's band to help decrease medication errors (Carayon, Wetterneck, Hundt, Ozkaynak, DeSilvey, Ludwig, & Rough, 2007). The most recent advancement in nursing technology was moving from paper

documentation in a patient's chart to electronic documentation taking place at the bedside. In the 1980s paper documentation in nursing was minimized by charting by exception (CBE). The idea behind CBE was for the nurse to spend more time with the patient and less time with paperwork (Murphy, 2003). The CBE charting was a check list for assessment information. The nurse preforming a patent assessment would check within normal limits (WNL) for each normal assessed area. The nurse would use the same checklist throughout the shift and most patients were reassessed every 2 hours for changes. The nurse made additional notes if there were changes in a patient's baseline condition, if expected outcomes was not met, and for procedures performed (Murphy, 2003). CBE documentation was completed at the bedside and later placed in the patient's paper chart. The EHRS was formatted much like the old CBE paper charting with a checklist and added notes when needed.

EHRS documentation is not a new concept to healthcare. The implementation of EHRS into medical facilities began in many agencies over the last two decades (Chan, Fowles, Weiner, 2010). The use of EHRS was limited to academic medical facilities in the United States (U.S.) since the 1960s (Atherton, 2011). The first electronic health record system was developed around 1972. This system was costly and initially only used by government hospitals. The systems were large and required a main frame. As personal computers became more affordable and the internet emerged in the 1990's, the Institute of Medicine started making a case for physician's offices to implement the use of computers for better patient care (Atherton, 2011). Technology did not move as fast as expected; slowing the move to EHRS for many medical facilities. This led to the Institute working on a variety of recommendations to achieve the goal to move toward medical records being stored on computers. When the technology did catch up the rate of adoption remained slow, partially due to the cost of the system and partially the cost

of converting to a new method. The goal to increase the use of EHRS in healthcare facilities and improve patient care added new laws to protect patient information through added clauses in HIPAA standards. The Institute of Medicine meetings continued to focus on emerging of EHRS and the rules and regulations surrounding patient privacy and confidentiality (EMR: "The Progress to 100% Electronic Medical Records," 2018). This led to the introduction of the 1996 Health Insurance Portability and Accountability Act (HIPAA) (Chaikind, 2004).

President George W. Bush (2004) mandated all medical facilities adopt an approved EHRS and implement the system by 2014. The facilities not in compliance with Meaningful Use guidelines would not receive reimbursement from Medicaid and Medicare. The mandate was a multi-year project introduced in multiple phases. The final phase began in 2016 with meeting complete compliance by 2018. During this final phase, facilites were encouraged to adpot an EHRS. Meaningful Use was designed to encourage as many healthcare facilities as possible to participate early in the program. Only those meeting Meaningful Use criteria would be eligible for reimbursement from Medicare and Medicaid and avoid any penalties. This mandate became overwhelming for many physicians and hospitals as they attempted to meet all the criteria associated with the mandate (Curry, 2010). Studies of EHRS implementation and utilization reveal a 50% failure rate among organizations and institutions which attempted to adopt and sustain EHRS (O'Harrow, 2009). This led to federal legislation in 2015 to established ways to pay physicians caring for Medicare patients and included funding for technical assistance for providers along with data sharing (MACRA: MIPS & APMs, 2018). As of 2015, the percentage of physician offices who had adopted EHRS was up to 77.9% (Jomoom, & Yang, 2016).

Healthcare Facility Experiences with EHRS Documentation

Physicians and hospital administrators understood the impact technology could have on improving patient care (Gardner & Jones, 2012). Even with the problems of implementation, hundreds of thousands of hospitals and physician offices in the United States have implemented an EHRS (Gardner & Jones, 2012). Mostashari (2013) updated the U.S. Senate Committee on Finance on May 2013 regarding the progress toward meeting the Meaningful Use criteria and adoption of EHRS. This report stated more than 220,000 physicians and over 3,000 hospitals met the requirements outlined in Stage 1 of the initiative. The U.S. Senate reported that tens of thousands of physician offices, clinics, and hospitals have qualified for the Medicaid incentive payments under the Meaningful Use Initiative. They all are in different stages of adopting an EHRS. These facilities are in addition to almost 300,000 healthcare facilities already qualified to receive incentive payments over the next 12 months (Mostashari, 2013).

Federal laws and policies regarding the security of patient health information protect the records stored as electronic documents. The medical facilities are ultimately responsible for following all laws and policies to protect trillions of EHRS. Hospital and physicians' offices must use caution when allowing students access to patient records for many reasons. The Health Insurance Portability and Accountability Act of 1996 set standards for security of patient records on paper and electronic formats (Chaikind, 2004).

The security standards, the cost of equipment, training, and implementation are all taken into consideration when adopting electronic documentation (Harman, Flite, & Bond, 2012). Medical facility which allow clinical rotations by student have an added expense for training and providing them with secure access to the facilities EHRS. These facilities must weigh risk and cost of student access. This added security decreases access for nursing students to patient's

medical records (Harman, et al. 2012). Facilities often will only allow minimum access or student access only through the instructor working with the student.

The change to EHRS in healthcare has greatly influenced healthcare at all levels including nursing, physicians, healthcare facilities, nurse educators and student nurses (Trotter & Uhlman, 2011). The adoption of EHRS has created a gap in student documentation. Nursing programs have no guidance for the adoption or implementation of an EHRS. The gap can mean nursing students may not have access to the EHRS during their program due to a lack of funding or time it takes for nursing curriculum changes to include an EHRS. There are nursing graduates starting new positions and never had adequate training on an EHRS. The hiring facility have added responsibility and cost for training the new graduates nurse to document using an EHRS.

Nurse Faculty and Program Experiences with EHRS

The use of high-tech technology in nursing programs has increased over the past decade. Nursing programs struggle to meet the demands for more technology in the classroom and clinical settings including high cost Human Simulation Labs and Electronic Health Record System.

The transition from paper-based documentation to EHRS has not been an easy transition, especially for the nurse educator (Miller, Stimely, Matheny, Pope, McAtee, & Miller, 2014). Nursing programs were not part of President Bush's overall plan. Nursing programs, in conjunction with boards of nursing, have assessed, planned, and begun working toward changing and implementing curriculum to meet the needs of the nursing workforce. Many nursing programs have spent hundreds of thousands of dollars in recent years for state-of-the-art equipment in their simulation labs (Frick, Swoboda, Mansukhani, & Jeffries, 2014).

According to Waxman (2010), the use of simulation manikins has increased substantially in recent years as clinical space is limited. Unfortunately, most HPS labs do not have an EHRS. "There are no reported studies on the use of electronic health records in simulation labs in nursing education" (Zhang, Ura, & Kaplan, 2014). HPS labs with ERHS would provide nursing students an opportunity to care for the mock patient and multiple opportunities to use electronic documentation. There has been a delay in adding these systems to the HSP labs due to the cost of equipment/software, the need for additional faculty, and faculty resistance to the changes (Curry, 2010). A study by Frick et al. (2014) illustrated the costs of integrating HPS labs into a curriculum and includes faculty's time for simulation development and setup; staff's time for simulation development and setup; and both faculty and staff time to run, debrief and evaluate the simulation. The HPS lab allows students to simulate patient care before entering their clinical rotations to care for real patients. The entire simulation experience has proven to be beneficial for allowing the student to plan care, provide hands-on care and make critical decisions during the experience (Cassio, Giessen, Araya, Perez-Cotapos, Vergara, Manca, & Holmberg, 2012). The integration of EHRS into nursing education curricula is often dependent on the faculty members' experiences with the new technology and costs (Curry, 2010).

Nursing faculty played a vital role in the advancement and use of the EHRS. As the medical facilities began implementation, faculty failed to support the transition due to lack of knowledge regarding nursing informatics (Yedidia, 2014). Nursing programs continued to have a wide range of concerns stemming from budgets to clinical access to faculty shortages. According to the American Association of Colleges of Nursing (2015), the shortage of faculty continues to increase because the average age of master's prepared faculty is 55 and the average age of doctoral prepared nursing faculty is 56.8 years. The average age of retirement is 62.5

years (Hartman, 2015). The aging population of nursing faculty hinders the move to EHRS even more. Faculty members are uncomfortable trying to learn new technology, which pushed some into early retirement (Sensmeier, 2015). Filling vacant nursing faculty positions has not been easy due to budget restrictions and increasing job competition.

Faculty concerns include the current lack of clinical space, incorporating an EHRS into the curriculum, and how these changes might affect the student learning outcomes (American Association of Colleges of Nursing, 2015). Nursing programs realize that limited exposure to EHRS software may impact student's understanding of the EHRS when entering practice.

The nursing programs delayed implementation of EHRS in classes and lab settings due to faculty onboarding, budget restrictions, limited access to EHRS and clinical space (Mahon, et al. 2010). Nursing programs review and implement EHRS as the budget allowed. Mahon, et al. (2010) explored nursing faculty perceptions of teaching undergraduate nursing student's documentation skills using paper-based and EHRS. Their findings indicated ways faculty have attempted to overcome these obstacles encountered during the implementation process: time expenditures and constraints, lack of access to secure patient's charts in an EHRS and an insufficient number of computers available. The top complaint heard in clinical and hospitals setting after implementation of the EHRS was the lack of computer access (Kowitlawakul, Chan, Wang and Wang, 2014).

Mahon, et al. (2010) researched faculty perceptions of student documentation skills during the transition to EHRS software. The results indicated faculty was not comfortable with electronic documentation, only instructors had a password to access the EHRS, and all clinic students had to use the instructor's code. The faculty felt they spent more time at the clinical site checking, teaching and signing off student documentation. They found endless drop-down

menus on the EHRS were annoying, taking too much time and not promoting critical thinking (Mahon, et al. 2010).

Kowitlawakul, et al. (2014) reviewed the perceptions of the faculty implementing EHRS in the nursing labs and found mixed results. The nurse faculty role was to advance the use of the EHRS by exposing students to electronic documentation in classrooms and HPS lab activities. The researcher identified the areas of importance for the development of critical thinking skills were innovation, transition, and integration (Kowitlawakul, et al., 2014) Regarding innovation, one faculty member stated, "I doubt it is useful for them … It makes me feel lousy because I have to ask students to do it when I am not convinced myself … It is pretty hard" (Kowitlawakul, et al. 2014, p. 502). Regarding transitioning from paper-based documentation to an EHRS faculty stated, "It allows me to train the students … you know in the current healthcare industry we are using electronic health records" (Kowitlawakul, et al, 2014, p. 503).

There are many commercial based EHRS developed for medical facilities compared to few EHRS available to meet the needs of nursing programs. Some companies have tried to modify commercial system to meet academic needs but often do not fill the needs of academia (Bartholomew, 2011). The commercial ERHS may impact the teaching, learning, and critical thinking process in nursing education. Jeffries (2005) suggested nurse educators must be more creative when implementing an EHRS. Faculty should develop new innovative models of teaching. The design often used by faculty is to provide electronic documentation in classrooms or simulation labs by assigning students a patient case built into the current HPS lab software. This system allows students to collect information on the simulated patient, analyze the patient information, and document findings. The difference in doing this with EHRS compared to paper-based documentation is the students have a difficult time connecting urgent clinical

information such as a complete understanding of a health problem and the treatment (Whitt, Eden, Merrill, & Hughes, 2017)

The concerns of the faculty are the time and expense it takes to learn and integrate and EHRS into the HSP lab (Kowitlawakul et al, 2014). Other concerns include a lack of a user-friendly EHRS integration into the nursing students' curriculum, new nurses entering the workforce with no EHRS experience and the possible creation of a learning gap for development of critical thinking skills and understanding of informatics in nursing.

Student Experiences with EHRS

Fetter (2009) investigated computer technology use in schools of nursing and found minimal health information technology competency among students and faculty. Alternately, nursing students found using a training EHRS an effective tool to support nursing knowledge, critical thinking, and skill development (Fetter, 2009). Student users believed a hands-on approach enabled them to understand how to apply theoretical knowledge in the classroom and in real patient case scenarios (Leighton, 2009). This knowledge includes the development of critical thinking skills, understanding all aspects of documentation and the disease process in application to electronic documentation, not just the informatics of point and click.

Leighton (2009) performed a study in a simulation lab with students using a patient-center simulator. The study reviewed the development, implementation and evaluation of EHRS and how student use their care skills in management of disease. The twelve students participating in the study were more advanced than other students not using simulation. The students used an EHRS to review the patient's health and physical information. The student had to provide care skills learning in their courses to develop a care plan and document in the EHRS their assessments, plan, medications, monitoring recommendations and follow-up plan. It was

interesting to see the student had to utilize all levels of Bloom's Taxonomy when documenting in the ERHS. The study used a pre-course and post-course survey to assess the student's perceptions of the knowledge gained with use of the EHRS. The study used Wilcoxon, Mann-Whitney U test and ANCOVA for data analysis of the pre-course data with a 5% significance level. The post-course data was analyzed using F-Test statistics and the Kruskal-Wallis test with a 0.05 significance level. This analysis was used to show the overall value of this simulation activity based on the student's perception of their learning. The overall results of using simulation for ERHS documentation and learning improved students' skills in providing patient-centered care.

Students see the EHRS from a different perspective. Baillie, et al. (2012) reviewed what perceived benefits the EHRS had in the delivery of care and what concerns arise related to practical and logistical issues among nursing students. The authors reported two themes, benefits and concerns, and subthemes. The association of the benefits in the use of the EHRS is in the first group of sub-themes. The top benefit was being able to provide better availability and quality of records including legibility, clarity, and accuracy.

The second sub-theme was related to the practical and logistical use of an EHRS. Students identified several issues with use of an EHRS: all healthcare providers have different system, the location of computers was often inconvenient, computers often "go down" and too few computers were available for use (Baillie et al., 2012). Another sub-theme found students had difficulty adjusting to the EHRS due to fear of breaching secured data. Students felt EHRS increased workloads and increased stress.

Bartholomew (2011) found students felt that they lacked training for ERHS but had moderate to high levels of confidence in their computer skills. In this study Bartholomew found

sixty percent of students indicated computer access in clinical placement was limited, and access to online clinical decision support tools to enhance understanding of patient care plans caused a learning barrier. The findings indicate that students need more access to learn electronic documentation used in the work environment while still being able to learn the critical thinking components of documentation.

Jones and Donelle (2011) employed a usability assessment study to explore undergraduate nursing students' knowledge and skill. This study used patient case scenarios to inform and develop informatics-based learning the undergraduate nursing curriculum. Integration of an EHRS into the nursing curriculum allowed students the much-needed hands-on experience which has potential to the enhance understanding and skill of the nursing processes, documentation, and critical thinking (Jones & Donelle, 20011). The faculty can guide teaching and learning strategies toward rising expectations for competency with health information technology.

The Jones and Donelle (2011) study found EHRS allowed students to navigate with little effort, locate patient information more easily, and document during patient interviews. The use of a smart device at the bedside created issues such as problems with access to web link documents, bulky devices, and discomfort navigating the device in front of the patients. The usability assessment was a good way to identify students' weaknesses with the EHRS. The problem is that current ERHS do not meet the needs of educating nursing students in the development of critical thinking skills (Jones & Donelle, 2011).

As technology in nursing is moving quickly, faculty and students will have to become more comfortable with informatics. The cost of technology to nursing programs is very high, and the HPS labs and EHRS will have to become an everyday part of the nursing student's

experience. This study could determine if this transition to EHRS will have an impact on the student's critical thinking and clinical decision-making skills.

Critical Thinking and Clinical Decision Making

The accreditation bodies, such as The Commission on Collegiate Nursing Education and The Accreditation Commission for Education in Nursing, have identified critical thinking to be an essential skill that should be included in the core competencies of nursing curriculum (National League for Nursing, 2005). As nursing students move toward graduation, there should be a progressive improvement in their critical thinking skills. Critical thinking skills are needed to have the student perform as highly skilled problem solvers (Latif, Mohamed, Dahlan, & Zarawi Mat Nor, 2016).

Critical thinking is a required component in making critical decisions in nursing care. Clinical reasoning in decision-making is an essential part of safe patient care (American Association of Colleges of Nursing, 2015). Critical thinking often does not come naturally to nursing students. To become a professional nurse requires learning to "think like a nurse" (Paul & Elder, 2009). Benner, et al. (2008) theory stated that learning to think critically requires a nursing student to learn nursing content, concepts, and theory. Building on the concepts and theory allows student nurses to develop critical thinking skills and clinical reasoning skills as a natural progression toward good clinical-decision making (Benner, et al. 2008). Nursing faculty has to ensure curriculum strategies help with the development of critical thinking skills while using EHRS documentation.

Teaching the basic principles of documentation is placed early in the nursing curriculum. The critical think skills development occurs during instruction of the nursing process and legal documentation (Chabeli, 2007). As the baby-boomers age, patients have higher acuities;

complex illnesses require a higher-order of thinking skills in nursing (Benner, et al. 2008). Educators should cultivate and encourage students to be independent thinkers. They must involve students in intellectual thinking to inspire curiosity and deeper investigation into problems (Benner, et al. 2008). Students need to develop humility, empathy, integrity, perseverance, and fair-mindedness as independent thinkers. Research indicates that many new nurses are not capable of meeting the essential clinical judgment skills expected at the entry-level (Del Bueno, 2006).

Teaching, developing, and encouraging critical thinking skills are as much a part of nursing as physical assessment skills (Popil, 2011). Many teaching methods used over the years to teach and assess critical thinking in nursing students were successful. Teaching strategies often studied for best practices in teaching critical thinking skills. There is no firm definition of critical thinking, but most agree critical thinking takes knowledge, skill, and attitude (Yildirim & Ozkahraman, 2011).

The nursing process is the oldest method of teaching critical thinking, and it is still used in nursing today. The nursing process has many different meanings but is described as a linear process using the four steps of assessment, planning, intervention, and evaluation (Yildirim & Ozkahraman, 2011). A recent method is the HPS labs which use case studies to facilitate and promote clinical problem solving and encourage students to develop critical thinking skills (Popil, 2011).

In one study, student satisfaction with nursing and academic level played a part in critical thinking disposition of Korean nursing students (Kim, Moon, Kim, Kim, & Lee, 2014). The study measured critical thinking dispositions; there was a significant relationship with students' academic level. Scores increased though their junior year, and significantly decrease in

the senior year. The research points to a relationship between student's satisfaction with nursing and higher levels of critical thinking. They concluded that new teaching methods should be included in the curriculum such as problem-based learning, simulation, and concept mapping, to help increase students' aptitude and satisfaction.

A study by Mahmoud Kaddoura in 2010 explored new graduate nurses' perceptions regarding what factors in clinical simulation promoted their critical thinking, learning, and confidence. The study had a small sample of 10 participating new nurses from large hospital's Intensive Care Unit. The results indicate the participants felt simulation was beneficial in helping to develop critical thinking skills in a non-threatening environment. They were able to receive immediate feedback which helped to identify gaps in knowledge. Debriefing helps them to reflect and learn from both their experience and others to reflect on what was and was not effective. The new nurses felt the clinical simulation experience increased their confidence, promoted teamwork and helped them to develop critical thinking skills and improve learning outcomes (Kaddoura, 2010).

One study closely related to the purpose of the current study explored the critical thinking needs of both the new nurse (<1 year) and the experienced nurse (>1 year). Fero, Witsberger, Wesmiller, Zullo, & Hoffman, (2009) used the Performance Based Development System (PBDS) with BSN, ADN, and diploma nurses. The PBDS assessed six critical thinking categories: recognizes problems; reports essential clinical data; initiates independent nursing interventions; differentiates urgency; anticipates relevant medication orders; and provides relevant rationale to support decisions (Fero et al., 2009). The goal of the study was to improve patient safety. Overall a fourth of the nurses in the study had problems with assessing changes in patient's

condition, thinking independently to develop an intervention, anticipating what orders would be, and being able to prioritize the care (Fero et al., 2009).

To put the results into perspective, the newly graduated associate degree nurses have learning needs associated with the ability to make appropriate decisions based on critical thinking skills (Fero et al., 2009). Of all associate prepared nurses in the study, 43.9% did not meet expectation in the six critical thinking categories (Fero et al., 2009). The percentage of nurses not meeting expectation in the six critical thinking categories with less than one year of experience was 31% (Fero et al., 2009). The most common deficit in critical thinking for the new nurses was to initiate independent nursing interventions.

Summary

This review of the literature explored the relationship between the nursing student's critical thinking skills before entering into practice, and how the nurse was taught documentation, either with an EHRS or paper-based documentation. The evidence from the literature review provided a well-rounded view of the EHRS use in healthcare, the perspectives of nursing faculty, nurses and students and the development of critical thinking and decision-making. Nursing faculty has been strategizing for years to help improve the development of critical thinking and clinical decision-making. There was no prior research located regarding the impact of the transition from paper-based documentation to electronic documentation. The review of the literature does support the transition to use of the EHRS has been difficult for all healthcare providers.

The literature has shown a strong link between paper-based documentation and the teaching of critical thinking within nursing. The nursing process has been used for years in teaching legal documentation and the development of critical thinking. The paper charting and

forms used to teach documentation and the nursing process have been very helpful in students' development of critical thinking. Of course, there may be no significant impact on the student's willingness to apply critical thinking in practice for students those who have not transitioned to an EHRS in nursing school but only had access to an EHRS in clinical settings. Other variables could have an impact such the age of the nursing student.

Due to the lack of previous studies, the study designed causal-comparative research was the best type of research. This design allows for the collection of data providing an analytical snapshot of any impact and the prevalence of the impact (Causal-comparative Research, 2015). A strength of this design is it may be used to determine if there is a relationship between critical thinking skills in the existing students and the type of documentation taught.

CHAPTER III

METHODOLOGY

Introduction

This chapter outlines the research strategy and the approach to data collection. It describes the research design, participants, setting, instruments, procedural design, data collection and data analysis.

The purpose of this research was to investigate the influence different methods of documentation has on critical thinking skills of nursing students. The dependent variable in this study was the Clinical Judgement and Clinical Reasoning and Critical thinking exit exam scores of Associate Degree nursing students. The independent variable was the teaching method used to teach documentation, paper-based or electronic documentation. The study used both the exam given at the end of their fundamentals course and the exit exam given at the end of their program. Both exams assessed Clinical Judgement and Clinical Reasoning and Critical thinking. Therefore, the study reviews the fundamental exam scores (as a covariate) to see the effects the fundamental exam may have on exit exam scores.

This study had two groups, paper-based group (known as Group 1) and the EHRS group (known as Group 2). Both groups were given the same exams, the HESI Clinical Judgement, Clinical Reasoning and Critical thinking, at the end of fundamentals and again at the end of the nursing program. The Wilcoxon matched-pairs signed rank test was used to compare each group's fundamentals scores against their exit exam scores. The purpose was to determine if there was a significant difference between the exams which would indicate an improvement in the nursing student's critical thinking skills by the end of their program.

The Mann-Whitney U Test was performed to compare Group 1 against Group 2 fundamental exam scores. The groups exit exam scores were compared. The purpose was to determine if there was a significant difference between scores of students using paper-based documentation versus those using an EHRS based on their development of critical thinking indicated by an increase in exit scores.

The goal of this study was to answer the following research questions:

RQ 1. Is there a significant difference between the scores each student earned on his/her HEIS fundamental exam versus the exit exam for Clinical Judgement and Clinical Reasoning and Critical Thinking?

RQ 2. Is there a significant difference on the fundamental exam scores in Clinical Judgement, Clinical Reasoning and Critical thinking between students completing Fundamental of Nursing in programs teaching electronic documentation and those teaching paper-based documentation?

RQ 3. Is there a significant difference in the exit exam scores on the Clinical Judgement and Clinical Reasoning and Critical Thinking between groups graduating from programs teaching electronic documentation versus those teaching paper-based documentation after controlling for fundamentals exam scores?

Research Design

This study used a causal-comparative research design to explore the relationship between four different associate degree nursing programs. The scores were collected from the Clinical Judgement, Clinical Reasoning and Critical Thinking portion of the HESI exam on the fundamental and exit exams. There are three major sources of weakness presented in a causal-comparative research study, the lack of randomization, manipulation, or any type of control by

the researcher. One other weakness associated with this type of research is the results will indicate if a relationship exists but did not establish a causation.

Internal and External Validity

The most common internal validity threat with causal-comparative research is the possibility the groups are not equivalent on one or more important variables. The problem is there is a strong probability the groups differ in ways not included in this study. The available demographics were from each cohort/group versus individual student demographics. Demographic data such as age, race/ethnicity and gender were available by group but could not be matched to individual students. Internal validity for this study was threatened by uncontrollable variables regarding a student's past experiences including course work, healthcare experience, and use of any EHRS or paper documentation. All participants in this study had graduated from the program and never met with the researcher. The study comparisons of the groups' critical thinking skills may not be equivalent before entering nursing school which may be a threat to the validity of this study.

The threat of external validity could exist in this study due to the student being exposed to the type of exam questions on the fundamental exam and exit exam. External validity could be effected by the fact the students are aware they will be given the critical thinking exam at the end of their program. Instrument selection may reduce the threat of validity since all four programs used the same exams and scoring procedures. The loss of subjects for this study did not exist because all scores collected were from the records of students who had completed both exams and ultimately graduated from the program.

Sample

The search for participating colleges was conducted in six states including Kentucky, Tennessee, South Carolina, Alabama, Florida, and Georgia. The search for participating nursing programs was performed in four phases. The first phase was conducted to determine which colleges had Associate Degree Nursing Programs (ADN). The second phase was conducted to determine which colleges with ADN program used HESI testing. The third phase was to contact nursing programs inviting them to participate in the study by email. During this phase the possible participating colleges were provided detailed information about the study and invited to participate in a phone interview. The phone interview was to determine if the program met all study requirements. The admission requirements were reviewed to match the nursing programs as closely as possible. These requirements included overall admission GPAs, pre-entrance exam, number and types of core or prerequisites courses, and number of applicants selected into each program.

The letter was emailed to programs who appeared to meet the qualifications. These were sent to either the Dean, Chair, or Simulation Lab Coordinator of approximately 56 colleges with Associate Degree Nursing programs to participation to the study. The initial email (Appendix A) introduced the purpose of the study, how the study would work, and that participating nursing programs and students would remain anonymous. Approximately 20 nursing programs responded to the initial email with two of the nursing programs which accepted the invitation required processing through their Institutional Review Board. One college required a copy of the studies Collaborative Institutional Training Initiative program certificate for their Institutional Review Board committee. None of the participating colleges required informed consent. All other programs agreed to enter the study as volunteers. A research statement required by the

Valdosta IRB committee was emailed (Appendix B) to each participating college and each returned by email their agreement statement. The nursing programs who responded to the invitation agreed to provide more information by phone interview in order to match participating programs as closely as possible based on the program's admission criteria, program curriculum, and documentation teaching methods.

There were two main questions during their phone interview for the program to meet participation criteria.

1. What type of documentation is used in the program as the primary means of teaching documentation, paper-based or an electronic health record system? If an EHRS was used, the name of the system used and how is was used was included in the interview questions.

2. Did the program test critical thinking used the HESI Clinical Judgement, Clinical Decision making, and Critical thinking based on nursing concepts on both the fundamental end-of-course and exit exams?

In an effort to match the programs as closely as possible admission requirements were used and multiple admission questions were asked during the phone interview with a program faculty member. All participating programs used equal or equivalent admission criteria. All programs were 2-year programs completed in 5 semesters. The student must have an official high school diploma or GED and college/program transcripts, with a GPA of 2.5 or higher on all completed college-level coursework (including transfer/transient courses). All programs required them to complete a minimum number of prerequisites with a C or better including Anatomy and Physiology 1 and 2, prior to applying to the program. Each program accepted a limited number of students ranging from 30 to 50 per cohort meeting the admission requirements did not guarantee admission to the program. Each required a college placement test for

admission into the college and a nursing placement test such as the TEAS or HESI exam for entrance into the nursing program. All programs had the same minimum score requirements.

All participating programs started the development of critical thinking by teaching the nursing process using standardized paper-based documentation early in the fundamentals course. Two of the participating programs used an EHRS implemented SimChart (classroom and lab) and EPIC (clinical) documentation. The programs using the EHRS introduced the students to paper-based charting during their fundamentals course as part of a lesson introducing the nursing process. The students were introduced to SimCharting during this semester in simulation lab. They continued using SimCharting throughout the rest of the nursing curriculum in both the classroom and simulation labs. The EHRS called EPIC is used during clinical rotations at the local hospitals to document patient care. SimChart and EPIC documentation system are both provided by Evolve Elsevier, one is for academic use and the other for clinical use.

All programs administered the HESI fundamentals end-of-course exam which included the Clinical Judgement, Clinical Reasoning and Critical Thinking exam component. Each of the participating programs administer the HESI exit exam 4-6 weeks before the end of the program, which included the Clinical Judgement and Clinical Reasoning and Critical Thinking component.

Methods

The process began by searching for four Colleges with Associate Nursing Degree programs that used HESI exams and agreed to participate in this study. All the programs had to meet all search criteria. The study was then presented for approval and approved by the Valdosta State University Institutional Review Board (Appendix B) for the protection of the human research participants.

Data Collection and Management

The nursing programs participating in this study agreed to allow the researcher access to HESI exam scores for at least two previous graduating classes. The identification of participating nursing programs and students was held anonymous; only scores were reviewed and recorded. The four nursing programs are referred to in this study by letters A-D. The teaching method programs A and B was paper-based documentation from the beginning of the program. The primary teaching method for programs C and D was electronic health records for instruction in the classroom, simulation lab and clinical settings.

Data collection began by a planned visit to each of the four participating College's nursing programs. The researcher was given access to all graduates HESI scores for both the fundamentals specialty and exit exams during the visit to the campus. The data was placed on separate spreadsheets for each program.

Program A had a total of four cohorts graduating between 2015-2018 totaling 80 students. Program B had two cohorts graduating between 2017-2018 totaling 130 students. Program C had three cohorts graduating between 2017-2018 totaling 110 students. Program D had two cohort graduating between 2017-2018 totaling 93 students. Programs C and D both used electronic health record system called SimChart for all student documentation in class, labs and Epic for clinical documentation starting the last 6 weeks of fundamentals and throughout the program.

Instrumentation

The instrument used in this study was the HESI Clinical Judgement, Clinical Reasoning, and Critical Thinking portion of the exam. This instrument is used in both associate and bachelor's degree nursing programs throughout the U.S and other countries. Elsevier is the

publishing company which provides the HESI computerized exams and other educational materials for many nursing programs (Elsevier, n.d.).

The HESI fundamental specialty exam is used as a predictor of student success in a nursing program. The HESI exit exam is used as a predictor of student success on the student's first NCLEX-RN exam attempt. This exam is designed to match the latest NCLEX testing plan (Elsevier, n.d.). The results are often used by the nursing division to assess the effectiveness of the program's curriculum. HESI may also be used by the program directors as a faculty evaluation tool to assess strength and weaknesses (Elsevier, n.d.).

Approximately 98% of students who meet the program cut score will be successful in the nursing program or on the NCLEX exams, making the HESI a very reliable predictor of success (Elsevier, n.d.). The HESI exam with a score of 900 or better has a predictive validity of 98.4% for the student to pass the NCLEX licensing exam (Elsevier, n.d.). The cut scores can to be set by the individual nursing program though most programs follow the recommended guidelines from Elsevier to set at a minimum of 80%. The scores are leveled by possible success with a minimum cumulative score of 75% indicating the student will need more assistance, 80-89% indicates minimal assistance needed and 90% or higher indicated that the student will very likely do well in nursing school with little or no assistance (Elsevier, n.d.).

The fundamentals specialty exam is a one-hour computerized proctored exam which has different subcategories. The exam is given at the end of fundamentals which is the first nursing course in the nursing curriculum for all programs. The exam is between 50-100 questions depending on the program's request (Elsevier, n.d). The scores are provided in whole numbers 0-1500 with a conversion of scores to percentages on a scale 50-100% in increments of five points (Elsevier, n.d.). The HESI software automatically provides the scores. The conversion

chart was used to provide a percentage score which is the most common form of data. This changes the scores from a three-digit composite score to two-digit percentage score. This made preforming the statistical analysis more precise.

The scores collected for the purpose of this study were only the Clinical Reasoning, Clinical Judgement and Critical Thinking portion of the exams. The scores collect from both the fundamentals and exit exams were converted from a composite score to a percentage score using the HESI conversion table (Table 1).

Table 1 *HESI Conversion Scores*

HESI Score	<500	500-549	550-599	600-649	650-699	700-749	750-799	800-849	850-899	900-949	950-999	1000-1199	1200 & >
Percentage	50	55	60	65	70	75	80	84	87	90	93	96	100

The HESI exit exam consists of 150 multiple choices, multiple responses, fill in the blank, hot spots, charts and drag/drop questions using NCLEX question style writing (Elsevier, n.d.). The questions on the Clinical Judgement, Clinical Reasoning and Critical Thinking exam component of the HESI was used to measure students' knowledge of nursing content, abilities to critical think, apply clinical concepts and synthesis information for good clinical judgement and reasoning (Zweighaft, 2013).

The HESI exam is a computer-adaptive test much like the NCLEX licensure exam. Computer-adaptive tests are designed to adjust the level of difficulty based on the responses provided by the student. If the wrong answer is selected the computer follows up with an easier question; if the answer is correct, the next question will be more difficult. The focus of questions using computer-adaptive testing such as the HESI and NCLEX are leveled based on Bloom's

taxonomy from knowledge to evaluation (Mee & Hallenbeck, 2015, p. 494). The test items are individually weighted based on the difficulty or level of the question.

The framework by Crocker and Algina (2006) was used by HESI; it describes three principal types of scales or method to scoring. These are subject-centered, response-centered and stimulus-centered approaches to scoring. The HESI exit items are analyzed for reliability and calculated using the Crocker and Algina framework to identify elements of the exam framework using the observed score, true score, and error score (Morrison, Adamson, Nibert, & Hsia, 2008). Crocker and Algina (2006) reviewed scores by weighted responses using the index to weight all items equally.

The benchmark score most often used for HESI exams by nursing programs is between 850- 900. The programs participating in this study all have the cut score of 900. The predictive accuracy of the exit exam by HESI based on the ninth validity study is 96.61% which is still within the range of 83.36%- 99.016% for the previous eight validity studies (98.4%) (Zweighaft, 2013). There are more than 30 published peer-reviewed research articles which support the validity and reliability of 96.63%-99.16% accuracy of the HESI exam as a predictor of NCLEX-RN success (Elsevier, n.d.).

Data Analysis

SPSS software was used to analysis both descriptive and inferential statistical data on the exam scores. The data on the spreadsheets for all four participating programs were double checked for accuracy. The data on all spreadsheets, one per program, appeared to have no missing data and no unusual responses which could distort the study results.

The descriptive analysis was used to show patterns emerging from the data and presented this data in a more meaningful way. The descriptive data was not used to make conclusions

regarding data nor form a conclusion regarding any hypotheses. In this case, running the descriptive data allows us to determine if the data was normally distributed. Data which is not normally distributed has to be transformed in an attempt have normally distrusted data. The results included the mean of the scores on each exam. The measure of reliability was set at a 95% interval of confidence. The descriptive results also included the median, variance and standard deviation. The median was not used in reporting the descriptive results but rather the means was used as a measure of central tendency.

This study assessed both the fundamental exam and exit exam scores by group using descriptive data. Descriptive statistic assessments of the data were performed prior to statistical testing for assumptions of normality. One measure used was skewness to determine data symmetry. A perfect distribution of data would be a bell curve. This means the left and right of the distribution are a perfect mirror image of one another. The indication of symmetry or non-symmetrical data points helps to see if the data is equal on each side of the center point.

Like skewness, kurtosis is a measurement that is used to describe the distribution of data. Kurtosis tells us the height and sharpness of the peak of the distribution. The kurtosis measures normal distribution as being heavy-tailed or light-tailed. The high kurtosis indicates it is heavy-tailed, which tells us that the data is heavy with outliers thus the light tail indicated light on outliers. This study used the histogram to visually view the skewness and kurtosis of the data for normal distribution. The bar graphs were also used in the study as a visual inspection of whether the normality assumption is plausible. Shapiro-Wilks is a test of normality also used to determine normal distribution of the data.

This study used nonparametric inferential statistics including Wilcoxon test, Mann-Whitney U test, and Kruskal-Wallis H test. The Wilcoxon test is equivalent to the dependent

paired-sample *t*-test. The difference is the Wilcoxon test can be used whether or not two related samples are from the same distribution. This test is requires two variables which are the two scores from the same group. It was used to test the difference in the fundamental and exit scores. A p-value <0.05 rejects the null hypothesis indicating there is a difference between scores. This indicates there is not a significant difference in the scores. The Mann-Whitney U test is the nonparametric equivalent test for the parametric independent t-test. This test can also be used whether or not the two independent samples are from the same distribution. This test uses the rankings of the data. There are no assumptions about the shape of the distribution. It is performed using single variable representing the dependent variable and a second variable indicating members of the group. The Mann-Whitney U test is used to determine whether there is a statistically significant difference between the scores of the two groups. A significate Mann-Whitney U result indicates that the samples are different in terms of their average ranks. The data for each group's exams were compared using this test for the fundamental scores, as well as, the exit scores from each group.

The results allowed for comparison between the groups by running a Kruskal-Wallis H test which is the nonparametric equivalent of the one-way ANOVA analysis of variance. The Kruskal-Wallis H test is used to determine if independent samples are from the same population. This test can be used wheather or not several indepednet samples come from the same population. There are few assumptions. Like the ANOVA, the Kruskal-Wallis test assumes that the groups are equal. The data was used to determine whether there was a statistically significant difference between the mean of the groups. A significat result indicates that at least one group is different. The Kruskal-Wallis test cannot tell us which group the statistically significant differences existed; it tells us the two groups were significantly different. As an extension to this

test we performed an ANCOVA (analysis of covariance). This study design contains one dependent variable (exit exam scores), one independent variable (groups) and the fundamentals exam scores as the covariate for statistical control. The ANCOVA looks at the mean of the adjusted means. The benefit of comparing the Kruskal-Wallis and ANCOVA allows us statistical control over the third variable, in this case is the fundamental scores. There are nine assumptions when considering the results of the ANCOVA. It is not uncommon for one or more of the assumptions not to be met. The first three assumptions are vital to be met prior to performing the ANCOVA; in our case these assumptions were reviewed prior to running the ANCOVA.

Summary

This chapter outlines the type of research used which was quantitative research using a causal-comparative design. The participants are Associate Degree registered nursing students from four nursing programs in Alabama, Florida, and Georgia. The instrument used to collect data was the HESI exams. The scores were from the clinical judgement, clinical reasoning, and critical thinking scores of HESI exams. The students' scores were collected onsite by the researcher and analyzed using SPSS. Chapter four presents the data analysis for this quantitative study. The detailed results discussed in chapter four are in regard to each of the three research questions. Chapter 5 comprises a summary and conclusions of this study. The lack of research on this topic and results indicate the need for advanced research.

Chapter IV

DATA ANALYSIS AND RESULTS

Introduction

This chapter presents the sample size, demographics and results utilized a causal-comparative approach to investigate the relationship between the dependent and independent variables. The students' individual demographics were not available but the demographics for the participants per school were included. The tests performed are to answer the three research questions outlined in this study.

Sample

The study sample consisted of the 413 associate degree nursing students from 12 different cohorts graduating between 2015-2018 from the four programs participating within the tristate area of Alabama, Florida, and Georgia (Table 2). They were separated into groups based on the type of documentation taught in their nursing program. Most of the students who attended the programs lived in the state where their program was located, except students in the first Florida program (program B). Participants from this program were from both Florida and nearby counties in Georgia. The students were all required by their program to be enrolled full-time. The Georgia nursing program, designated as Program A, used paper-based documentation throughout the program. In the first Florida nursing program, designated as Program B, students were taught using paper-based documentation. The second Florida program, designated as Program C, used an EHRS as a teaching method for documentation. The Alabama nursing program, designated as Program D, used an EHRS as a teaching method for documentation. The students in Program C and D were introduced to paper-based documentation briefly in their

fundamental course but all documentation was performed using an EHRS. SimChart or EPIC were the two EHRS used by both Program C and D for teaching nursing electronic documentation in the classroom, lab, and sometimes clinical settings.

Table 2
Program demographic information by state

Program	#Cohorts	State	Group Size
A	4	Georgia	80
B	3	Florida	130
C	3	Florida	110
D	2	Alabama	93

Demographic data (Table 3) was collected for each participating program; 84% (347 of 413) were females and 16% were males (66 of 413). The lower number of males in nursing programs for this study was not surprising since historically the nursing workforce is predominantly made up of females. The data regarding ethnicity indicated 74.5% (n = 308) were Caucasian, 18.5% (n = 75) were African American, 6.75% (n = 28) were Hispanics and less than 0.5% (n = 2) were Asians. The mean age of participants in this study was 27.43 (*SD* = 7.72). This study provides age ranges based on the ages of the participants for each program. An overwhelming majority of nursing students in the study were in the 18-25 age range at approximately 69% (*n* = 286). The 30-39 age range was 20% (*n* = 82) of the students while the 40 and over group was somewhat higher than expected at 11% (*n* = 45).

Table 3
Demographics by Gender, Ethnicity and Age ranges.

Program	Females	Males	Caucasian	African American	Hispanic	Asian	18-29	30-39	Over 40
A	69	11	67	5	7	**1**	50	20	10
B	**108**	22	64	**52**	**14**	0	**122**	7	0
C	90	**20**	**88**	17	5	0	56	**34**	**22**
D	80	13	89	1	2	**1**	58	21	13
Total	347	66	308	75	28	2	286	82	45

Note. Highlighted are highest in each category.

Testing of Assumptions

Once all data was collected, entered, and properly labeled, descriptive statistics were run using SPSS. The Shapiro-Wilk test of normality was performed to verify if the data meets the assumption of normal distribution. The Shapiro-Wilks normality test was used to detect all departures from normality but does not indicate what parts of the distribution are non-normal. The findings of the Shapiro-Wilks tests for normal distribution determined the use of parametric verses non-paramedic data analysis.

Testing for Normal Distribution and Data Cleaning.

There is a standard assumption that data sets are normally distributed with the data following a symmetrical bell-curve shape around the mean (Laerd & Laerd, 2018). Assumption testing for normality was carried out with the Shapiro-Wilks test of normality with raw data. The data was not normally distributed. In an effort to transform the data to use parametric inferential statistics to analyze the data, each dataset was transformed using Logarithmic (Log 10) method and the Shapiro-Wilks testing was performed again using the transformed data. The alpha level is 0.05 indicating a p-values less than 0.05 violates the assumption of normal distribution. This assumption is violated by both Group 1and Group 2 which both had a *p*-value of 0.00 (< 0.05) noted violating normal distribution after transformation of the data. Due to violations of the Shapiro-Wilks test assumption of normality was not tenable.

The study used results from the skewness to show distribution and kurtosis to test for shape of distribution. When data was positively or negatively skewed it required a reflective transformation of the data. The reason for transformation of the data was to see if the data would convert to a normal distribution in order to meet the assumption of normality. Meeting the

assumption of normal distribution with the data would have allowed for conducting parametric inferential statistics on the data. The study used the Logarithmic (Log 10) method to transformation all data in order to see if there was a difference in distribution once the data was transformed. Presented in Figure 4 below are distribution graphs using raw data scores from each exam separated by groups. Presented in Figure 5 below are distribution graphs using transformed data scores from each exam separated by groups.

The final test, the Shapiro-Wilks test for normality of distribution was carried out using for each dataset below as a verification method after the data was transformed to ensure the data did not meet normal distribution. Normal distribution was not met even with transformation of the data in any of the tests for normal distribution.

Findings

The Group 1 scores from the Fundamental exam ranged from 50% to 100% (M = 86.53, SD = 11.25), with a level of confidence of 95 percent. The skewness of the scores are noted as -1.162 which shows the data is highly skewed, while the kurtosis is 0.885, indicating the left tail is longer than the right tail and the distribution has lighter tails and a flatter peak than the normal distribution noted in histogram (Figure 4). This indicates our sample is not normally distributed and the fourth assumption was not met.

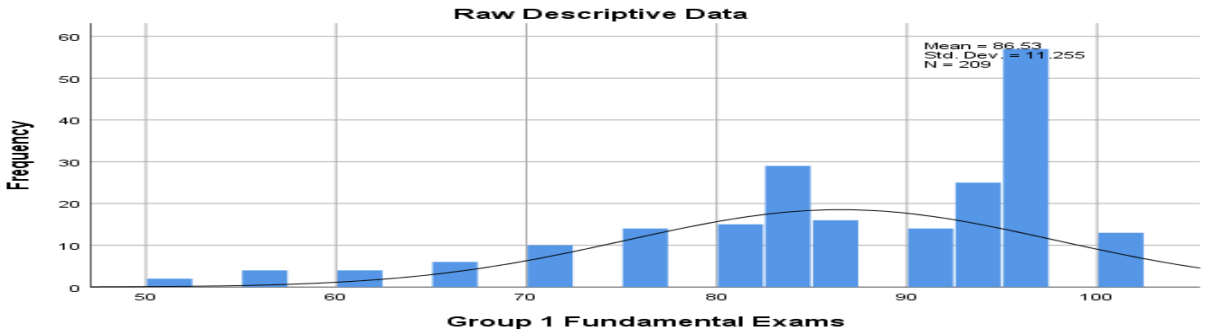

Figure 4. Group 1 Fundamental Exam Scores

The transformed data ranged from .00 to 1.71 (M = 1.01, SD = .397), with a level of confidence at 95 percent. The group's scores were transformed using a Logarithmic (Log 10) method to see if this would adjust for skewness. Although not a perfect distribution, mathematically the skewness at -.683 (SE.168) meets assumption of normal distribution in reference to a skewness not less than negative 1. Kurtosis data was 0.446 (SE .335) closer to zero assumes a more normal distribution. The histogram of fundamental scores for Group 1 is illustrated after transformation using Logarithmic (Log 10) method as not being normally distributed (Figure 5).

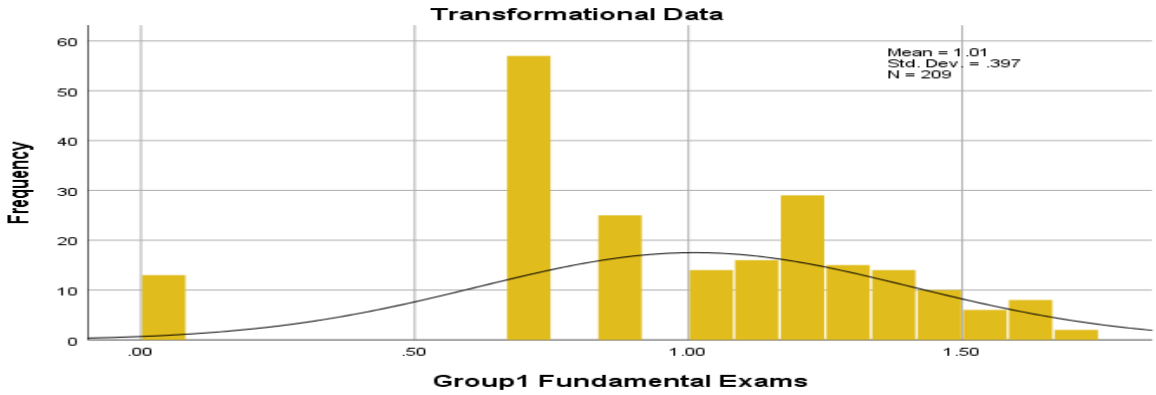

Figure 5 Group 1 Transformed Fundamental Exam Scores

The descriptive statistics computed for Group 1 scores on the exit exams ranged from 60% to 100% (M = 88.91, SD = 7.42), with a level of confidence of 95 percent. The skewness of the scores was a -1.115 (SE .168) which shows again this data was negatively skewed, while the kurtosis was positive 1.170 (SE .335), indicating it skewed to the left which was longer than the right tail and a flatter peak than the normal distribution as noted in histogram (Figure 6).

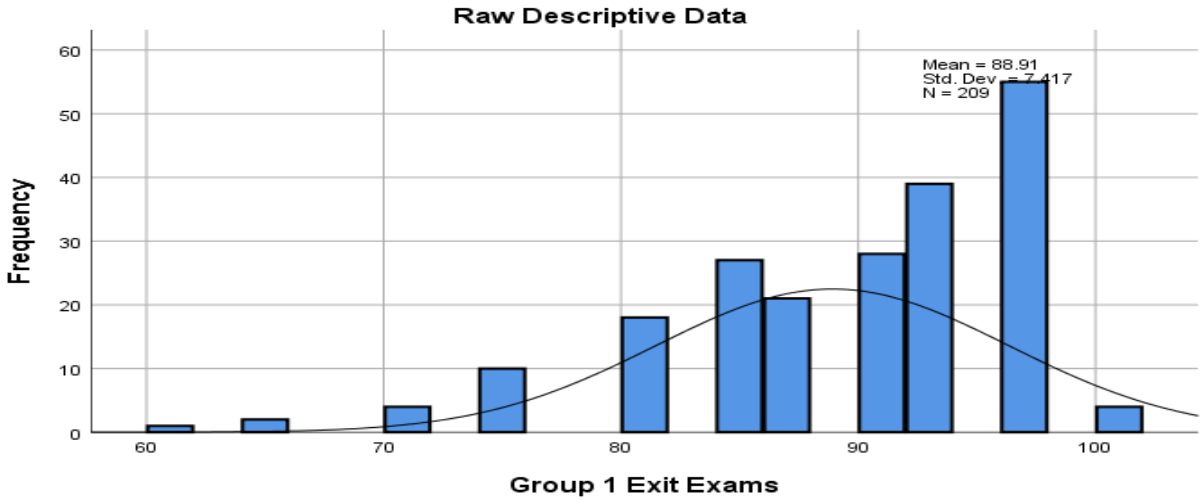

Figure 6. Group 1 Exit Exam Scores

The descriptive statistics computed for the exit exam scores are also negatively skewed, requiring a reflective transformation of data for Group 1 exit exam scores. This group's scores were also transformed using a Logarithmic (Log 10) method to see if this would adjust for skewness. The results of the Log_10 transformation indicated the data was mathematically meeting a normal distribution using the skewness of -.572 (SE .168) again using the reference of skewness not less than negative 1 to meet assumption of normal distribution mathematically. The Kurtosis data on the other hand was 1.176 (SE .335) which assumes again to be more normal distribution than the raw data but is greater than 1. The histogram of exit exam scores for Group 1 is illustrated after transformation using Logarithmic (Log_10) method (Figure 7). Even after transformation the data is not normally distributed.

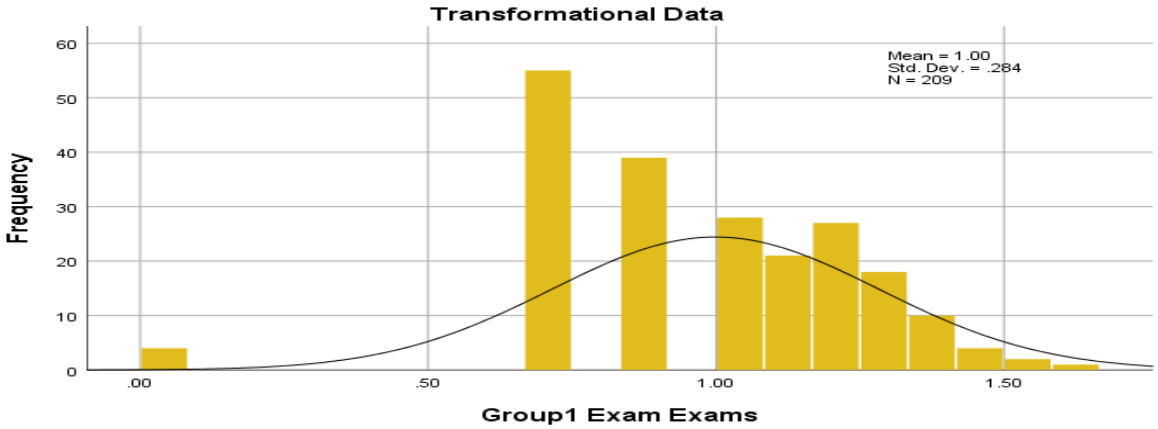

Figure 7. Group 1 Transformed Exit Exam Scores

The descriptive statistics were computed for Group 2 students, who used EHRS as a learning strategy for nursing documentation. The descriptive data on the fundamental exams ranged from 55% to 96% (M = 85.79, SD = 9.92), with a level of confidence of 95 percent. The skewness of the scores was a -.999 (SE .171) which shows again this data was negatively skewed. Kurtosis was positive .310 (SE .341), indicating it skewed to the left which was longer than the right tail and a flatter peak than the normal distribution as noted in histogram (Figure 8). This data was not normally distributed.

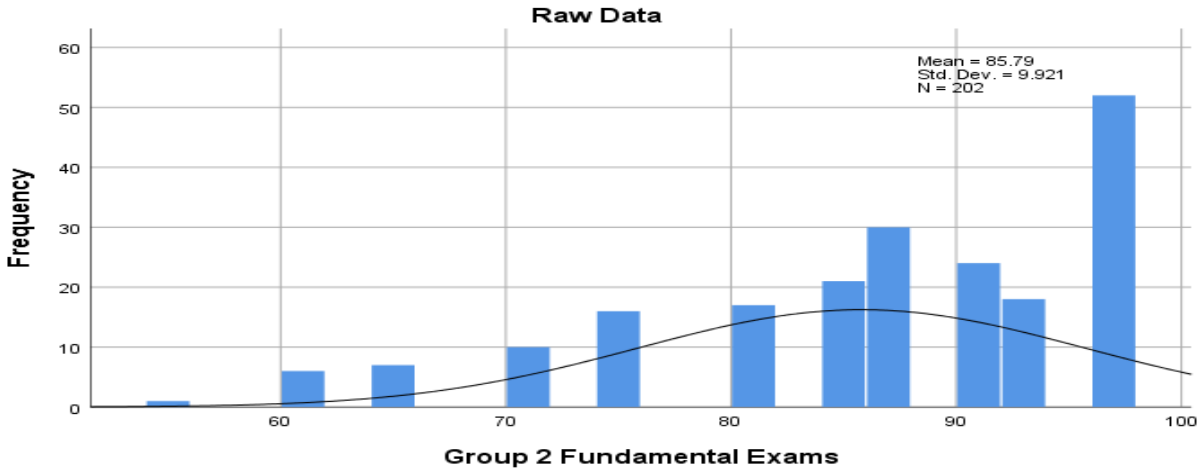

Figure 8. Group 2 Fundamental Exam Scores

Due to the negative skewness of the fundamental exam scores for Group 2 a reflective transformation of the data was performed using the same Log_10 procedure. The transformation of the data was completed in hopes of changing the data to a normal distribution in order to meet the assumption of conducting a parametric means comparison. The transformed data ranged from .70 to 1.66 (M = 1.09, SD = .290), with a level of confidence at 95 percent. The Group 2 scores were transformed using a Logarithmic (Log 10) method for adjustment of skewness. There was a noted difference in the mathematical skewness at .000 (SE.171) which meets assumption of normal distribution in reference to a skewness parameter of not greater than 1 or less than negative 1. Kurtosis data was -1.135 (SE .341) a greater distance from zero assumes a less normal distribution. The histogram of fundamental scores for Group 2 is illustrated after transformation using Logarithmic (Log 10) method (Figure 9). There was a great improvement in the graph after the transformation of the data. This indicated there was not a change in the data after the transformation and does not meet the assumption of normal distribution.

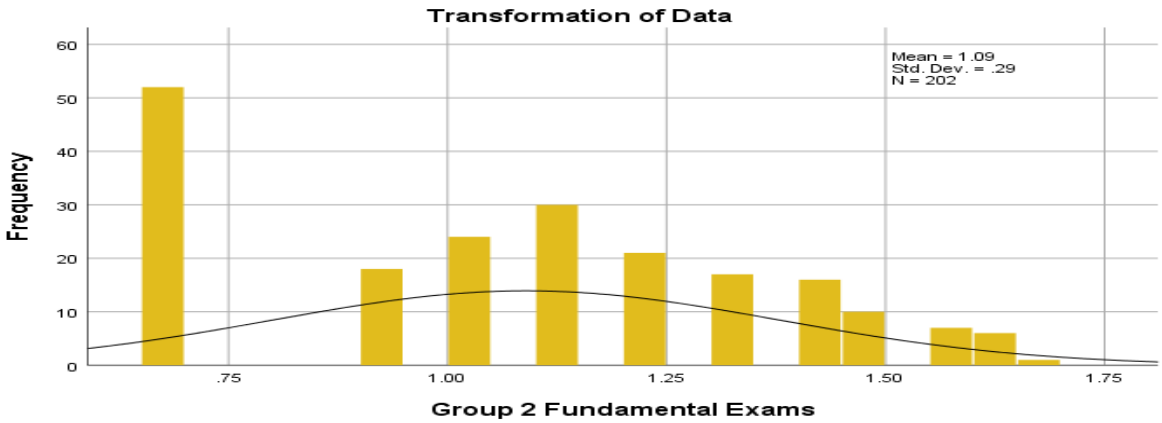

Figure 9. Group 2 Transformed Fundamental Exam Scores

The descriptive statistics were run using group 2 exit scores which ranged from 60% to 100% (M = 86.03, SD =8.13), with a level of confidence of 95 percent. The skewness of the data was -.920 (SE .171) and a kurtosis of .859 (SE .341), indicating the skewness of the scores

the data are moderately skewed. The kurtosis has a left tail longer than the right and the distribution has lighter tails and flatter peak than a normal distribution. The histogram below is representing Group 2 raw data for the exit exam is illustrated in (Figure 10) and does not meet normal distribution.

Figure 10. Group 2 Exit Exam Scores Raw Data

After transforming scores using the Log_10 method, the exams left tail skewness remained unchanged at -.816 (SE .171) and a kurtosis of 1.688 (SE .341), indicating the exit scores meet assumption of normal distribution by being greater than negative 1 and less than positive 1. The Kurtosis was within the parameters of -2 to +2. The histogram of the transformed exit scores for Group 2 is illustrated below (Figure 11). Visual inspection of the graph notes normal distribution was still not met after the transformation of data.

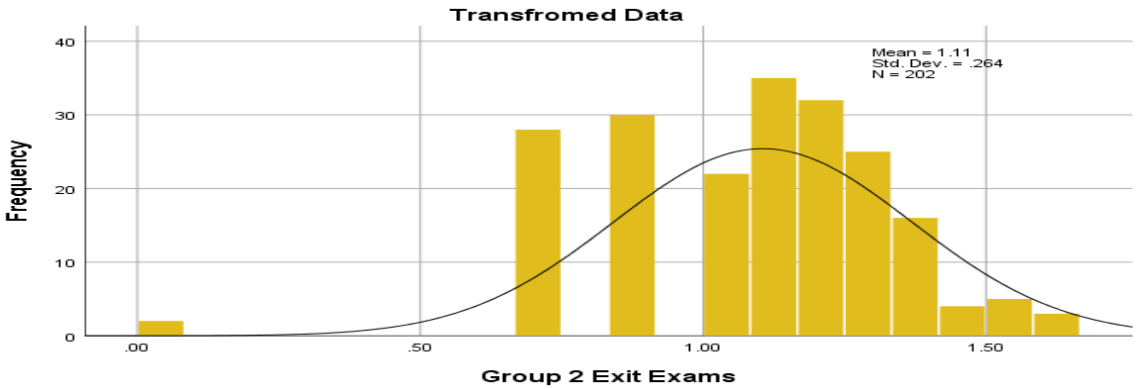

Figure 11. Group 2 Transformation Exit Exam Scores

Nonparametric Inferential Statistics

The purpose of this section was to summarize the initial findings and hypothesis testing for each research question. Non-parametric inferential statistical tests were performed using SPSS to test for significant difference between groups and scores. The Wilcoxon matched-pairs signed rank test was used to replace the parametric inferential *t*-test to compare the fundamental exam with the same group's exam. The Mann-Whitney U Test was used to replace the parametric inferential independent *t* test for comparison of exam scores between groups.

The statistical assumptions for the Wilcoxon matched-pairs signed rank test, Mann-Whitney U-test, Kruskal-Wallis H Test and ANCOVA have all been met as indicated below. The statistical assumptions were outlined and met regarding the measurement of dependent variable and independent variables being measured on either a continuous scale or an interval scale of measurement (Laerd & Laerd, 2018).

The data sets did not have a normal distribution preventing the use of a parametric *t*-test analysis to explore the difference between fundamental and exit exam scores. The nonparametric equivalent Wilcoxon test was performed using the transformed datasets from both groups. The results provide a *z* value which is the approximate number to being normally distributed for large samples over 10 and a *p* value showing if there is a significant difference between the scores by group.

Research Question 1

Is there a significant difference between the scores each student earned on the HEIS fundamentals and exit exams for Clinical Judgement, Clinical Reasoning, and Critical thinking?

Assumptions

Wilcoxon matched-pairs signed rank test.

1. The two samples are independent of one another - matched pairs, before and after measurements on the same unit;
2. The measurement scale is such that the Wilcoxon differences can be ranked- interval scale of measurement;
3. The Wilcoxon difference all come from a continuous symmetrical distribution;
4. There are at least 5 pairs of observation (Laerd & Laerd, 2018).

All assumptions required for the Wilcoxon matched-pairs signed rank test were met. There were two groups which had the same number of students taking the fundamental and the exit exams. The data was measured on interval scale of measurement and could be ranked. Based on differences in boxplots, the fourth assumption was met noting continuous symmetrical distribution (Figure 12). The fifth assumption was also met in regard to the number of observed pairs. The minimum number of required parirs was five; this was easily met with 413 pairs observed.

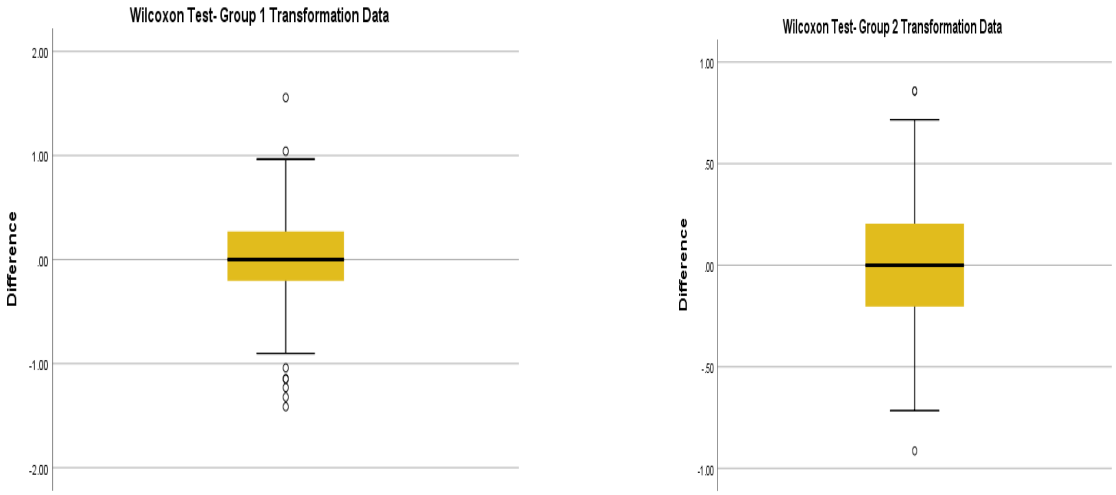

Figure 12. Boxplots

Findings

For RQ1 the Wilcoxon matched-pairs signed rank test was the nonparametric test performed to compare if there was a significant difference between the fundamental exam scores versus the same group's exit scores. This group consists of 204 students who were taught to use paper-based documentation. The fundamental exam and exit exams were used to measure critical thinking development during their nursing program. The Wilcoxon matched-pairs signed rank test used these before and after transformed scores. The ranking indicated there was a number of exit exam scores which were less than fundamental scores on 74 exams, exit exam scores were greater than fundamental scores on 93 exams and 42 of the exit scores were equal to fundamental scores (average rank of 71.67 vs. 93.81). The Wilcoxon matched-pairs signed rank test indicated Group 1 scores on the exit exam were statistically significantly higher than their fundamental exam scores with a p value of < 0.05 ($z = 2.734$, $p = 0.006$). The results reject the null hypothesis, indicating there is a significant difference between the student scores earned on the HEIS fundamental exam versus the exit exam for Clinical Judgement and Clinical Reasoning & Critical thinking. It can be inferred the teaching method caused a significant change in critical thinking scores for the group who learned to document using paper-based documentation.

The Wilcoxon test examined Group 2 exam scores using the same fundamental exam versus exit scores to determine if there is a significant difference the scores for this group. Group 2 was introduced to paper-based documentation early as part of one fundamental lesson but moved immediately to electronic documentation for the remainder of their nursing program. The 209 students who took the exams used SimChart, EPIC or both for documentation during their nursing program. This group's fundamental and exit transformed scores were used in the Wilcoxon matched-pairs signed rank test. The ranks were listed noting the exit scores were less

than the fundamental scores on 87 of the exams, exit scores were greater than fundamental scores for 87 exams and the exit scores were equal to the fundamental scores on 30 exams (average rank of 82.09 vs. 92.91). The Wilcoxon matched-pairs signed rank test indicated Group 2 scores on the exit exam were not statistically significantly different than their fundamental exam scores with a p value of > 0.05 ($z = -.708$, $p = .479$). The results retain the null hypothesis that both samples are from the same population, and we might assume the teaching method caused a little to no significant change in critical thinking scores for student who were taught documentation using EHRS (Appendix C).

Research Question 2

Is there a significant difference on the Fundamental exam scores in Clinical Judgement, Clinical Reasoning and Critical thinking between students completing Fundamental of Nursing in programs teaching electronic documentation and those teaching the use of paper-based documentation?

Due to these violations of normality evident, a non-parametric test, Mann-Whitney U was conducted instead of the equivalent parametric independent t test. The use of the Mann-Whitney U test is appropriate when assumption of normality is not tenable (Laerd & Laerd, 2018). The Mann-Whitney U test the two independent samples from the same distribution. The student scores were converted to ranks and outliers were not excluded, since the outliers do not have as much influence on the results when using the non-parametric Mann-Whitney U test (Denis, 2015).

The scores used were transformed using a Log_10 as before with the Wilcoxon test. This test is similar to the independent groups t test and equivalent to a two-sample Wilcoxon rank-sum; however, the scores (dependent variable) are measured by ranked data on an ordinal level.

The Mann-Whitney U test is used to examine the difference between two groups based on dependent variables (Cronk, 2017).

Assumptions

Mann-Whitney U Test.

1. Requires one dependent variable measured at the continuous level of measurement;
2. Must be one independent variable that consists of two categorical independent groups;
3. There can be no relationship between the observations in each group of the independent variable or between the groups themselves;
4. You must determine whether the distribution of scores for both groups of your independent variable have the same shape or a different shape (Laerd & Laerd, 2018)**.**

The four assumptions for the Mann-Whitney U test were met. The first assumption was met as the dependent variables were measured at the continuous level of measurement. The second assumption met the requirement since Group 1 and Group 2 student were categorically two independent groups. There was no relationship between the groups, meeting the third assumption. The final assumption was a little more difficult to determine. The Mann-Whitney U test had to be performed to determine if the distribution of scores for both groups had the same shape. This assumption was met as the distribution of the scores were the same across the two groups.

Findings

A Mann-Whitney U test was used to determine if there was a difference between the group's exam scores based on the type of documentation they were taught. This study was comparing the fundamental exam and the exit exam for critical thinking scores from students' HESI exams. A significant result is suggestive that values for the two groups are different.

The Mann-Whitney U tests calculated the difference in the fundamental exam scores between the EHRS group and paper-based group. The results indicated there was not a significant difference (U = 23,045, z = -1.442, p = .149, r = -0.07) on the fundamental exams of the two groups, accepting the null hypothesis. Regardless of whether students used paper-based or electronic documentation at the end of fundamental exam their critical thinking skills did not improve. This same Mann-Whitney U test was performed on the exit scores using the same two groups of students. The results of the exit exam indicated there was a significant difference (U = 26,143, z = -4.021, p = .000, r = -0.20) between the exit scores of the two groups therefore rejecting the null hypothesis. This test indicated that group 1 performed better on the exit exam than group 2 (Appendix C).

Research Question 3

RQ 3. Is there a significant difference in the exit exam scores on the Clinical Judgement and Clinical Reasoning & Critical Thinking between groups graduating from programs teaching electronic documentation versus those teaching paper-based documentation after controlling for fundamentals exam scores?

Assumptions

Kruskal-Wallis *H* Test

1. There is one independent variable with two or more groups.
2. The Dependent variables should be on an Ordinal scale, Ratio scale or Interval scale.
3. The groups should be independent/no relationship between the member in the groups.
4. All groups should have the same shape distribution.

The four assumptions for the Kruskal-Wallis *H* Tests were met. The first assumption was met with one independent variable being two groups of Associate Degree nursing students. The

dependent variables were on the interval/continuous scale of measurement meeting the second assumption. The third assumption was met since there was no relationship between Group 1 and Group 2 members. The final assumption of same shape distribution was met for both groups.

Findings

The non-parametric inferential statistics Kruskal-Wallis H test was performed in place of the parametric ANOVA test due to the data not being normally distributed even after the data was transformed. This test was conducted comparing the scores of associate degree nursing student by the type of documentation system they were taught to document nursing notes. There was a significate result found ($H(1) = 16.17$, $p < .01$), indicating that the groups differ from each other on the exit exam. The Kruskal-Wallis H test showed a significant difference indicating that at least one of the groups' scores were significantly different from the other groups. The pairwise comparison was used to follow-up and determined that the students taught using paper-based documentation scored better on the exit exam than those who were taught with the EHRS.

In addition to a Kruskal-Wallis H test, an ANCOVA was used to remove covariates, fundamental exam scores, from being a possible explanation of variance in the dependent variable. This helped to determine if the fundamental scores influenced the exit scores. The ANCOVA uses the same assumptions as the ANOVA, plus three others, two which are easily fixable. The assumption for normality when it comes to the ANCOVA is considered to be robust, which means it can tolerate violations of normality assumptions. All outliers were removed from the transformed data in an attempt to achieve a normal distribution of the data in order to answer RQ3 using the ANCOVA. By removing the outliers, the data was transformed to closely meet this assumption.

Assumptions

One-way ANOVA.

1. The Dependent Variable should be measured at the interval level.
2. The independent variable should consist of two or more categorical, independent groups.
3. There should be an independence of observations, which means there is no relationship between the groups.
4. There are no significant outliers.
5. The dependent variable should be approximately normally distributed for each category of the independent variable.
6. There needs to be homogeneity of variances

ANCOVA Assumptions.

Similar to the assumptions of the ANOVA on assumptions one through six, the ANCOVA has three other assumptions.

7. The covariant should be linearly related to the dependent variable at each level of the independent variable.
8. Homoscedasticity is needed.
9. Homogeneity of regression slopes is needed, meaning no interaction between the covariate and independent variable (Laerd & Laerd, 2018.)**.**

The robust ANCOVA assumptions were met for number 1 with data at the interval level. Assumptions two and three were also met by the independent variable consisting of two groups which had no relationship or were independent from each other. In order to meet assumption four, the outliers were removed and the distribution of Group 1 with 206 and Group 2 with 196

participants. Assumption five for approximate normal distribution, though not perfect, was met after the removal of outliers as indicated on graphs in green (Appendix C). Assumption number six was met by using the Levene test to check for Homogeneity of Variances. The rule of thumb for this test is that the variances are not equal if sig. is < 0.05. The results of the fundamental scores were F(1,400) = 2.27, p = .133 and the exit score F(1,400) = .006, p = .940. The Levene test indicated equal variances between scores and does not violate the homogeneity of variance assumption.

Findings

ANOVA is most useful in determining if there are any statistically significant differences in the mean of three or more independent unrelated groups. There are only two groups participating in this study. The non-parametric inferential Kruskal-Wallis test was performed to replace the ANOVA followed by an ANCOVA. The ANCOVA was conducted to further test the impact of the independent variable (groups) on the dependent variable (exit exam) to determine whether a significant difference existed between the critical thinking skills at graduation, when correcting for the covariate (fundamentals exam).

The ANCOVA is an extension of the one-way ANOVA and was used to incorporate a covariate, fundamental exam to determine the effect of the fundamental exam on the exit exam scores, if any. The one-way between-subjects ANCOVA was calculated to examine the effect teaching methods for documentation (by group) had on exit scores, covarying out the effect of the fundamental exam. Fundamentals exams were significantly related to exit exams F (1, 395) = 34.27, p < .001. The main effect of group (represents type documentation) was significant F (2, 395) = 8.8, p = .003 which indicates the covariate significantly adjusts the association between the predictor and outcome variable. The variance in the dependent variable was small at

7% of the independent variable. The results of the ANCOVA when controlled for fundamentals scores, F (2, 395) = 8.8, p = .003, indicates those students who used EHRS documentation had lower scores on the exit exam than those taught paper-based documentation. The results reject the null hypothesis. When controlling for the fundamental scores covariate the exit exam scores were higher for the students who used paper-based documentation. These findings agreed with our Kruskal-Wallis H test previously conducted.

Summary

The HESI scores from both groups were used to determine if the transition from paper-based documentation to an EHRS impacted the student's fundamental exam given at the end of their fundamentals course compared to the exit exam given prior to graduating from the program. Both exams covered the same content (Clinical Judgement and Clinical Reasoning & Critical Thinking). There were 826 scores collected from archived data of students graduated between May 2015- May 2018. This chapter outlined each program's demographics as they related to the overall nursing student population.

The tests used were nonparametric inferential statistics as the data violated the normal distribution assumptions for use of parametric inferential statistics. An ANCOVA was used to address RQ3 after converting the data to rank. These included the Wilcoxon test, Mann-Whitney U and the Kruskal-Wallis H test. The assumptions were outlined for each of the test to be used in the study. Followed by how each assumption was met or not met. The findings were provided with the statistical significance and whether the null hypothesis was rejected or not.

Chapter V

SUMMARY AND DISCUSSION

Introduction

Nursing documentation is a legal document, a communication tool for continuity of care, and a permanent record for future care. EHRS have become part of nurses' everyday lives. A review of literature indicated most research was centered on the effect of implementation or use of EHRS in many different areas of nursing such as physicians' offices and hospitals. The research regarding the effects the EHRS is having on nursing education was very limited. Nurse educators have used paper-based documentation for decades to help development critical thinking skills. Nursing programs began the transition from paper to EHRS within the past five years. The problem was current EHRS available for academia do not fit the needs of nursing education nor promote critical thinking skills. The purpose of this quantitative casual-comparative designed study using archived data was to determine if differences exist in critical thinking skills of undergraduate nursing students taught using two different teaching methods, paper versus electronic documentation. The purpose of this chapter is to provide an overview of this study, summarize the findings, discuss the conclusions and make recommendations for a deeper understanding of this topic.

Limitations

The limitations of this study included the number programs participating, the limited number of students per program, the use of archived data, lack of individual student demographic information, and limited tools to measure critical thinking. There was a limited number of research articles related to EHRS in academia. The review of literature, noted in chapter 2,

focused on the implementation of EHRS and how it may affect the healthcare profession from the frontline providers to nursing education. The articles described the problems associated with EHRS located in medical facilities more than those used by nursing programs. There were discussions related faculty and student beliefs regarding the transition and critical thinking changes indicated since the implementation of EHRS. The evidence in the review of literature supported the need for change in implementation and use of EHRS in nursing programs. The limited literature available supported the belief that the current EHRS used in academia may not support the development of critical thinking skills. Though this study had a limited number of programs participating, number of students and student records available, the study presented an accurate representation of the population for the area in which the study took place.

Discussion of Results

The first research question tested was to determine if there exists a significant difference in the development of students' Clinical Judgement and Clinical Reasoning & Critical thinking scores by comparing their end-of-course fundamentals exam to their end-of-program exit exam. This question was answered using a Wilcoxon test.

The paper-based groups' scores were compared to answer question one. Reviewing the descriptive data for this group, the number of students for this group was 209 with the mean score of 86.53 on their Fundamentals exam. The exit exam for the same group had a mean score of 88.91. This indicates that the mean scores on the exit exam scores were higher than the fundamental exam and the deviation had less variation of spread in scores. It would appear from this analysis that the students performed better on the exit exam. This will be verified with the Wilcoxon test in order to answer the question.

The Wilcoxon test was used to provide evidence of a significant difference between each group and two variables, fundamental and exit exam scores. First the paper-based group's exams were compared. The results of the Wilcoxon test t = -2.965; $p = 0.003$, the closer the t was to zero the less likely there was a significant difference, but the p-value plays a significant part in this test. The lower the *p*-value the more likely the null hypothesis will be rejected. The evidence rejects the null hypothesis in these findings indicates there was a significant difference between the exams for the paper-based students. Wilcoxon test results indicate there was a significant difference between the scores students earned on the HESI the fundamental exam versus the exit exam. Rejecting the null hypothesis that there is not a significant difference between the scores earned on the HESI fundamental exam verses the exit exam for Clinical Judgement and Clinical Reasoning & Critical Thinking.

The EHRS Group had 204 students and the descriptive data was as noted, the Fundamental exam mean of 85.79. This group's Exit exam scores were mean of 86.03, SD = 8.125. When comparing this data, the students appeared to again increase their scores, the standard deviation in scores was slightly less but not significantly.

The EHRS group's scores were compared to answer research question one. The Wilcoxon test was used to answer the question if there was a significant difference, t = -0.309 and p = 0.758. This question was answered with information previously discussed. The Wilcoxon test of the EHRS group does not reject the null hypothesis for question one. This was where the distribution table helps for a visual cue. When comparing figure 6 and 7 with the results of the Wilcoxon test, it appears to be a significant difference in the EHRS scores. In this case the null hypothesis was not rejected. There was not a significant difference between the

score students earned on the HEIS exams for Clinical Judgement and Clinical Reasoning & Critical thinking.

The second research question tested whether a significant difference existed in the Fundamental exam scores of students in programs teaching electronic documentation versus those teaching paper-based documentation. This will help determine which scores in question 1 were possibly significantly different. The Mann-Whitney U test was performed with descriptive information which reviewed the mean of the fundamental students (M = 86.53, SD = 11.255, N = 210) and electronic students (M = 85.79, SD = 9.921, N = 204). The mean for exit scores for the paper-based students were (M = 88.91, SD = 7.417, N = 210) and for electronic students were (M = 86.03, SD = 8.125, N = 204). The results indicated there was not a significant difference (U = 23,045, z = -1.442, p =.149, r = -0.07) on the fundamental exams of the two groups, accepting the null hypothesis. This would indicate student who use Electronic-Based documentation will have lower Fundamental scores on the Clinical Judgement, Clinical Reasoning & Critical thinking scores than those taught paper-based documentation.

The Kruskal-Wallis test was run to help determine which groups are different. The results of this test were to determine that at least one group is different from the other. The findings indicated ($H(1) = 16.17$, $p < .01$), there is a statistically significant difference between the exit exam scores of the two groups.

The third research question tested whether a significant difference existed in in the exit scores in clinical judgement and clinical reasoning and critical thinking between the two groups of students when controlling for the covariant, fundamental scores. The ANCOVA was utilized to help answer this research question, followed by performing an ANCOVA to account for the Fundamental scores to determine if there was a significant difference in the result of the exit

scores. The results F (2, 395) = 8.8, p = .003 indicates that the covariate significantly adjusts the association between the groups and exit exam scores. Review of the ANCOVA exit results, F (1, 395) = 34.27, p < .001. This indicates the null hypothesis was rejected.

Test for covariance was performed using ANCOVA. The Levene's test for variances indicted an F = 1.001; p = 0.318; this indicates the error of variance of the dependent variable was equal across the group. The fundamental scores were F(1,400) = 2.27, p = .133 and the exit score F(1,400) = .006, p = .940. The Levene's test indicated equal variances between scores and does not violate the homogeneity of variance assumption. The p-value of more than 0.05 met the assumptions. The test of between the effects related to the fundamental covariate indicates a p=.000; indicating there was a statistically significant difference between the groups when controlling for the covariate. The results reject the null hypothesis. Students who were taught to document on an Electronic documentation had lower exit scores when controlling for fundamental scores in clinical judgement, clinical reasoning and critical thinking.

Conclusions

This study was performed to determine if the adoption and implementation of an Electronic documentation system impacted students' Clinical Judgement and Clinical Reasoning & Critical thinking scores. The scores of students using EHRS versus paper-based documentation were collected and analyzed. The scores were higher for undergraduate nursing students who used paper-based documentation during the entire nursing program than those who used electronic documentation. When comparing the two groups fundamental scores with their exit scores, the tests show a significant difference in the scores. These results did not tell which scores were higher for each group. The fundamental scores were then reviewed to determine the difference in the scores for each of the groups. These results allowed us to determine that the

fundamental scores were lower for the students who learned to document using an EHRS. The final review of scores was for the exit exam scores between groups. The comparison of the exit scores also indicated that the students learning with the use of an EHRS had lower scores on the exit exam.

This research does not seek to show causation for the differences in text scores between the groups; it only shows that there was a relationship between the independent and dependent variables by group. The results of this study were not surprising, if you review the definition of critical thinking. Critical thinking requires a higher level of thinking. Student must assess evidence, explore assumptions, know when to question assumptions, decipher fact from fiction, define and set goals, find value when the value is not evident and evaluate conclusions (Secginli, et al., 2013). This definition of critical thinking is supported by the theoretical framework this study by Paul & Elder critical thinking model, Bloom's taxonomy, and the nursing process. The Paul & Elder model (2009) illustrates students must develop learning through the element of reasoning, asking purposeful questions, understanding concepts, points of view, and use of inferences, assumptions and implications. This leads the student to development of intellectual traits of autonomy, courage and confidence in reasoning. As the student develops these traits, they become logical, deeper thinkers of relevant information and information with was significant and precise. Bloom's taxonomy and the nursing process go hand in hand for the development of critical thinking. Bloom's taxonomy are the building blocks to development of critical thinking through remembering, understanding, applying, analysis, evaluation and creating. The nursing process follows Bloom's taxonomy by teaching students to assess problems, develop nursing diagnoses, plan care, implement care, and evaluate the results of the implementation. As discussed previously in this study, paper-based documentation allows

students to work through these processes to good critical thinking skills, the use of clinical reasoning, and applying clinical judgement. Paper-Based documentation allows for visual application and understanding of how to put concepts together, what was relevant, and how to use inferences, assumptions and implications to become deeper thinkers.

This study has practical implications for nurse educators. The findings of this study may be useful for nurse educators who are seeking to make decisions regarding the value of using adopting and implementing an EHRS. This study has practical implications for nurse educators.

Future research should consider replication of this study with a larger student population in different locations throughout the US and other countries. Researchers may consider performing an experimental study and/or longitudinal study and collect of real time data versus archived data. They may be able to locate a better critical thinking tool. There are some available at a cost.

Furthermore, with replication of this study researchers may consider collecting other information such as gender, ethnicity, age, GPA, and other variables unavailable in the archived data for this study.

Finally, there is a real need for a well-designed EHRS for nursing education. Researchers may consider studying the informatics of EHRS to help make evidence-based practice changes to help design an academic EHRS with relevant content to promote critical thinking among students who use EHRS.

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APPENDIX A

Letter of Participation

LETTER OF PRATICIPATION

DATE

Good Morning,

I am Michele Miller, a doctoral student at Valdosta State University and a member of the nursing faculty at Western Governors University. I am involved in a research study designed to determine how the transition from handwritten documentation of records to electronic documentation may have impacted the critical thinking skills of student nurses. I plan to review scores from the HESI critical thinking exit exams as an element of data collection for this study. I believe your school uses the HESI exit exam but am not sure if you use the critical thinking portion of this exam. If your program does use this portion of the exam, I would like to invite you to be a part of this study. Below is some information to help you make an informed decision:

Purpose of the Study: The purpose is to determine if the transition from paper-based documentation to electronic documentation has made a difference in development of nursing students' critical thinking skills. I believe this study can impact our programs and assisting in the defining best-practices for teaching documentation skills and to assist in the development and promotion of critical thinking skills for students. To date, no research was found addressed the impact this transition to electronic documentation, nor any mention of the development of critical thinking skills based on the type of documentation taught in their nursing programs. I plan to review past HESI exit critical thinking scores from at least four Associate Degree Nursing Programs who use the critical thinking exit exam. My goal is to have two programs which still use handwritten documentation for teaching and two programs which have moved to electronic documentation as the only method of teaching documentation. At the conclusion of the study the results will be shared with participating nursing programs to assist in the justification of curriculum changes or for future research for improvement of critical thinking skills based on the type of documentation.

What will happen to you if you are in the study? If you participate in this study, your will be asked to allow me access to scores for the students' critical thinking scores over the past 3 graduating cohorts. The study will collect demographic information about the program and the student population. I will come to your school to collect the data on site. Once completed, all documents will be returned to you. No identifiable individual student information will be used in the research. The name of the institution or program will only be used to obtain written consent from the participants.

Will the study impact my program? The research will not identify any programs so there is no risk for participants. Participation is completely voluntary and participants you may choose to withdraw from the research at any time.

I sincerely appreciate your time and hope you will decide to participate. Please feel free to call or email me if you have any questions about my study and participation. Also feel free to forward this invitation to any of your Nursing Colleagues who may fit the criteria for this research study.

Thank you,

Michele L. Miller, EdDc, MSN, R.N.
Principal Investigator
Graduate Student
Valdosta State University
Email: michemiller@valdosta.edu
Cell # 229-220-3917

APPENDIX B

Institutional Review Board Exemption

VALDOSTA STATE UNIVERSITY

For the Protection of Human Research Participants

Protocol Number:	**03639-2018**	**Primary Investigator:**	**Ms. Michele L. Miller**
Supervising Faculty:	**Dr. James L. Pate**	**Co-Investigators:**	**Dr. Nicole Gibson, Dr. Gerald Siegrist**
Project Title:	***High Fidelity Nursing using Electronic Health Record Systems: Impact on Critical Thinking in Nursing Practice.***		

INSTITUTIONAL REVIEW BOARD DETERMINATION:

This research protocol is **Exempt** from Institutional Review Board (IRB) oversight under Exemption **Category 4**. You may begin your study immediately. If the nature of the research project changes such that exemption criteria may no longer apply, please consult with the IRB Administrator (irb@valdosta.edu) before continuing your research.

ADDITIONAL COMMENTS:

- *Research data (data list, email lists, correspondence, etc.) must be maintained securely (locked file cabinet, password protected file, etc.) and accessible only by the researcher(s) for a minimum of three years.*

☒ ***If this box is checked, please submit any documents you revise to the IRB Administrator at irb@valdosta.edu to ensure an updated record of your exemption.***

Elizabeth W. Olphie *06.27.2018*

Elizabeth W. Olphie, IRB Administrator Date

Thank you for submitting an IRB application.

Please direct questions to irb@valdosta.edu or 229-253-2947.

Revised: 06.02.16

APPENDIX C

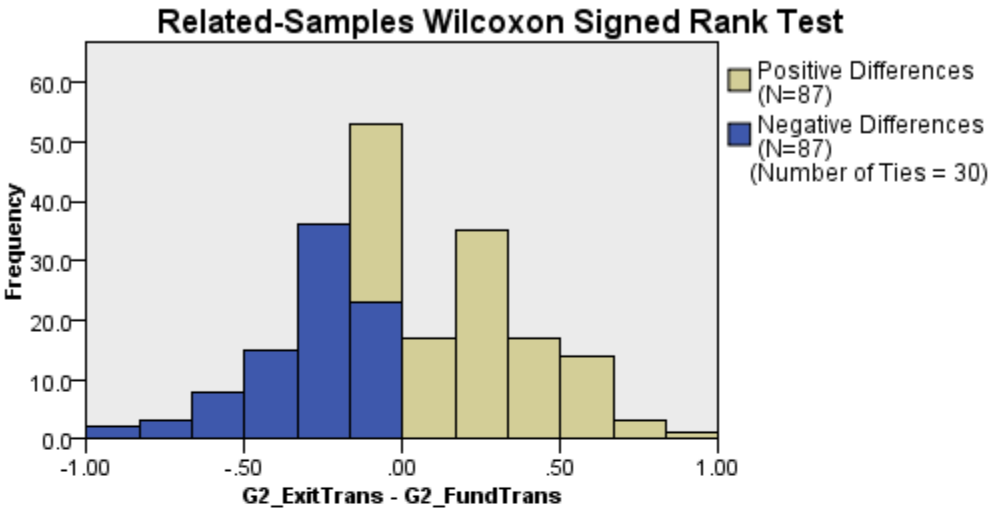
Data Charts and Graphs

Wilcoxon matched paired
Group 1

Hypothesis Test Summary				
	Null Hypothesis	**Test**	**Sig.**	**Decision**
1	The median of differences between Log_G1fund and Log_G1exit equals 0.	Related-Samples Wilcoxon Signed Rank Test	.006	Reject the null hypothesis.
Asymptotic significances are displayed. The significance level is .05.				

Group 2

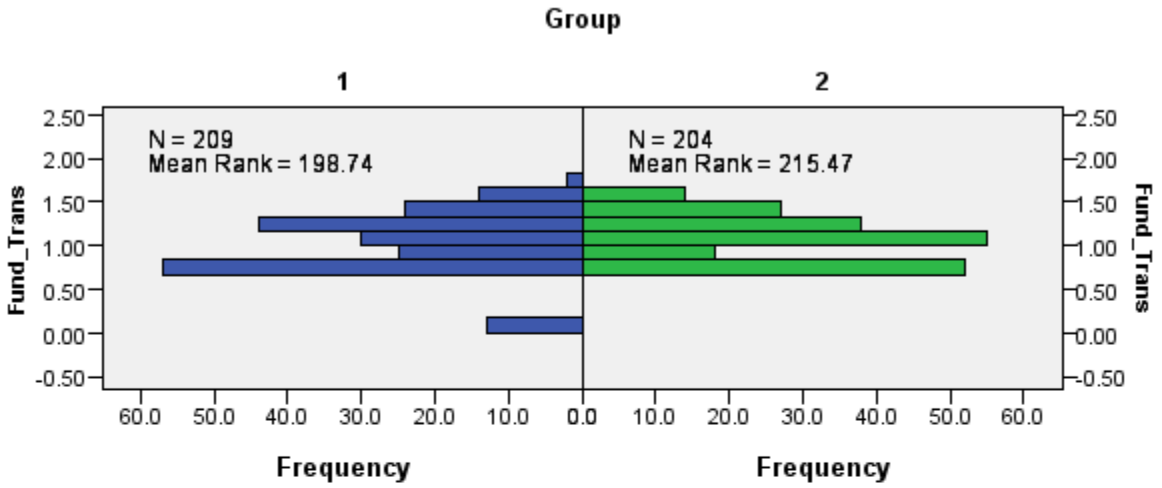
Hypothesis Test Summary				
	Null Hypothesis	**Test**	**Sig.**	**Decision**
1	The median of differences between G2_FundTrans and G2_ExitTrans equals 0.	Related-Samples Wilcoxon Signed Rank Test	.479	Retain the null hypothesis.
Asymptotic significances are displayed. The significance level is .05.				



Total N	204
Test Statistic	8,083.500
Standard Error	665.256
Standardized Test Statistic	.708
Asymptotic Sig. (2-sided test)	.479

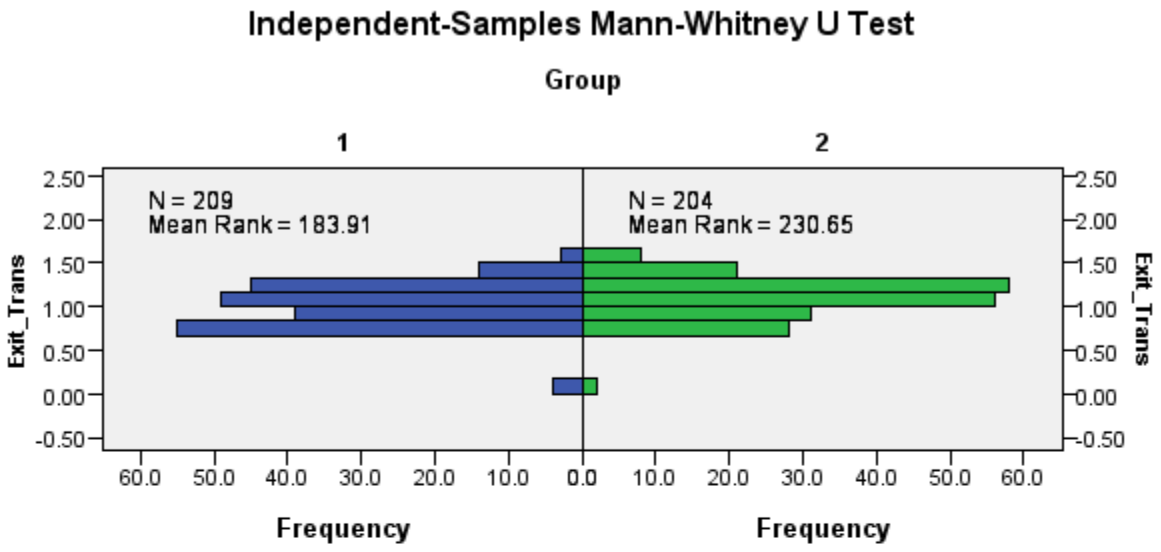
Mann-Whitney U test

Independent-Samples Mann-Whitney U Test



Total N	413
Mann-Whitney U	23,045.000
Wilcoxon W	43,955.000
Test Statistic	23,045.000
Standard Error	1,197.836
Standardized Test Statistic	1.442
Asymptotic Sig. (2-sided test)	.149

Hypothesis Test Summary				
	Null Hypothesis	Test	Sig.	Decision
1	The distribution of Exit_Trans is the same across categories of Group.	Independent-Samples Mann-Whitney U Test	.000	Reject the null hypothesis.
Asymptotic significances are displayed. The significance level is .05.				



Total N	413
Mann-Whitney U	26,143.000
Wilcoxon W	47,053.000
Test Statistic	26,143.000
Standard Error	1,199.899
Standardized Test Statistic	4.021
Asymptotic Sig. (2-sided test)	.000

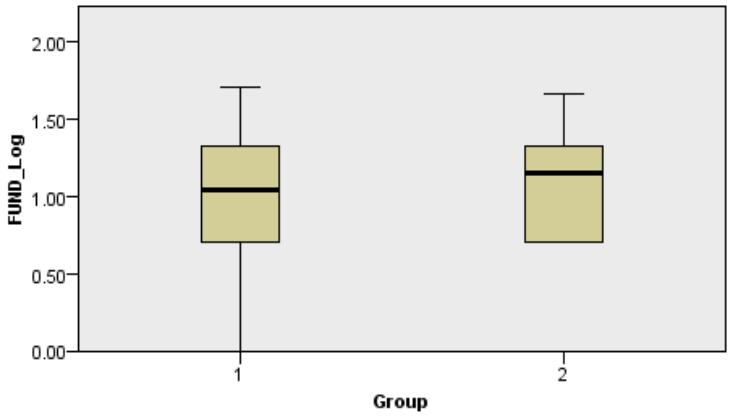
Kruskal-Wallis test

No change

Hypothesis Test Summary				
	Null Hypothesis	Test	Sig.	Decision
1	The distribution of FUND_Log is the same across categories of Group.	Independent-Samples Kruskal-Wallis Test	.149	Retain the null hypothesis.
2	The distribution of Exit_Log is the same across categories of Group.	Independent-Samples Kruskal-Wallis Test	.000	Reject the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

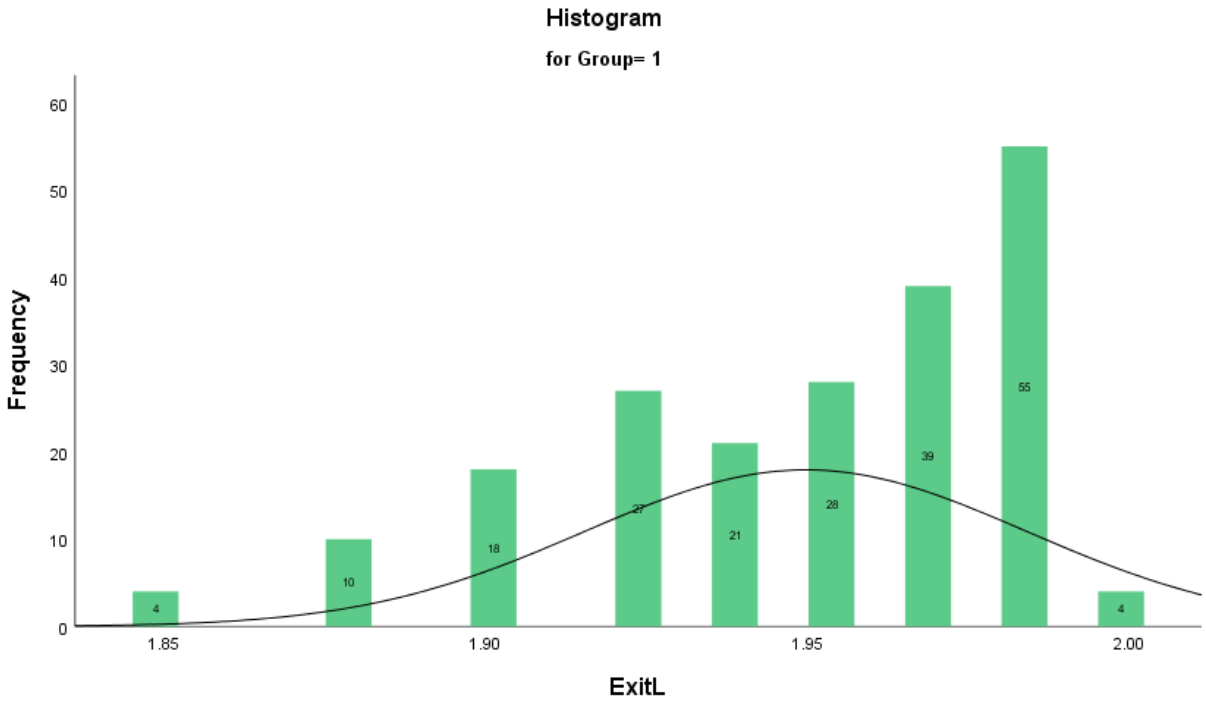
Independent-Samples Kruskal-Wallis Test

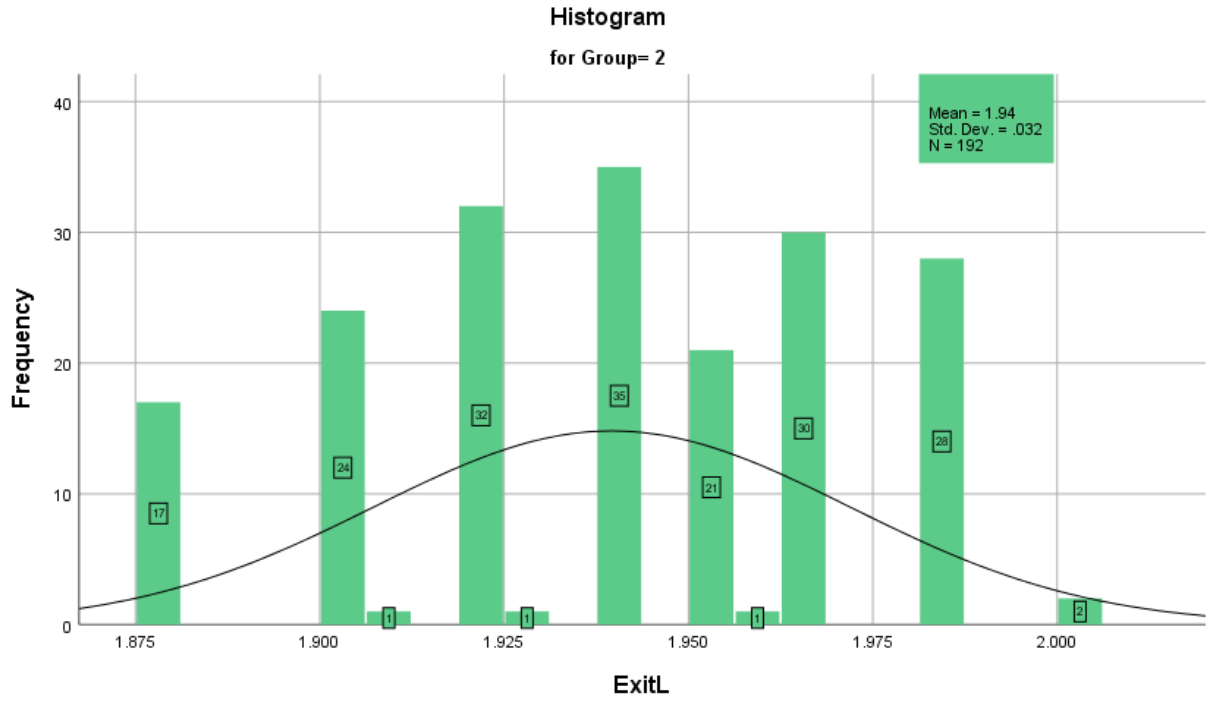


Total N	413
Test Statistic	2.079
Degrees of Freedom	1
Asymptotic Sig. (2-sided test)	.149

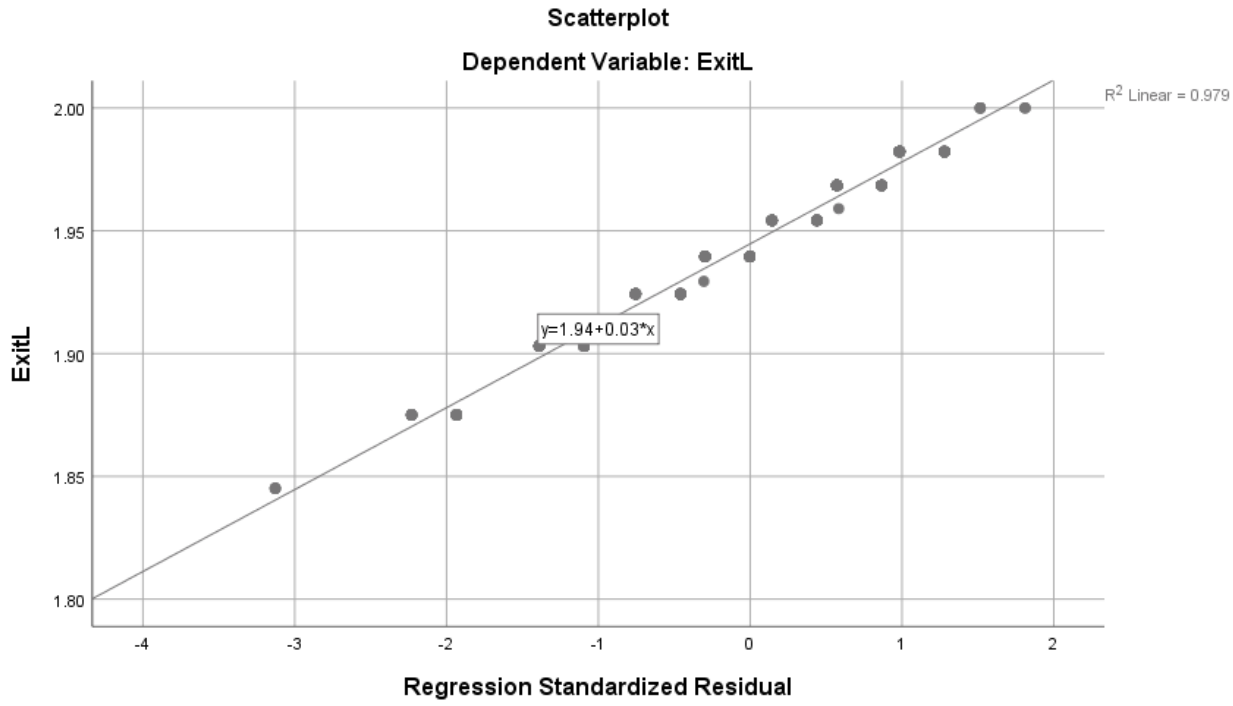
1. The test statistic is adjusted for ties.
2. Multiple comparisons are not performed because the overall test does not show significant differences across samples.

Assumption 5 ANOVA/ANCOVA &





Homoscedasticity Assumption 8 for ANCOVA

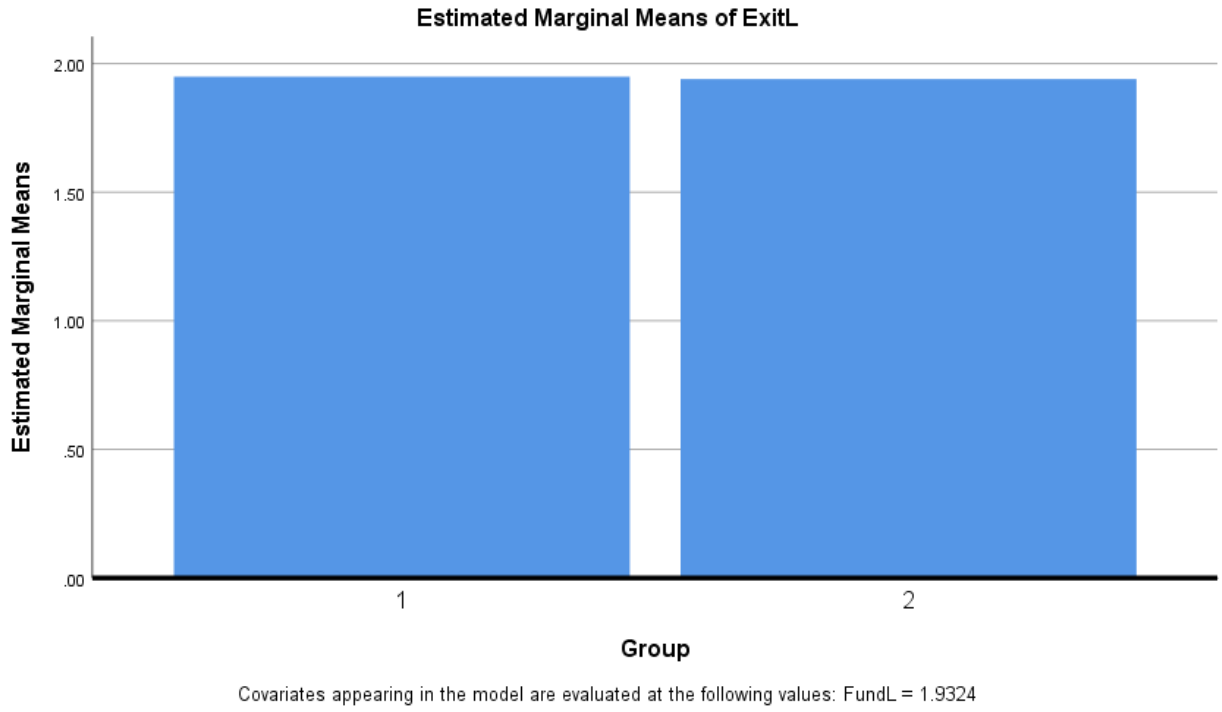


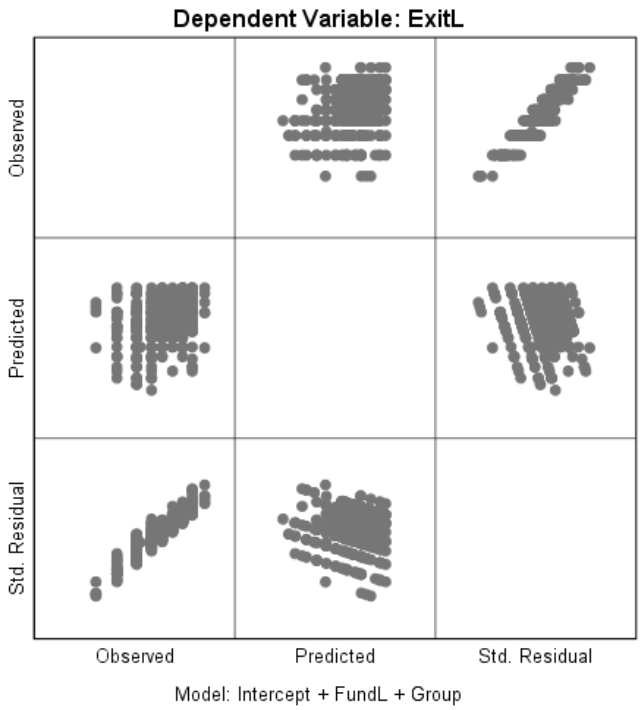
Univariate Tests

Dependent Variable: ExitL

	Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Contrast	.009	1	.009	8.796	.003	.022
Error	.405	395	.001			

The F tests the effect of Group. This test is based on the linearly independent pairwise comparisons among the estimated marginal means.




Dependent Variable: ExitL
Observed
Predicted
Std. Residual
Observed
Predicted
Std. Residual
Model: Intercept + FundL + Group