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A Self-Guided Educational Program Based on Informatics Competency Self-Assessment

Brenda J. Kulhanek
Walden University

Walden University

College of Nursing

This is to certify that the doctoral study by

Brenda Kulhanek

has been found to be complete and satisfactory in all respects,
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Review Committee
Dr. Deborah Lewis, Committee Chairperson, Nursing Faculty
Dr. Robert McWhirt, Committee Member, Nursing Faculty
Dr. Joanne Minnick, University Reviewer, Nursing Faculty

Chief Academic Officer and Provost
Sue Subocz, Ph.D.

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Abstract

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Brenda J. Kulhanek

PhD, Capella University, 2010

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Project Submitted in Partial Fulfillment

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Doctor of Nursing Practice

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Abstract

The informatics competency gap for nurses has existed since the first use of technology in healthcare. Although numerous informatics competencies for nurses have been identified over the past 20 years, there is a lack of standardized educational content to help address the informatics competency gap. In a digital healthcare environment, the ability for nurses to understand and use informatics competencies is essential and the lack of informatics competency has a far-reaching impact. Based on the identified gaps, an informatics competency self-assessment tool with associated microeducation was developed to provide a standardized learning approach that would be supported by stakeholders in healthcare organizations. The electronic self-assessment tool embodies Knowles principles of adult learning. A review of current literature was performed using scholarly databases and peer-reviewed sources and a current nursing informatics competency self-assessment tool was identified to be used as the foundation of this project. Self-guided microeducation modules were developed, and a Delphi method was used to validate the content through the feedback of five subject-matter experts with informatics expertise. When completed, the electronic microeducation was linked to each question in the competency self-assessment tool. A final Delphi review of the educational project demonstrated that an informatics competency self-assessment tool with associated microeducation could provide a standardized learning approach that would be supported by stakeholders in healthcare organizations. This project impacts social change by providing a mechanism for to improve nursing informatics competencies that will reduce technology-related nursing burnout and improve patient outcomes.

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Dedication

This doctoral project is dedicated to my sweet husband Mark. He has kept the home fires burning and patiently reviewed thousands of pages of my writing during the completion of two doctoral degrees. I promise this will be my last.

I would also like to dedicate this project to my family, and especially my grandsons Cayson and Rylan. I hope that someday I will have the honor of presenting their doctoral degrees!

Acknowledgements

To paraphrase Sir Isaac Newton, we can see further by standing on the shoulders of those who came before us. In the world of nursing informatics and education, I owe a dept to those who have paved the way. I would like to first acknowledge my DNP committee chair, Dr. Deborah Lewis, for flawlessly guiding me through to project completion. I would also like to acknowledge my additional committee members Dr. Robert McWhirt and Dr. Jody Minnick for your expert and insightful input and guidance. My volunteer subject matter experts contributed their time and expertise to review my work and provide wise and insightful project feedback, I owe them a debt of gratitude. The nursing informatics and education world is a better place because of you! Finally, and foremost, I would like to thank my Heavenly Father for guiding my path and giving me the strength and clarity of mind to complete this project.

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Section 1: Overview of the Problem

Information technology was first used in healthcare almost 50 years ago (Evans, 2016). In the subsequent decades, the use of health information technology (HIT) has integrated into almost every area of care delivery in the United States. Over 95% of hospitals and 80% of physician offices are now using technology to view and document patient care (Colicchio et al., 2019; McBride et al., 2018). Unfortunately, there was little early focus on assisting nurses to keep pace with the expansion of HIT by providing them with the necessary education, thus impacting the ability of many nurses to provide quality patient care (De Leeuw et al., 2020; Lambooij et al., 2017; Schenk et al., 2021).

In 2004, the Technology Informatics Guiding Education Reform (TIGER) initiative was formed with an initial mission of raising awareness of the need for nurses to become competent in their use of HIT ("The TIGER initiative", 2006), leading to a call for action to add informatics competencies into nursing school curriculum (Sensmeier, 2007). However, an estimated 2 million current registered nurses in the United States attended nursing school prior to the widespread use of HIT in healthcare and before the recommendations of the TIGER initiative (Zhang et al., 2018). Consequently, a large segment of the nursing workforce may have not received education on informatics competencies, resulting in a potential knowledge and competency gap (Furst et al., 2013; Kinnunen et al., 2019).

Health care is complex and reflected in the complexity of HIT systems. The use of HIT is not an intuitive process for nurses and requires training (Al-Rawajfah & Tubaishat, 2019), and additional specialized training may be needed to work with

detailed data (Grisot et al., 2019). Each HIT system differs in how information is accessed and documented (Koppel & Kuziemsky, 2019), and nurses must be able to easily access and use the tools required for their daily work (Tubaishat, 2018). In addition to the ability to use HIT, nurses must also be competent in their understanding of the purpose of HIT (Furst et al., 2013), but academia and practice have not kept pace with the rapid spread of technology within healthcare (Sensmeier et al., 2017; Skiba, 2016). Add summary and synthesis throughout the paragraph to balance out the use of information from the literature.

Background

Nurses work in a digital health care environment, and technology cannot be separated from the clinical practice of nurses. However, the lack of informatics competencies for nurses and the need for standardized informatics competency education hampers the ability of nurses to fully utilize HIT. Enhancing informatics competency for nurses and providing standardized informatics education will help move health care towards full utilization of the benefits of HIT.

Problem Statement

Since initial inception almost 50 years ago, evolving HIT is now integrated into almost all aspects of patient care in developed countries (Evans, 2016). However, the ability of nurses and other healthcare workers to fully use HIT has lagged far behind technology implementation. The initial TIGER initiative raised awareness of the need for informatics education to be incorporated into nursing education (O'Connor et al., 2017; Sensmeier, 2007; Weaver & Skiba, 2006), and current work is focused on

standardizing informatics education for nursing students across the globe (Hübner et al., 2016). For those attending nursing school after the widespread introduction of informatics concepts into nursing curriculum, there remains a lack of standardization and adequate preparation for the realities of the workforce (Forman et al., 2020).

The ability to understand and use nursing informatics competencies in the workplace is essential and the lack of competencies has a wide-reaching impact. The lack of informatics competencies has been associated with reduced nursing efficiency (Nation & Wangia-Anderson, 2019), patient dissatisfaction (Meyerhoefer et al., 2018), poorer patient outcomes (Furukawa, 2020), and increased errors (Billings et al., 2019; Zadvinskis et al., 2018). Although TIGER recommendations have focused on the need for informatics education for all nurses for over a decade (Sensmeier et al., 2017), the lack of available standardized informatics educational content for practicing nurses points to the need for a nursing informatics educational program.

Purpose Statement

The purpose of this doctoral project was to develop an educational program based on an informatics self-assessment tool to address the identified gap in nursing informatics competencies. The educational program was designed to provide concise, focused education that addressed the specific informatics competency needs identified by the competency assessment tool. The Nursing Informatics Competency Assessment Tool (NICAT) informatics competency self-assessment tool was intentionally chosen to provide targeted questions that focus on the foundational areas of informatics that can best impact and improve the work of nurses and patient care (Rahman, 2015). With

stakeholder support, an informatics educational program can provide the foundational informatics information needed by all nurses and could provide an efficient and effective means of distributing education. The practice focused question for this project was “Will the creation of an informatics competency-based microeducation program offer a standardized learning approach that will be supported by stakeholders in a healthcare organization?”

Nature of the Doctoral Project

The development of this capstone project addressed a gap in informatics knowledge for nurses. The complete project provided efficient ways for nurses to improve their informatics competencies through a self-assessment tool. The foundation of the selected informatics self-assessment tool included identification of the informatics competencies that should be demonstrated by all nurses who work with health information technology (Rahman, 2015).

Significance

The educational product created by this doctor of nursing (DNP) project impacts staff nurses who use health information technology to care for patients. Improved HIT competency in computer literacy, informatics literacy, and information management will allow nurses to better use HIT(Weaver & O'Brien, 2016). HIT competency will allow nurses to locate, analyze, and use data, and to follow HIT workflow to document information in the proper manner and location. Improving HIT competencies can improve patient safety, decrease healthcare associated errors, improve nursing satisfaction, increase nursing efficiency, and provide more reliable organizational data

(Craswell et al., 2016; Lambooij et al., 2017). Improved HIT competencies may also impact the wisdom of nurses by helping them to access data, which flows to information, knowledge, and wisdom (Nation & Wangia-Anderson, 2019).

Summary

A significant portion of registered nurses in the United States attended nursing school prior to the widespread advent of HIT (Zhang et al., 2018). These nurses did not have the opportunity to learn about HIT or to gain competence in HIT while attending nursing school. In addition, there is little evidence that nursing schools are providing a standardized approach to education about HIT competencies to current students (Bove, 2020), although efforts are underway to refine this approach (O'Connor et al., 2017). To add to the issue, nursing faculty themselves are often lacking the necessary HIT competencies to adequately address this topic in the classroom (Bove, 2020; Forman et al., 2020). The purpose of this doctoral project was to provide foundations informatics education for all nurses, based on a self-guided informatics competency assessment. This tool can be used by healthcare organizations as an efficient and cost-effective tool that can improve patient care, quality, outcomes, nursing satisfaction, efficiency, and data quality.

Section 2: Background and Context

There is a gap in nursing informatics knowledge and competencies in the nursing workforce. Many nurses were educated and entered the nursing workforce prior to the widespread implementation of HIT in healthcare delivery settings (Zhang et al., 2018). Additionally, the informatics education provided in nursing schools for those nurses entering practice after HIT implementation has not been standardized in either content or program ((Forman et al., 2020; Orhan & Serin, 2019). In a review of top-rated online nursing schools, just over half of the Bachelor's of nursing (BSN) programs offered at least one informatics course with little change from the prior 2013 study, about two-thirds of Master's of nursing (MSN) programs offered at least one informatics course, and doctoral programs included an informatics course at least 80% of the time (Bove, 2020). Based on the identified gap in informatics competencies in practicing nurses, the purpose of this doctoral project was to develop an educational program based on an informatics self-assessment tool for organizations to use to address the identified gap in nursing informatics competencies. The educational program was designed to provide concise, focused education that addressed the specific informatics competency needs identified by the competency assessment tool.

Concepts, Models, and Theories

The design and development of this project was guided by the framework of adult learning, or andragogy. According to the andragogy framework, adults learn best when certain conditions are met, which include the following six criteria:

- Adults must understand why they need to learn something before learning it.

- The self-concept of adults helps direct their learning as self-learning
- Adults approach learning with a rich history of experiences
- Adults are most ready to learn when they view learning as necessary preparation for a situation or task
- Adult learning is centered around the context of life and the ongoing process of achieving full potential
- The motivation for adult learners in intrinsic rather than extrinsic. (Knowles et al., 2005).

Developing informatics education based on a self-assessment tool aligns with the criteria outlined in andragogy. The self-assessment tool can not only be used when the learner realizes the need to learn something, but the question responses can further improve the learner's understanding of their own informatics knowledge gaps. An on-demand self-assessment tool places control of learning into the hands of the learner, thus supporting the concept of self-learning. In addition, the use of a self-assessment tool allows for past life experiences and knowledge to be validated such that only that which needs to be learned is completed.

Adults are most ready to learn when they see the need to prepare for a situation or task (Knowles et al., 2005), therefore an on-demand self-assessment driven learning tool can provide a just-in-time learning solution. Adults view learning as part of the process of achieving full potential (Knowles et al., 2005), thus gaining knowledge and skills from the self-assessment driven learning tool can facilitate movement towards improve knowledge and skills. Finally, by providing an organization with a self-service tool, the

organization can view the nurse as an adult learner who can make their own determination on when and how learning occurs and gain internal satisfaction from enhanced knowledge and skills.

Relevance to Nursing Practice

HIT has become the stethoscope of the 21st century and is integrated into and most aspects of nursing practice, including patient information, documentation, treatment plans, and communication (Orhan & Serin, 2019). A lack of informatics competency can lead to poor or unreliable data quality (Colicchio et al., 2019; Craswell et al., 2016; Muthee et al., 2018), inefficient nursing practice (Al-Rawajfah & Tubaishat, 2019; Billings et al., 2019), increased errors (Aiken et al., 2018; Furukawa, 2020; Patterson et al., 2017), and decreased nursing satisfaction (Brown et al., 2020; De Leeuw et al., 2020). Concise and effective informatics education that is delivered to address knowledge gaps identified by a self-assessment may allow an organization to provide the informatics knowledge needed for nurses to optimize their practice while using adult learning theories to minimize the time impact to nurses and the organization.

Local Background and Context

Since the initial legislation spurred rapid adoption of HIT ("Executive Order 13335," 2004), the use of technology in all areas of healthcare has increased. Although there are continuing efforts to improve the usability of HIT (Al-Rawajfah & Tubaishat, 2019; Brown et al., 2020; De Leeuw et al., 2020), use continues to expand and the nursing workforce requires specialized training to be able to not only use the technology

but also to understand the informatics concepts that underpin HIT (de Fatima Faria Barbosa, 2017; Furst et al., 2013).

I conducted a literature search in multiple databases within the Walden online library to identify articles. Search terms included *HIT, health information technology, informatics competencies, education, training, errors, quality*, and *nurse(s)*. Available databases I used included CINAHL, ProQuest, MEDLINE, Ovid, PubMed, and Cochrane Database of Systematic Reviews. In addition, government websites and Google Scholar were used for further background literature. The literature search was based on articles dated within the past 5 years, although several earlier seminal and historical works have been included in the literature review and synthesis. Results of the comprehensive search provided 101 articles published in peer-reviewed, scholarly journals or on government websites.

History of Informatics and Competencies

Although nursing informatics has been a nursing specialty for almost 30 years (Cummins et al., 2016), the role of nurses in using technology has received little national attention. The 1999 report by the Institute of Medicine (Kohn et al., 2000) was the first to raise awareness about the errors in healthcare resulting from insufficient safety focus. The widespread use of HIT was touted as a solution for reducing healthcare associated errors (Institute of Medicine, 2001), however, the nursing profession was often absent from these conversations, obfuscating the need for nurses to attain education and competency in the use of HIT (Weaver & Skiba, 2006).

A workgroup formed to address the need for supporting nurses to use HIT asserted the following: (a) informatics is a core competency for healthcare professionals, (b) a majority of nurses in the workforce in 2006 lacked technology skills, (c) nursing leaders do not have the required HIT competencies to lead their organizations, (d) informatics was lacking in the curriculum for nursing school, and (e) there were few doctoral resources for informatics nurses to advance their education (Weaver & Skiba, 2006). A decade after this workgroup formed, the call for insertion of nursing informatics competencies into nursing school curriculum remains unfulfilled (Hebda & Calderone, 2010; Sensmeier, 2007; Walker, 2010), although there is movement towards globalizing informatics competencies for nursing education (Hübner et al., 2016; O'Connor et al., 2017). The initial call for informatics education for all nurses included education on informatics competencies within the workplace ("The TIGER initiative- Informatics competencies for every practicing nurse: recommendations from the TIGER collaborative," 2006), however, literature about teaching informatics competencies in the workplace is rare and primarily focused on learning to use a specific organizational technology during HIT implementation (Traynor, 2018).

HIT and Usability Factors

The need for foundational informatics competencies is seen in the workplace as issues with quality, errors, insufficient technology literacy, and lack of adoption (Schenk et al., 2021). The implementation of HIT often results in unintended consequences such as decreased team communication (Hassan, 2018; McBride et al., 2018), increased or minimally decreased rates of errors (Aiken et al., 2018; Bauer et al., 2020; Muthee et al.,

2018), and breaches in patient privacy (Weiner, 2017). Issues with data quality inhibit the ability to confidently analyze and report on big data, and impacts machine learning and predictive analysis (Bauer et al., 2020; Craswell et al., 2016; Topaz et al., 2019). Nurses with more nursing experience are less efficient when using HIT and less satisfied with using technology in their daily work (McBride et al., 2017). Educating nurses on foundational informatics competencies may improve the quality and adoption of HIT for nurses working in a digital healthcare environment.

Higher levels of computer literacy positively impacted self-reported assessments of informatics competency (Kleib & Nagle, 2018b), but computer literacy had no relationship to satisfaction with the electronic health record (EHR) (McBride et al., 2017). Challenges with using technology resulted in poorer attitudes towards HIT (De Leeuw et al., 2020), low confidence in HIT at the time of system implementation (Schenk, 2016), and attitudes did not improve as nurses gained more experience and comfort with using technology (Schenk et al., 2021). Computer literacy alone is not the solution to improved use of HIT.

Usability of HIT presented an additional challenge for nurses and included themes such as age, computer skills, educational level, knowledge of HIT, training, functionality of HIT systems, and the resulting personal stress and attitudes towards HIT (Vehko et al., 2019). Technology in healthcare has been widely in use for at least 5 years (Colicchio, et al., 2019), however, the complexity and challenges of technology use and alignment with nursing workflow remains unchanged (Robichaux et al., 2019; Schenk et al., 2021). Despite the pervasive integration of HIT into the work of nurses, the complexity of the

technology along with workflows that do not align with how nurses work continues to present challenges to nurses of all ages and computer skill levels.

Age

The age of the registered nurse often impacts the ability to use HIT. Senior nurses are not as competent and comfortable with the use of computers (Al-Rawajfah & Tubaishat, 2019; Bramble, 2016; Brown et al., 2020; De Leeuw et al., 2020), resulting in more time required to use HIT for patient care. In addition, the longer ago nursing education was completed, the lower the computer abilities of the nurse and a higher negative impact on their use of HIT (Al-Rawajfah & Tubaishat, 2019; Bramble, 2016; Brown et al., 2020; De Leeuw et al., 2020). In the current nursing workforce, the use of HIT remains a challenge and barrier for senior nurses that impacts their ability to provide efficient and effective patient care.

In contrast to their technology abilities, mature nurses often had a better sense of nursing workflow and the entire flow of patient care, despite the intrusion of HIT into their work (Bramble, 2016), yet also displayed lower levels of technology acceptance. These nurses were very seasoned in their daily work and viewed the EHR as a barrier to efficiency (Tubaishat, 2018). Like the entire nursing population, over time seasoned nurses gained more confidence and proficiency in the use of the EHR regardless of age or preexisting technology skills (Schenk et al., 2021; Schenk, 2016; Zadvinskis et al., 2018). When nurses are provided with microeducation designed to enhance their informatics skills and EHR use, acceptance and proficiency of HIT may improve.

Computer Skills

The lack of computer skills was associated with decreased efficiency in using EHR technology (Bramble, 2016; Tubaishat, 2018), and decreased technology skills coupled with complex technology can result in an increase in mental energy, leaving the nurse at risk for inadequate clinical judgment and less than optimal performance (Al-Rawajfah & Tubaishat, 2019). The use of technology that is not fully integrated into the work of nurses may increase nursing fatigue. However, decreased computer skills were not correlated with decreased acceptance of HIT, pointing to the conclusion that computer skills alone are not a predictor of HIT acceptance (McBride et al., 2017). Nurses felt that computer skills should be included in training offered by health care organizations to help improve their computer skills and facilitate their work (Bramble, 2016; De Leeuw et al., 2020). Although computer skills contribute to ease in using HIT, computer skills alone do not fully address the lack of HIT acceptance that can facilitate the work of nurses. Informatics microeducation may provide the means to improve computer and technology understanding and skills.

Educational Level

The educational level of the nurse correlated with increased acceptance of health information technology (Al-Rawajfah & Tubaishat, 2019), and leadership nursing positions viewed HIT more positively (McBride et al., 2017; Tubaishat, 2018). Those with lower educational levels were at risk for having decreased computer skills, resulting in lower HIT acceptance and trust (Bani-Issa et al., 2016). A study based in China, with a younger nursing population with a high level of education, nurses had high rates of

acceptance of the EHR even when faced with a large documentation burden, but the lack of experience and younger age of the nurses in this study may have influenced their attitude towards the burden of technology (Bei-Lei et al., 2019). Nursing leaders often possess higher levels of education than staff nurses, however, there is an urgent need for nursing leaders to obtain informatics competency (Collins et al., 2017). Although younger nurses and those with higher levels of education have a more favorable impression of HIT, the lack of informatics competency in nursing leaders points to the need for additional informatics competency education.

Informatics Background

Nurses approaching patient care with existing knowledge of informatics concepts are better prepared to accept and use HIT. When nurses are not aware of the safety background and purpose of some HIT functions such as alerts and alarms, they can become fatigued and dissatisfied with the technology (Robichaux et al., 2019), and they can remain ambivalent about the benefits of HIT in the nursing workplace (Schenk et al., 2021). HIT contains abundant and powerful data that can be used to increase the safety and quality of patient care; however, without awareness of the use and importance of data contained within HIT systems, nurses can overlook the information needed to best perform their roles (Weaver & O'Brien, 2016), resulting in uninformed decision making (Williams et al., 2019). In contrast, when nurses received informatics education to improve awareness and competency, they demonstrated enhanced competency in using HIT systems (Jouparinejad et al., 2020). A lack of informatics competency within the

nursing workforce not only impacts effective use of HIT but decreases the ability for nurses to fully use the data and information contained in HIT systems.

Training

Organizations typically provide training to nurses when HIT is implemented or changed. Training often addresses the specifics of the implemented HIT technology but not the overarching concepts of informatics, and training can be highly variable between organizations (De Leeuw et al., 2020; Staggers et al., 2018). HIT training during orientation is insufficient to address the complexities of nursing practice (Brown et al., 2020; Vehko et al., 2019), and is more effective when supported by ongoing training and the input of informatics support (De Leeuw et al., 2020; Schenk, 2016). Nurses may benefit not only from training to use HIT, but also from modeling of HIT behaviors in training, including communication skills when using technology (Robichaux et al., 2019; Vehko et al., 2019). Due to the continual changes and upgrades to HIT, ongoing education is recommended (De Leeuw et al., 2020; Schenk et al., 2021; Staggers et al., 2018). Nurses are trained to use the HIT within their organization, but without informatics competency the nursing workforce is not fully realizing the full potential of HIT to improve patient care when working in a digital health care environment.

Functionality

Although functionality is often associated with the design of the technology rather than informatics competency, is also plays a role in the ability of nurses to perform their work adequately and effectively and can contribute to increased stress and burnout (De Leeuw et al., 2020; Vehko et al., 2019). A poor match between HIT and nursing

workflow can be seen in mandated documentation that may be unnecessary or duplicative and results in negative impacts to time management (Brown et al., 2020). When usability is not optimal, safety issues can arise from workarounds (Robichaux et al., 2019). Nurses can also become desensitized and fatigues from the overuse of alerts and alarms (Robichaux et al., 2019), hardware and network issues such as slow screen loading time or interrupted access to information (Brown et al., 2020), inconsistency in appearance and function (Koppel & Kuziemsky, 2019), lack of ease and efficiency in accessing and viewing key data (Schall et al., 2017), and lack of visibility into the work of nursing (Stein et al., 2019) within HIT systems. EHR systems with poor functionality produce additional barriers for nurses using HIT for patient care. When informatics competency is insufficient, nurses may fail to recognize and use the safety elements that are embedded in HIT systems.

Nurses who view HIT as more reflective of their work find more value in, and demonstrate higher acceptance of HIT (Lambooij et al., 2017). Nurses who view HIT as detracting from patient care due to usability issues exhibit higher levels of job dissatisfaction and burnout (Nation & Wangia-Anderson, 2019). A lack of interoperability forces the nurse to become the hub of communication responsible for ensuring information flows between and across systems (Staggers et al., 2018). Recommendations for improved functionality include removal of unnecessary documentation and forms (Brown et al., 2020), creating processes that provide essential information for nurses that is easily accessible in HIT systems (Schall et al., 2017), and redesign of HIT to better reflect nursing workflow with a focus on efficiency and

usability (Nation & Wangia-Anderson, 2019). Although improving the functionality of HIT can decrease the barriers causing nursing dissatisfaction, a lack of informatics competencies can decrease the ability of nurses to advocate for the improved HIT functionality that can improve their daily work.

Emotional Impact

Although nurses consistently report stress and anxiety prior to, and during the early implementation period of HIT (Bramble, 2016; Schenk, 2016), over time they adapt to system functionality whether or not usability is optimal. When systems remain cumbersome, the nurse will adapt but system function will continue to contribute to ongoing uncertainty about the use of HIT for nurses (Schenk et al., 2021). High levels of stress in nursing have been associated with use of the EHR, and subsequently with nursing burnout (Wedding, 2019). There is a correlation between reduced satisfaction with HIT and nursing burnout (Khairat et al., 2020). Components of dissatisfaction can include inefficient HIT (Brown et al., 2020), and conversely, satisfaction increases as usability and perceived benefits of HIT increase (Vitari & Ologeanu-Taddei, 2018). A majority of nurses in the United States, and across the globe, use HIT for some or all aspects of patient care. Nurses continue to experience disruption to their work due to HIT and usability issues, and as a result experience dissatisfaction and burnout. As HIT more closely matches the work of nurses, satisfaction improves.

The Nursing Workforce

Within the nursing workforce, 37% of nurses working in the United States in 2015 were aged 50 and above, 36% of nurses were aged 35-39, and 27% of working

nurses were under age 35 (Buerhaus, 2017). Using the assumption that a majority of nurses attended nursing school shortly after completing secondary school, approximately 73% of the nursing workforce in 2015 attended nursing school prior to the widespread use of HIT, or incorporation of informatics concepts into nursing schools (Zhang et al., 2018).

Informatics Competency Models

Over the past two decades, multiple nursing informatics competency models have been developed, each using a different lens to identify informatics competencies for different nursing roles. Based on output from an earlier nursing informatics workgroup, Staggers et al. (2001) developed a list of 305 informatics competencies for nurses, grouped by experience level and role. This list was reviewed using a team of informatics subject matter experts in a Delphi study (Staggers et al., 2002), resulting in a final list of 281 informatics competencies. These competency lists remained categorized by the nursing roles of beginning nurse, experienced nurse, specialist, and nurse innovator.

The development of informatics competencies for nurses continued to evolve with the work of the TIGER initiative. Similar to the work of Staggers et al. (2002), a broad range of stakeholders convened to continue the earlier work of others and produce a standard list of informatics competencies. The TIGER initiative grouped their final list of informatics competencies into three functional categories that included basic computer competencies, information literacy competencies, and information management competencies. A total of 231 individual competencies were published, grouped within the three categories ("The TIGER initiative- Informatics competencies for every practicing

nurse: recommendations from the TIGER collaborative," 2006). Despite continuing work to establish and promote this list of informatics competencies for all nurses that is intended to be integrated into education and practice, the sheer number of competencies has created barriers to forward movement.

To advance the spread of informatics competencies into nursing and nursing education, Hebda & Calderone (2010) refined the list of informatics competencies published by TIGER to reflect the approach of nursing educators. The prior list of 231 competencies was condensed and refined to include 15 high-level competencies grouped into categories of all nurses, beginning nurses, and experienced nurses. The work of Hebda & Calderone created a more efficient list of competencies by removing concepts that were outdated based on a technologically maturing nursing population.

As globalization of health care continued, informatics competencies for nurses needed to keep pace. The TIGER initiative promoted a global informatics competency harmonization effort reflecting the informatics requirements for nurses around the world, and the updated approach to informatics based on increasing technical competency in nurses (Sensmeier et al., 2017). Based on the ongoing international evolution of nursing informatics competencies, the efforts have shifted from specific competencies to themes. The top six informatics competency categories for clinical nurses were established and consist of nursing documentation, information knowledge management, principles of nursing informatics, data protection and security, ethics and IT, and information communication systems.

Additional competency work has resulted in variations on models, and the highly detailed aspects of informatics competencies have dissolved into a more conceptual approach to nursing informatics competency (Hübner et al., 2018). Despite the attempts to define and qualify a specific list of informatics competencies for nurses, there appears to be no single model or list of informatics competencies for nurses in practice or education (O'Connor et al., 2017) that meets the needs of all nurses. The development of informatics microeducation provides a standardized method for gaining basic nursing informatics competency.

The role of the nursing leader is essential for the forward movement and effective use of HIT in a digital healthcare world. A large percentage of nursing leaders possess nursing informatics knowledge that was obtained on the job or through other means (Collins et al., 2017). Without informatics competencies, nurse leaders lack the ability to guide and evaluate the technologies and processes in use within healthcare (Strudwick, Nagle, et al., 2019). Additionally, nurse managers work closely with nurses who provide patient care and play a strong role in informatics adoption through education and advocacy (Strudwick, Booth, et al., 2019). Nursing leaders guide and support the use of HIT for their nursing staff, and informatics competency is essential for this role.

Academia

Ongoing development of nursing informatics competencies through nursing education have been hindered by gaps in faculty informatics knowledge, experience, and support of the importance of nursing informatics concepts (Jeon et al., 2016; McGowan et al., 2020). In addition, informatics concepts and courses are not yet incorporated into

the curriculum in all baccalaureate or graduate nursing programs, with DNP programs demonstrating the highest number of informatics content and BSN programs with the lowest levels of content (Bove, 2020). For nursing education programs that contain informatics concepts, there is a high amount of variation in content. (Ying et al., 2017). Development of standard informatics content for nurses could help address the informatics knowledge gap seen in nursing faculty.

A majority of pre-licensure nursing schools report integrating informatics into the curriculum, but closer inspection reveals that faculty can interpret the use of technology for online coursework as nursing informatics, making study results questionable (Vottero, 2017). Promisingly, there has been work to create informatics educational materials for academic use as seen in the Canadian informatics teaching toolkit (Forman et al., 2020), and the work to identify global informatics competencies for education (Cummings et al., 2016; O'Connor et al., 2017) but there is opportunity for a more comprehensive approach, similar to that seen in Canada, for integrating informatics curriculum into nursing schools at all levels of education.

Entry-level nurses exhibit higher levels of informatics knowledge upon entry into practice and were able to access information resources (Wahoush & Banfield, 2014), but lacked the preparation needed to seamlessly incorporate HIT into their practice (Shin et al., 2018), and demonstrated more confidence than competence with this use of HIT (Mitchell, 2015). For optimal application of informatics education, coursework must be designed to include not only informatics knowledge and content, but context and application to practice (O'Connor & LaRue, 2021). Although entry-level nurses may have

higher levels of technical skills and a higher level of informatics knowledge, these nurses would benefit from standardized informatics competencies in their nursing education.

A self-guided educational program based on an informatics competency self-assessment addresses an identified gap in knowledge and competency and provides an organization with an efficient method to enhance informatics competency in the nursing workforce. The educational program will address foundational informatics competencies that are needed for all practicing nurses who use HIT (Kinnunen et al., 2019; Kleib & Nagle, 2018a; Rahman, 2015). Not included in the informatics competency self-assessment and educational tool are specialized competencies needed for nursing specialty roles and nursing leaders (Jouparinejad et al., 2020; Strudwick, Booth, et al., 2019).

Role of the DNP Student

Nurses may be lacking competency or complete understanding of the foundational concepts of nursing informatics. Nurses who attended nursing school prior to the pervasive use of HIT in healthcare lack education about foundational informatics concepts. The nursing population educated after HIT became incorporated into healthcare may have more understanding of the role of informatics in nursing. However, the inclusion of informatics concepts into nursing school educational content is neither universal nor standardized. Additionally, nursing faculty may lack the informatics competencies and knowledge needed to adequately teach and understand the topic. This identified gap not only impacts the ability of nurses to provide the highest quality of care,

but impacts patient safety, nursing efficiency, nurse satisfaction, and presents a financial impact to healthcare organizations.

As a nurse with leader with past roles in both nursing informatics and nursing education, I have drawn upon my experiences and insights to develop a method for educating nurses about informatics concepts that provides easily accessible foundational informatics knowledge for nurses. I believe that organizations will be able to adopt the competency self-assessment and self-guided educational tool with minimal impact to nursing operations and increased benefit to patient care, quality, and outcomes.

Role of the Project Team

This doctorate of nursing practice project required a collaborative team approach. The project team consisted of subject matter experts in both nursing informatics and nursing education. Each subject matter expert provided input into the development and functionality of the tool to enhance the final product of a completed informatics competency self-assessment tool that provides effective and concise self-guided education.

Summary

Without knowledge of foundational nursing informatics competencies, nurses are not able to fully optimize the use of HIT in their daily work to improve care quality and outcomes. Lacking an understanding of informatics concepts, nurses experience role dissatisfaction, frustration and stress, and rising levels of burnout that are associated with HIT. Section three provides the background and evidence supporting the history, current state, and existing gaps in foundational nursing informatics education and knowledge.

Section 3: Collection and Analysis of Evidence

Despite the promises associated with the implementation of HIT into healthcare delivery in the United States, opportunities exist to improve efficiency, quality, outcomes, data integrity, and to decrease errors. Increasing complexity, time pressures, and the generational mix of the nursing workforce presents a variety of informatics competencies and knowledge (Farzandipour et al., 2021). The purpose of this doctoral project was to create an educational tool that can help increase informatics knowledge and competency for nurses. In this section, sources of evidence for the project development, participant selection and protection, and data collection and analysis processes will be discussed.

Practice-Focused Question

The purpose of this doctoral project was to develop a self-guided educational program, based on an informatics competency self-assessment, to provide an organization a tool that can provide the informatics education that nurses need to improve quality, outcomes, and data integrity while increasing efficiency and decreasing errors. A self-guided educational program aligns with adult learning theory and provides a just-in-time method of education that is minimally impactful to nursing staffing and educational budgets but provides the knowledge needed for a nursing workforce that must effectively use HIT. Based on the identified nursing need, the practice focused question was “Will the creation of an informatics competency-based microeducation program offer a standardized learning approach that will be supported by stakeholders in a healthcare organization?”

Sources of Evidence

A doctoral project must be supported with current evidence and informed by best practices, evidence, and expert input. A combination of scholarly sources bridging multiple disciplines provided the evidence to support this project. Development of this doctoral project was based on learning and education research, informatics literature, and the input of informatics subject-matter experts.

Evidence Generated for the Doctoral Project

Evidence collected for this project was obtained from a review of informatics literature, and through collaboration with subject matter experts in the specialties of nursing informatics and nursing education. The experts are known to me from past professional association and were selected for their specific knowledge areas to provide multiple perspectives on the project. Because this doctoral project was intended to be used by any nurse, it was important to gain input with the perspectives from many different areas of nursing education and informatics.

Sources used to design the self-guided education were obtained from current literature. Multiple databases found within the Walden online library were used for a literature search. Search terms included *HIT, health information technology*, *informatics competencies, education, training, errors, quality*, and *nurse(s)*. Available databases I used included CINAHL, ProQuest, MEDLINE, Ovid, PubMed, and Cochrane Database of Systematic Reviews. In addition, government websites and Google Scholar were used for additional selections. The literature search was focused on articles dated within the past 5 years, and seminal or historical works were included in the review of literature.

Results of a comprehensive literature search yielded over 500 articles which were reviewed to create a final list of 104 articles published in peer-reviewed, scholarly journals or on government websites.

The literature continues to echo themes first noted over 20 years ago. Nurses need to possess competency in informatics to work in a highly digitized healthcare environment (Jouparinejad et al., 2020; Staggers et al., 2001). However, nurses do not currently possess the level of informatics competencies necessary to practice safely and efficiently (Aiken et al., 2018; Furukawa, 2020). Nurses with a graduate level of education have a somewhat better understanding of informatics but do not have the ability to apply that knowledge in practice (Mitchell, 2015). According to researchers like Bove (2020) and Cummings et al. (2016), academic institutions are not reliably providing informatics education or concepts to students. Despite over two decades of HIT implementations and use in health care environments, the informatics competencies of nurses have not kept pace with the rate of technology growth and implementation.

Participants

Participants who assisted me in the development of the doctoral project were selected based on their levels of education, current professional roles, and their ability to provide a unique perspective both during the project development and upon completion of development. Five subject matter experts provided review and input for the doctoral project, each of the subject matter experts possesses a doctoral degree or a graduate degree and a leadership position within an organization.

The first subject matter expert holds a PhD in education and performance improvement and currently directs the HIT education team at a large university medical center. Her experience with creating, delivering, and evaluating HIT training provided insight into the knowledge gaps that nurses currently possess at all stages of their careers. The second participating expert is the director of the nursing informatics team at the same university medical center and is responsible for many informatics nurses who function in each nursing inpatient area as well as over 200 outpatient clinics. Through her ongoing work to train new informatics nurses and nursing informatics liaisons, she was able to provide input into what types of informatics competencies are needed for all nurses. A third expert reviewer holds a DNP degree and is the senior associate dean of nursing informatics at a university. Her input as an education leader and educator provided invaluable academic perspective for the project. A fourth content expert holds a DNP degree and is the director of an outpatient clinical informatics team at a large healthcare facility in Maryland, and functions as an adjunct clinical faculty for a nursing informatics graduate program. Her current work with nurses in multiple care settings, including outpatient settings, added an additional dimension to the review of the project. The fifth reviewer is the nurse residency program director at a university medical center, she was able to provide information and input on the informatics learning and competency needs for graduate nurses, as well as the best ways to format and deliver education to this nursing population, based on self-assessment.

Procedures

The doctoral project was developed using the existing NICAT informatics competency self-assessment tool, which contains 21 questions. The self-assessment tool was developed and previously validated by the author of the tool (Rahman, 2015). Permission was obtained from the author for use of the tool, and also to make one change in section I.3 of the tool to update the types of electronic communication tools currently in use in the United States. Microeducation was developed for each of the 21 self-assessment questions, and the completed microeducation was incorporated into the informatics competency assessment tool and placed into an electronic survey.

Using a Delphi technique, the five subject matter experts participated in a formative and summative evaluation of the educational tool. To guide initial development of the educational content, the subject-matter experts were emailed a prototype and the proposed content for the first version of the informatics competency self-assessment and educational program, including a survey (Appendix A). The formative survey gathered subject matter input about the proposed microeducation for each of the 21 associated competency questions. Based on the formative subject matter expert feedback, the microeducation was updated and finalized. The completed doctoral project was sent to the subject matter experts to collect final summative feedback. When subject matter experts received the summative survey (Appendix B), the finalized microeducation modules were embedded into the electronic survey, and each microeducation module was also linked to the matching survey question to facilitate review. The subject matter

experts were given three weeks to complete both the formative and then the summative survey.

Protections

The electronic survey was designed to be anonymous, allowing the subject matter experts to respond candidly and without bias. The formative and summative survey forms were developed specifically for this project and contained a series of three questions for each competency-associated microeducation module. The subject matter experts provided input on the correctness of the education, the clarity of the microeducation, and the completeness of the education. If the subject matter expert responded to a question indicating that the microeducation is not clear, complete, or correct, a text box was available for additional comment within the survey. The use of an answer-based branching scenario in the survey provided efficiency for the subject-matter experts and aligned responses with the correct microeducation module. The survey was designed to require answers for each question so that the survey tools would contain complete information when returned. The summative survey contained survey questions that focused on the acceptability of the completed microeducation modules that were all updated based on the prior formative input. This survey approach provided efficiency for both the subject-matter experts and the doctoral student.

Analysis and Synthesis

Survey results from the five subject matter experts were reviewed both quantitatively and qualitatively. Quantitative results were obtained from yes/no responses and were presented using mean scores. Qualitative data was analyzed for topic content

and responses were based on a presentation of the completed competency self-assessment topic and associated microeducation. Survey scores were downloaded from the electronic survey tool in spreadsheet format and maintained as a password-protected document on a personal computer. Completed survey results are being stored in a secure digital location and will be maintained for at least five years after completion of this study. Survey responses and qualitative feedback were used to refine the doctoral project educational content.

The purpose of this doctoral project was to develop and validate a self-guided educational program based on informatics competency self-assessment. Although the newly developed tool was not implemented as part of this doctoral project, and did not involve study subjects, permission was be obtained from the Walden University Institutional Review Board, approval 05-07-21-0295709, and notification was made to the primary health care facility associated with this doctoral project, and it was determined that IRB approval from the health care facility was not needed.

Summary

In this section, the project development plan, collection, and analysis of formative and summative evidence was presented. The purpose of this doctoral project was to develop an educational program based on informatics competency self-assessment. The input and feedback from organizational stakeholders was used to help address an identified nursing knowledge gap and assist in answering the research question: Will the creation of an informatics competency-based microeducation program offer a standardized learning approach that will be supported by stakeholders in a healthcare

organization? The next section of this paper will focus on the development of the self-guided educational program based on individual nursing informatics competency assessment.

Section 4: Findings and Recommendations

The purpose of this doctoral project was to address the identified gap in nursing informatics competencies through the development of an educational program based on an informatics self-assessment tool. An existing informatics tool was used as the foundation for this project (see Rahman, 2015). Microeducation was developed for each of the 21 self-assessment questions in the existing tool. The microeducation was reviewed by a group of informatics subject matter experts, using a modified Delphi approach to provide formative and summative responses. The anonymous survey data was obtained using a commercially available survey tool, and data were analyzed using quantitative and qualitative methods. In this section, the findings of the project data collection, implications of the project, the contributions of the project team, and the strengths and limitations of this project will be discussed.

Findings and Implications

During the formative phase of data collection, survey responses were received from the five identified subject matter experts. The purpose of the formative survey was to gather feedback from nursing informatics subject matter experts about the proposed wording for the microeducation modules. The subject matter experts were presented with a prototype of one microeducation module along with the proposed scripting for the narration and content for all 21 informatics competency self-assessment questions. The subject matter experts were asked to analyze the correctness of the proposed education, the clarity of the information as proposed, and the completeness of the presented script. Subject matter expert feedback was provided for all the 21 microeducation topics,

consisting primarily of minor changes and clarifications to the proposed scripts. Table 1 provides evidence of the accuracy of the initial microeducation scripts based on subject matter expert responses. Appendix C contains the complete list of formative comments associated with the 21 informatics competency questions.

Table 1

Initial Formative Feedback

Formative Responses	Correct	Clear	Complete
Subject Matter Rating of Microeducation Scripts	90%	86%	86%

I analyzed and synthesized the formative feedback obtained for the 21 microeducation modules to revise the proposed microeducation narrative and content. Upon completion, the microeducation modules were developed using commonly available learning technology. The completed microeducation was presented to the five subject matter experts using an anonymous survey. For ease of use, the survey contained a link to the entire completed competency self-assessment tool with associated microeducation and a link to the specific microeducation module associated with each of the self-assessment questions. Table 2 provides the overall percentage of subject matter acceptance of each microeducation module as designed, and perceived acceptability of the completed tool by organizational stakeholders.

Table 2

Initial Summative Feedback

Total Modules for Summative Review	Total Modules with Feedback	Percentage of Modules Accepted Without Comment	Would this informatics competency self-assessment tool with associated microeducation offer a standardized learning approach that would be supported by stakeholders in your previous or current health care organization?
21	8	62%	100%

An unanticipated result of the summative survey was that the subject matter expert responses appeared to focus mostly on the relevance of the competency assessment questions existing in the competency self-assessment tool that was used as the foundation for this project. Using experience from their own organizations, the subject matter experts expressed their belief that some of the questions on the competency assessment tool were no longer relevant or were redundant to their organizations. No subject matter expert feedback was provided about any issues with the actual linked microeducation except for the design elements of narration and the volume of one of the modules.

The qualitative responses provided by subject matter experts during the final summative review can be seen in Appendix D. All the subject matter experts confirmed the original project purpose and stated that the informatics competency self-assessment tool with associated microeducation could offer a standardized learning approach that would be supported by stakeholders in their previous or current health care organizations. Table 3 provides a listing of the competency questions and associated microeducation that were acceptable or were not acceptable as developed.

Table 3

Summative Feedback

Is Microeducation Topic Satisfactory?	Yes	No
1. Use of tele-communication tools such as electronic mail, and facsimile (fax)	3	2
2. Create, rename, move and delete files using computer operating systems such as Microsoft Windows	5	
3. Use word processing function such as save, categorize documents, copy, paste, and delete	5	
4. Navigate computer operating systems to access installed application and choose active printer.	3	2
5. Use software to create presentations such as Microsoft PowerPoint	5	
6. Use external devices such as USB flash drive, digital camera, CD-ROM.	4	1
7. Perform basic computer systems troubleshooting such as checking power source, rebooting computer, and printing.	5	
8. Manage computer systems security to protect data, devices, and passwords.	5	
9. Collect and document patient data relevant to care such as vital signs, height, and weight.	5	
10. Navigate the electronic health record.	4	1
11. Review and acknowledge patient orders in the electronic health record.	5	
12. Develop and document care plan in electronic health record	5	
13. Use medication administration tools such as barcode medication verification and scanning.	5	
14. Use of medication dispensing system such as Pyxis and Omni cell	5	
15. Continue patient care documentation and patient identification when computer system is down.	3	2
16. Protect confidential patient data by logging out, suspending sessions, and password protection	5	
17. Use information technology as a primary means of patient safety such as bedside laboratory verification, barcode scanning, etc.	4	1
18. Use electronic communication with colleagues, patients, or other departments.	4	1
19. Find information stored in the clinical information system to guide patient care such as standardized care plans and guidelines.	5	
20. Use nursing data for improving practice and for clinical decision-making.		1
21. Use data and statistical reports for unit-based quality improvement initiatives and practice evaluation.	5	
22. Would this informatics competency self-assessment tool with associated microeducation offer a standardized learning approach that would be supported by stakeholders in your previous or current health care organization?	5	

Recommendations

Health care organizations throughout the United States are at different stages of health information technology implementation, and a standardized educational tool can help to improve the informatics competencies for nurses in many different health care delivery settings. However, due to the differences in technologies, infrastructures, and policies in each organization, the self-assessment tool with associated microeducation would not be suitable to deliver education specific to an organization without additional customization. Based on the responses of the subject matter experts, the completed self-assessment tool with associated microeducation may be able to positively impact the health of patient populations, the work of nurses, and to increase the effective use of health information technology by providing standardized informatics content for all nurses.

Although the DNP project was designed using widely accepted technology so that it can be used without technical problems in most organizations, each organization that adopts the completed tool may wish to add some customization of the microeducation to better address specific needs within the organization. By using commonly accepted learning delivery tools, educational specialists or informatics nurses at an organization should be able to access and update the microeducation content or add additional information into the tool.

Contribution of the Doctoral Project Team

The subject matter experts involved in this DNP project were selected based on their existing informatics knowledge, their unique roles in nursing informatics, and their

diverse locations throughout the country. The subject matter expert team provided feedback on the project that was relevant and contributed to the development of a higher quality, more accurate learning product. Although there are currently no plans to continue to develop this project, there is opportunity to pilot the tool within some of the organizations represented by the subject matter experts. Additionally, the competency self-assessment tool was designed so that an organization could collect data about the primary or commonly occurring informatics competency needs within their organization.

Strengths and Limitations of the Project

The primary strength of the self-assessment tool with associated microeducation is that there are currently no standardized educational programs available to address the foundational informatics competency needs of nurses. The tools were designed to be easily implemented in any organization, and to provide ongoing data about the informatics competency needs of the staff within each organization. If the tool is broadly adopted, there could be improvements in patient outcomes and decreases in nursing dissatisfaction and burnout due to increased informatics competency and the ability to better use health information technology.

One of the limitations of the educational tool is the current educational content is static, and uses videos published on the internet to provide consistent access to the materials. Updates and changes to the microeducation will require several phases of work that include creating new educational modules using learning technology software, publishing the finished modules to an internet platform, and then re-establishing the

connections that link the educational modules to the informatics competency self-assessment questions.

Section 5: Dissemination Plan

There is a great need for improving the informatics competencies in nurses at all levels of experience and the informatics self-assessment tool with linked microeducation was designed so that it could be easily implemented throughout the country. To stimulate dissemination of this new tool, I have submitted abstracts to multiple nursing informatics and nursing leadership conferences to present the new tool. Additionally, articles will be submitted to selected nursing journals to share information about the new informatics competency self-assessment tool with microeducation to different audiences.

The completed self-assessment tool with associated microeducation will be offered to each of the subject matter experts for implementation in their own organizations if they choose to use the tool. When the tool is implemented, there will be opportunities to conduct additional research and publish articles about the implementation results. Additionally, the American Association of Colleges of Nursing ("The essentials: Core competencies for professional nursing education," 2021) recently published an update to the essentials for nursing education that include a new informatics dimension. This added dimension is focused on the need to increase the inclusion of informatics concepts into all nursing courses to increase informatics competencies for nurses. To facilitate this major change in nursing education, many nursing faculty members will need to acquire informatics competencies. The newly created competency self-assessment tool with associated microeducation may provide a readily available opportunity for nursing faculty to acquire new informatics knowledge and skills.

Analysis of Self

This DNP project has provided an opportunity for me to use the knowledge and experiences of other nursing informatics experts to enhance an existing informatics competency self-assessment tool to provide efficiency with linked microeducation. The work of my DNP project coincided with a national emerging need for increased informatics competency for both nurses in practice and for nursing faculty. My past experiences have included project management, instructional design, creation of education using educational technology, nursing informatics, and nursing leadership. I have been able to blend my experiences as a practitioner with new scholarly work to produce a project that may be able to meet a recently identified national need for nursing and nursing education. It is my hope that I can continue to advance the informatics competencies of nurses throughout the rest of my career by identifying and utilizing innovative new ways to provide necessary knowledge in a way that aligns with the needs and practices of nurses.

Summary

The innovative educational tool developed for this doctoral project was conceived to address a long-existing gap in informatics competency for nurses. Nurses practice in a digital healthcare environment and gaps in informatics knowledge and competency can impact patient safety, increase healthcare errors, decrease nursing satisfaction, affect nursing efficiency, and decrease the reliability of healthcare data. The timeliness of this doctoral project is supported by emerging national and global initiatives. The national and global focus on social determinants of health is dependent on the ability of nurses to

collect the essential information needed to produce reliable data. Additionally, the AACN has updated the essentials for nursing education to include a new domain focused on informatics and the inclusion of informatics into all nursing courses.

The microeducation linked within the completed informatics competency self-assessment tool offers a standardized learning approach that is supported by stakeholders in healthcare organizations around the country. When faced with an aging society, rising nursing shortages, and increasing levels of nursing burnout, the microeducation can improve care and patient outcomes through data and technology. As the digital healthcare environment continues to transform, the informatics competency self-assessment tool with linked microeducation can be used nationwide to improve the informatics competency of nurses.

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Appendix A: Formative Survey

After reviewing the microeducation associated with each of the informatics competency self-assessment questions, the subject matter experts will respond to the following questions for each of the 30 microeducation modules:

Question	**Responses**	**If Response is No:**
Is the microeducation correct?	Yes / No	Please provide additional information
Is the microeducation clear?	Yes / No	Please provide additional information
Is the microeducation complete?	Yes / No	Please provide additional information

Informatics Competency Self-Assessment
Computer Literacy Section
1. Recognize the basic components of the computer system such as mouse, screen, and workstation
2. Use of telecommunication tools such as electronic mail and facsimile (fax).
3. Use of remote communication tools such as adobe connect, Skype, and Lync.
4. Create, rename, move, and delete files using computer operating systems such as Microsoft Windows.
5. Use word processing function such as save, categorize documents, copy, paste, and delete.
6. Navigate computer operating systems to access installed application and choose active printer.
7. Use software to create presentations such as Microsoft PowerPoint.
8. Use external devices such as USB flash drive, digital camera, CDROM.
9. Perform basic computer systems troubleshooting such as checking power source, rebooting computer, and printing.
10. Manage computer systems security to protect data, devices, and passwords.
Informatics Literacy Section
11. Use the Internet to locate and download items of interest.
12. Navigate the electronic health record.
13. Review and acknowledge patient orders in the electronic health record.
14. Develop and document care plan in electronic health record.
15. Review point of care data such as urine dipstick, glucose check, and hemoglobin meter to make timely decisions
16. Respond appropriately to alerts from clinical decision-making tools such as algorithms, best practice alerts.
17. Conduct literature searches in the accessible proprietary database systems such as CINAHL, EBSCO, etc.
18. Use medication administration tools such as barcode medication verification and scanning.
19. Use of medication dispensing system such as Pyxis and Omni cell.
20. Collect and document patient data relevant to care such as vital signs, height, and weight.
21. View trended electronic documentation to understand the effectiveness of nursing interventions.
22. Use systems to assist with admission and discharge process.
23. Continue patient care documentation and patient identification when computer system is down.
Informatics Management Skills Section

24. Protect confidential patient data by logging out, suspending sessions, and password protection
25. Use information technology as a primary means of patient safety such as bedside laboratory verification, barcode scanning, etc.
26. Use electronic health record and other clinical information system as per organizational policy for documentation.
27. Use electronic communication with colleagues, patients, or other departments.
28. Find information stored in the clinical information system to guide patient care such as standardized care plans and guidelines.
29. Use nursing data for improving practice and for clinical decision making.
30. Use data and statistical reports for unit-based quality improvement initiatives and practice evaluation.

Appendix B: Summative Survey

Hello Subject Matter Experts-

A previously developed nursing informatics competency self-assessment tool (NICAT), was used as the foundation of my DNP project (Rahman, 2015). Based on each of the 21 NICAT self-assessment questions, microeducation was developed and linked to the corresponding question to provide education at the time of need. Earlier this year you provided formative feedback on my project, titled *A Self-guided Educational Program Based on Informatics Competency Self-Assessment.* Your input about the planned content of the informatics competency microeducation modules was used to make changes in the materials for all of the micro-learning modules. At this point, the education modules have been developed and integrated into the completed informatics competency self-assessment tool.

When implemented, this competency-based educational tool can be used to improve informatics competencies for nurses, identify areas where the informatics competency need is the greatest within an organization, track utilization of the microeducation modules, and analyze overall use of the self-assessment tool as a measure of perceived value for nurses.

The following survey was designed to collect your concluding summative feedback based upon your review of the finalized microeducation linked within the informatics competency self-assessment tool. If you decide to participate in this final survey, please understand that your participation is voluntary, and that you have the right to decline participation by indicating your decision below. Your individual privacy will be maintained in all publications or presentations resulting from this study.

If you have any questions regarding this project, you may contact the researcher at brenda.kulhanek@waldenu.edu or 623-256-3301.

If you have questions regarding your rights as a research participant or any concerns regarding this project, you may contact my advisor, Dr. Deborah Lewis at deborah.lewis@mail.waldenu.edu. If you wish, an electronic copy of this consent form can be provided to you upon request.

Prior to providing summative feedback on the 21 micro-learning modules, you can view the entire project as the end users will see it when they assess their informatics competencies. For your convenience, as you provide summative feedback, the microeducation for each competency question is linked in the questions below.

The 21 questions below are intended to collect your final summative feedback on the completed microeducation. Each microeducation module ranges from 1:30 minutes to 4:32 minutes, and the modules have been linked within each question for ease of use. The final 22nd survey question will collect input on the entire project and the anticipated usefulness for healthcare organizations.

I wish to continue this survey.	Yes ☐	No ☐	
Questions	Yes	No	Comments
1. Use of tele-communication tools such as electronic mail, and facsimile (fax): the microeducation lesson is satisfactory as presented. View Microeducation			
2. Create, rename, move and delete files using computer operating systems such as Microsoft Windows: the microeducation lesson is satisfactory as presented. View Microeducation			

3. Use word processing function such as save, categorize documents, copy, paste, and delete: the microeducation lesson is satisfactory as presented. View Microeducation			
4. Navigate computer operating systems to access installed application and choose active printer: the microeducation lesson is satisfactory as presented. View Microeducation			
5. Use software to create presentations such as Microsoft PowerPoint: the microeducation lesson is satisfactory as presented. View Microeducation			
6. Use external devices such as USB flash drive, digital camera, CD-ROM: the microeducation lesson is satisfactory as presented. View Microeducation			
7. Perform basic computer systems troubleshooting such as checking power source, rebooting computer, and printing: the microeducation lesson is satisfactory as presented. View Microeducation			
8. Manage computer systems security to protect data, devices, and passwords: the microeducation lesson is satisfactory as presented. View Microeducation			
9. Collect and document patient data relevant to care such as vital signs, height, and weight: the microeducation lesson is satisfactory as presented. View Microeducation			
10. Navigate the electronic health record: the microeducation lesson is satisfactory as presented. View Microeducation			
11. Review and acknowledge patient orders in the electronic health record: the microeducation lesson is satisfactory as presented. View Microeducation			
12. Develop and document care plan in electronic health record: the microeducation lesson is satisfactory as presented. View Microeducation			
13. Use medication administration tools such as barcode medication verification and scanning : the microeducation lesson is satisfactory as presented. View Microeducation			
14. Use of medication dispensing system such as Pyxis and Omni cell : the microeducation lesson is satisfactory as presented. View Microeducation			
15. Continue patient care documentation and patient identification when computer system is down : the microeducation lesson is satisfactory as presented. View Microeducation			
16. Protect confidential patient data by logging out, suspending sessions, and password protection: the microeducation lesson is satisfactory as presented. View Microeducation			
17. Use information technology as a primary means of patient safety such as bedside laboratory verification, barcode scanning, etc. : the microeducation lesson is satisfactory as presented. View Microeducation			

18. Use electronic communication with colleagues, patients, or other departments: the microeducation lesson is satisfactory as presented. View Microeducation			
19. Find information stored in the clinical information system to guide patient care such as standardized care plans and guidelines: the microeducation lesson is satisfactory as presented. View Microeducation			
20. Use nursing data for improving practice and for clinical decision-making: the microeducation lesson is satisfactory as presented. View Microeducation			
21. Use data and statistical reports for unit-based quality improvement initiatives and practice evaluation: the microeducation lesson is satisfactory as presented. View Microeducation			
22. Would this informatics competency self-assessment tool with associated microeducation offer a standardized learning approach that would be supported by stakeholders in your previous or current health care organization?			

Appendix C: Formative Survey Results

Question	Correct?	Clear?	Complete?	Comments
1. Use of tele-communication tools such as electronic mail, and facsimile (fax)	4	5	4	• In #2, I would add "electronic mail" in parenthesis as you have done with facsimile (fax) on the title page. Alternately, you could add it on the title slide. • Fax and email seem a bit basic. I do feel like there are some variations of fax where people scan in documents on their phone and email (oftentimes confused with a fax). Key points on this one- email is not considered confidential- would emphasize more?
2. Create, rename, move and delete files using computer operating systems such as Microsoft Windows	5	4	5	• I would add that you are giving directions for using the Microsoft Word app specifically, as you have done in other modules. • #7 in micro learning-missing “be” before the word renamed. • I feel like many organizations are moving away from shared files due to security risks. Would recommend including some information re: security systems for many healthcare organizations.
3. Use word processing function such as save, categorize documents, copy, paste, and delete	4	5	3	• I think more could be added as there is so much one can do with the app, however this is a great intro to MSFT Word! • You have many apple users who do not always use Microsoft word- might want to include some variations that are commonly used (google docs, oneword, etc)
4. Navigate computer operating systems to access installed application and choose active printer.	5	3	4	• Consider making this module more agnostic for all types of computer such as Macs, as I believe the instructions could be different for the users (not just Windows-based). • #4 -last sentence-should say activate before correct printer. • many orgs have an IT department to assist if you cannot find an app- would recommend including that as an additional resource
5. Use software to create presentations such as Microsoft PowerPoint	4	4	4	• Very good that you added other 'similar presentation applications' language to this one. • #3-select a “templates” should be singular • would be careful about citing only PowerPoint since there are so many other presentation apps (prezi, etc). If you are specifically getting at using Microsoft, I would consider introducing that as a bundle rather than the individual programs. If you are getting at

				presentations in general, would make the content more general with concepts rather than specific ppt access.
6. Use external devices such as USB flash drive, digital camera, CD-ROM.	5	5	4	• Consider adding external hard drives as another external device as they are now common place, I would say vs. CD-ROMs today and moving forward.
7. Perform basic computer systems troubleshooting such as checking power source, rebooting computer, and printing.	4	5	4	• This is very good, and would consider making it Operating System agnostic. • #8 It may be necessary “to” reprint-last sentence • you talk about printing up on question 4- would it not be better to incorporate troubleshooting printing there instead of here?
8. Manage computer systems security to protect data, devices, and passwords.	4	4	4	• I like that you added #7, very engaging content. Would consider moving it to the top, maybe #3. Also, consider adding this type of content to other modules. • Depending on when you publish- would need to ensure your statistics are up to date (#7) • Embarrassment seems to be a judgement statement, perhaps rewording this to account for exposed private data.
9. Collect and document patient data relevant to care such as vital signs, height, and weight.	5	5	5	• Consider moving #9 module to next section, perhaps near the patient orders. On title slide, bullet 2, spell out 'heath information technology' before 'HIT' (put in parenthesis) or omit 'HIT'. • #4 last sentence-should have an “and” Last sentence. And are used for…
10. Navigate the electronic health record.	5	5	4	• Add 'EHR' in parenthesis to the title after 'Electronic Health Record'. Very good keeping this module vendor agnostic. • would consider adding that most organizations will provide training during orientation for their specific EHR
11. Review and acknowledge patient orders in the electronic health record.	5	5	5	• Consider updating #6 with 'impact patient care, such as assessments and treatments'.
12. Develop and document care plan in electronic health record	4	4	4	• #4- you talk about nursing diagnosis in the first line and then say multiple diagnosis in the third sentence. Are you still referring to nursing diagnosis or medical?
13. Use medication administration tools such as barcode medication verification and scanning.	5	4	4	• On first bullet, title slide, spell out 'Bar Code Medication Administration' before 'BCMA'. In #2 add '(BCMA)' after 'bar code medication administration' as you refer to it as that on the title slide, however not in the module. Overall this looks great. • would it be helpful to reference internal policies and procedures for override or emergency circumstances for BCMA? Or for scanning malfunction? The

				recommendation would most likely be to follow your org policies.
14. Use of medication dispensing system such as Pyxis and Omni cell	4	4	4	• Consider removing 'Pyxis and Omni Cell' on the title, perhaps add it in the module content. This will add consistency throughout modules as what you did with the MSFT Office apps in first section. This module is very succinct - well done.
15. Continue patient care documentation and patient identification when computer system is down.	4	3	5	• is it worthwhile to reference that it still takes concentration and focus by the nurse in utilizing this technology to prevent errors (i.e. no multitasking, no pulling out multiple patient drugs at the same time)?
16. Protect confidential patient data by logging out, suspending sessions, and password protection	5	5	5	• #4 acsribed? To and the transposed
17. Use information technology as a primary means of patient safety such as bedside laboratory verification, barcode scanning, etc.	4	4	4	• Might there also be other identifiers that are the same such as DOB, and perhaps a similar MRN that could inadvertently be mistaken for another? Perhaps use 'patient identifiers' with explanation of what those are in #2. • #3 & #4- again, I think it is patient ID band (not wrist band)
18. Use electronic communication with colleagues, patients, or other departments.	5	4	5	• On title slide, bullet 2 & 3 appear to be redundant - consider summarizing both into one. Very succinct module - well done. Consider adding title slide bullet 2 & 3 content within module content for further clarity.
19. Find information stored in the clinical information system to guide patient care such as standardized care plans and guidelines.	5	4	4	• This may be an opportunity to discuss what Clinical Decision-Support is. You allude to it, and there is space for the content. • this seems to be more connected to the slides previously about documenting in the system. You might not be able to move it because of your tool question sequence, but it seems more appropriate earlier in the slides.
20. Use nursing data for improving practice and for clinical decision-making.	5	4	4	• For clarity, revise title slide bullets 1 & 2, perhaps combine them. Omit 'predictive analytics' on title slide bullet as it is a term that needs explanation beyond this module and is not mentioned in the content again aside from 'algorithms'. Perhaps another opportunity to explain CDS(S) vs. algorithms - term also may not be understood by the user.
21. Use data and statistical reports for unit-based quality improvement initiatives and practice evaluation.	4	4	5	• #2 & #3 & the final box- would department be a more inclusive term than unit?

Appendix D: Summative Survey Comments

Question	Comments
Use of tele-communication tools such as electronic mail, and facsimile (fax)	• the screen shots for the email are really blurry and i had to get into full screen to view. basic learners may not know how to get to the full screen mode so consider that in the directions. • Not entirely sure how helpful the information on how to fax is- nice to know it's secure and the preferred document method, but this feels a bit dated. Also- these are two very limited forms within healthcare- texting, communication within EHR, and phone calls are all more common in today's practice.
Create, rename, move and delete files using computer operating systems such as Microsoft Windows	
Use word processing function such as save, categorize documents, copy, paste, and delete	
Navigate computer operating systems to access installed application and choose active printer.	• give definition of printing to PDF and Fax - not sure all will know the difference. • Again- so much of this is dependent on where you work and what you have access to for printing.
Use software to create presentations such as Microsoft PowerPoint	
Use external devices such as USB flash drive, digital camera, CD-ROM.	• The voice changed? Also- most laptops no longer have CD ROMs and many healthcare organizations are no longer allowing USBs due to security. I would recommend more information on the various ports located on laptops or computers, along with cloud sharing options.
Perform basic computer systems troubleshooting such as checking power source, rebooting computer, and printing.	
Manage computer systems security to protect data, devices, and passwords.	• I like the description of the different security safeguards- this is super helpful!
Collect and document patient data relevant to care such as vital signs, height, and weight.	
Navigate the electronic health record.	• this is good info many will need - i think many don't know differences between radio buttons , etc • changed voice? This is almost too generic- EHR • is a very broad topic dependent on where someone • works, I would not find this helpful to me • specifically to increase my workflow.

Review and acknowledge patient orders in the electronic health record.	
Develop and document care plan in electronic health record	• changed voice?
Use medication administration tools such as barcode medication verification and scanning.	
Use of medication dispensing system such as Pyxis and Omni cell	• this seems slightly repetitive from #13 on BCMA.
Continue patient care documentation and patient identification when computer system is down.	• need to mention that recovery for DT is also impt to refer to policy re: entry of data that was manually captured (scan in vs enter into the system) • downtime and patient identification do not appear to go together- you should always do patient identification, but the downtime pieces of information are also helpful.
Protect confidential patient data by logging out, suspending sessions, and password protection	
Use information technology as a primary means of patient safety such as bedside laboratory verification, barcode scanning, etc.	• see comment from #15- patient identification would fit better here I think.
Use electronic communication with colleagues, patients, or other departments.	• could this not be integrated into #1 to make more sense?
Find information stored in the clinical information system to guide patient care such as standardized care plans and guidelines.	
Use nursing data for improving practice and for clinical decision-making.	• the recording volume was lower on this video than all the others.
Use data and statistical reports for unit-based quality improvement initiatives and practice evaluation.	
Would this informatics competency self-assessment tool with associated microeducation offer a standardized learning approach that would be supported by stakeholders in your previous or current health care organization?	• This is excellent, please reach out to me to pilot this informatics education self-assessment in my organization. • Maybe.... some of this content is really basis and i see most of the nurses as being beyond that point. Also it is very inpt focused w/ the examples (pictures etc) consider adding examples for ambulatory or procedural/ periop to expand scope. It might be good to get a few of the estar reps or nurses to review and see what they think - maybe i have unrealistic expectations of where they are. • It would be helpful to change up either the voice or the presentation between the 21 competencies... add music or some form of an auditory appealing introduction or closing.