A Focused Ethnography to Explore Nursing Faculty Experiences in Integrating Digital/Informatics Tools to Support Undergraduate Students' Learning and the Development of Informatics Competencies

by

Amelia Jane Chauvette

A thesis submitted in partial fulfillment of the requirements for the degree of

Doctor of Philosophy

Faculty of Nursing
University of Alberta

© Amelia Jane Chauvette, 2021

Abstract

Background: Nurses working in today's contemporary health care environment are expected to use a variety of digital/informatics tools when providing direct care. These tools are increasingly essential to improve data management and consequently patient and system outcomes. Nursing faculty, therefore, have been urged to integrate digital/informatics tools in their teaching and learning practices to facilitate the development of nursing students' informatics competencies, a requirement for safe and competent practice in a technologically rich healthcare environment. Recognizing the importance of informatics in modern nursing practice, professional nursing and governmental organizations have called upon schools of nursing to embrace informatics and facilitate the integration of digital/informatics tools in their curricula. Although research has examined the integration of nursing informatics (NI) and digital health in Canadian undergraduate nursing education, little is known about nursing faculty experiences with integrating digital/informatics tools into the curriculum and their teaching practices. Further, their perceptions as to how these educational experiences contribute to developing informatics competencies in undergraduate nursing students.

Purpose: The purpose of this study was to explore nursing faculty experiences in integrating digital/informatics tools to support students' learning in undergraduate nursing programs and the development of students' informatics competencies.

Method: A focused ethnography was used. Twenty-one faculty members from nine Western Canadian undergraduate nursing programs participated in semi-structured interviews. Data analysis consisted of thematic analysis with constant comparison, aligning with Roper and Shapira (2000). Data was managed within Quirkos, a qualitative data analysis software.

Results: Data analysis revealed ten themes, these included: (a) the meaning of the term nursing informatics, (b) faculty perceived NI competence, (c) perceived usefulness of digital informatics tools, (d) facilitators, (e) challenges, (f) developing students' NI competence (g) building connections, (h) teaching approaches, (i) the learner, and (j) the pandemic. Nursing faculty are integrating/digital tools in their teaching to some extent; however, it is evident that informatics competencies and their application in nursing education and practice are still not explicitly understood by faculty. Nursing faculty face several challenges which can be overcome by some of the enablers that have been identified to improve capacity of nursing faculty to teach and develop student's entry-to-practice informatics competencies.

Conclusion: Nursing faculty play an important role in preparing the next generation of nurses; therefore, removing barriers and increasing supports for nurse educators to advance their informatics capacity is urgently needed. This study has implications for nursing faculty, program administrators, nursing organizations and NI researchers. Limitations of the study included timing of the interviews and sample diversity. Several recommendations were identified for future research, as well as for nursing faculty, program leaders and clinical sites.

Keywords: nursing informatics, nursing education, informatics competencies, nursing faculty

Preface

This thesis is an original work by Amelia Chauvette. The research project, of which this thesis is a part of, received research ethics approval from the University of Alberta Research Ethics Board, Project Name: A Focused Ethnography to Explore Nursing Faculty Experiences in Integrating Digital/Informatics Tools to Support Undergraduate Students' Learning and the Development of Informatics Competencies, Pro00091981, August 16th., 2019.

Dedication

I would like to dedicate this work to my family. My husband has been my main source of support. His patience and inner strength provided me with the drive to continue through this journey. My children were a source of motivation and inspiration as well as they know what is important in life. I am forever grateful for my parents for showing me the importance of hard work and being disciplined.

Acknowledgement

First and foremost, I would like to thank the participants of my study. I am aware of the limited time available to you and I appreciate the time that you spent with me when you shared your experiences with me. I also acknowledge the support from my supervisors, Dr Kleib and Dr Paul. Throughout my dissertation work, they have provided me with their expertise, guidance, support and pushed me to dig deeper, and encouraged a higher level of thinking. I would like to also acknowledge my committee member Dr Raymond, for her gentle approach, perspectives and welcomed feedback, as well as, Dr Borycki, an internationally-renowned researcher in nursing and health informatics, for her contributions to my thesis as an external examiner. I wish to recognize the examination committee members, Dr Joanne Olson and Dr Anna Santos Salas for their generosity and perspective during the dissertation process. I thank Dr. Jude Spiers for chairing my final oral examination. Finally, I am grateful for the funding support I received during my PhD study. In particular I thank the WNRCASN for the Graduate Award, and the Canadian Nurses Foundation for supporting me with the Dr. Kathryn J Hannah Nursing Informatics Scholarship.

Table of Contents

Tables

Chapter 1

The development of nursing students' informatics competencies has become a significant issue in nursing education. Nursing informatics is the "science and practice [that] integrates nursing, its information and knowledge, with management of information and communication technologies to promote the health of people, families, and communities worldwide" (International Medical Informatics Association, 2009, para 2). Information and communication technologies are digital and analogue technologies that facilitate the capturing, processing, storage, and exchange of information via electronic communication (Canadian Association of School of Nursing [CASN], 2012). Within the Canadian healthcare context, the application of these technologies in healthcare is referred to as *digital health*. In this study, the term '*digital/informatics tools'* was used to denote the application of information and communication technologies in healthcare and/or educational environments.

Nurses working in contemporary healthcare settings are expected to work with a variety of digital/informatics tools when providing direct care. These tools are increasingly essential to improve data management and consequently patient and system outcomes (Canadian Nurses Association [CNA] & Canadian Nurses Informatics Association [CNIA], 2017). Likewise, nursing education has become more reliant on these tools to support learning and teaching. Increasing informatics capacity in nursing has therefore become a key priority worldwide. Given the important role nursing faculty play in this process, the purpose of this focused ethnographic study was to explore nursing faculty experiences in integrating digital/informatics tools to support teaching and learning, and the development of informatics competencies among undergraduate nursing students.

Background of the Study

Nursing informatics has become an integral part of nursing practice enabling nurses to manage information and assisting them with clinical decision-making. Nurses integrate a multitude of digital/informatics tools in every aspect of their work, from monitoring patients' bodily functions to accessing lab values, documenting nursing care through electronic health records (EHRs), as well as delivering and monitoring care over distance via telehealth. An EHR is a longitudinal and secure digital record of a patients' integrated healthcare history available to authorized healthcare providers anywhere, and anytime in support of high-quality care (CASN, 2012; Canada Health Infoway [CHI], n.d.). Nurses' utilization of digital health tools is growing in Canada. In a 2020 *National Survey of Canadian Nurses: Use of Digital Health Technology in Practice* (n=1642), more than eighty percent of nurses who provide direct care indicated use of digital/informatics in their practice, an increase from 78% in 2017. Twenty-seven percent of them used fully electronic record keeping systems (versus 23% in 2017). There has also been an increase in using digital tools to provide virtual care. For example, nurses reported using email (36%), and virtual videoconferencing (27%) to deliver patient care (CHI, 2020). In addition, most nurses (59%) felt it essential to have access to mobile devices to provide patient care. An earlier version of the survey revealed that three-quarters of Canadian nurses who provide direct patient care (n=1342) are using digital/informatics tools in their practice, specifically the use of electronic documentation (74% versus 63% in 2014), and EHRs (60% versus 43% in 2014) (CHI, CNA & CNIA, 2017). These findings suggest that digital health technologies do support nursing practice; therefore, increasing nurses' informatics competency to utilize these tools across all practice settings is warranted. This is particularly important because 35% of nurses reported that they were not satisfied with the quality of formal education to support their use of

technologies in their practice and only 39% reported that they felt very confident in the use of these tools (CHI, CNA & CNIA, 2017).

Since 2003, informatics has been recognized as a core competency for health professional practice (Institute of Medicine [IOM], 2003). For example, informatics competency enables care providers to use digital health tools to access and retrieve evidence-based information. In nursing, providing nurses and nursing students with access to point-of-care digital resources improves the quality of care (Borycki et al., 2009; Darvish et al., 2014; Havens et al., 2010; Kuiper, 2010) and promotes patient safety (Abdrbo, 2015; Altmann & Brady, 2005; CNA, 2006; CNA & CNIA, 2017; Dingley et al., 2008; Greenfield, 2007; IOM, 2003; Johansson et al., 2014). As the largest discipline within the healthcare system and the largest group of end-users of digital health tools, nurses can make a significant impact on the health outcomes of Canadians. Expanding nurses' and nursing students' informatics capacity is vital for them to keep pace with technological advances taking place in Canada and facilitate safe and quality care.

Nursing Informatics

Nursing informatics (NI) is a relatively new concept in nursing that was first coined in 1980 by Scholes and Barber. In 1989, seminal writers Graves and Corcoran (1989) defined NI as "the study of the management and processing of nursing data, information and knowledge" (p. 227) and outlined the fundamental tenets of NI: data, information and knowledge. Later, wisdom was added as a fourth concept (Nelson, 2018). Nurses collect, store and retrieve data and information in order to construct knowledge and use wisdom to guide their practice (Greer, 2012). Accordingly, NI is considered a foundational skill set of any nurse irrespective of their role, as each nurse relies on data and information to make informed decisions about patient care (Remus & Kennedy, 2012). Becoming competent in NI is no longer an option but rather a

requirement for nurses (Ball, et al., 2011; Kinnunen et al., 2017). To this end, it is essential to develop nurses' and nursing students' competencies in informatics to appropriately apply and integrate digital/informatics tools into their current and future nursing practice (CASN, 2012; Staggers et al., 2002).

NI Competencies. Competencies specific to nursing informatics have progressively developed over the past three decades. Tardif defines competency as "a complex know-act based on combining and mobilizing internal resources (knowledge, skills, and attitudes), and external resources to apply appropriately to specific types of situations" (as cited in CASN, 2012, p. 6). Nursing students gain entry-level competence during their undergraduate education in order to practice safely, competently and ethically (British Columbia College of Nurse and Midwives [BCCNM], 2021). Entry-level competency is the minimum expectation of a nurse's performance; anything less is considered unacceptable (BCCNM, 2021).

Staggers et al. (2001, 2002) proposed one of the first lists of informatics competencies required for nursing practice, research, and education in the United States. The list identifies specific competencies for four levels of nursing practice in the core areas of computer skills, information knowledge and informatics skills at all levels. They also outlined four different levels of practice, these include: the beginning nurse, the experienced nurse, the informatics specialist, and the informatics innovator. The competencies for the beginner nurses are the fundamental competencies that all nurses should acquire.

This landmark study (Staggers et al., 2002) laid the foundation for NI competencies development work in other countries, such as Australia (Foster & Bryce, 2009), Canada (CASN, 2012; Nagle et al., 2014), India (Verma, & Gupta, 2019), Taiwan (Chang et al., 2011) and New Zealand (Honey et al., 2020) in developing their own sets of NI competencies for entry-to-

practice nurses or generalist nurses (Kleib et al., 2021). For example, Chang et al., (2011) identified computer skills, information knowledge and information skills as core informatics skills based on the Staggers et al. (2001; 2002) competency list. The Australian Nursing and Midwifery Federation (2015) core competencies include computer literacy, information literacy and information management. A study identified core informatics competencies for Portuguese nurses as information literacy and information management (Cardoza & Souza, 2015). As noted, most countries identified similar core competencies based on the seminal work by Staggers et al. (2001; 2002) with some minor differences.

To date, generalist or entry-level nursing informatics competencies are widely accepted to include computer literacy, information literacy, and the ability to use digital/informatics tools to manage data, information and knowledge (Kleib et al., 2021; McKinney et al., 2017). Computer literacy includes the proficiency in applying a variety of technologies and their applications. Possessing information literacy skills allows the nurse to retrieve needed information to access evidenced-based information efficiently, to critically appraise information from a variety of sources, as well as how to incorporate that information into their knowledge base to support the delivery of safe patient care in all settings (Button et al., 2014). The third core competency, the ability to use digital/informatics tools to manage data, information and knowledge, reflects the capacity to use digital/informatics tools to manage data, information and knowledge as they relate to nursing practice. This involves the ability to use tools to collect, process, manage, analyse, evaluate, present and communicate data and information to support the development and application of nursing knowledge across practice settings (Registered Nurses Association of Ontario [RNAO], 2012).

***NI Entry-to-Practice Competencies*.** The drive to develop nursing student's informatics competencies has become a top priority for national nursing organizations and researchers as nursing students must become competent in the use of digital/informatics tools before they enter the technological healthcare workforce (American Association of Colleges of Nursing [AACN], 2021 CNA, 2006; CNA & CNIA, 2017; Fetter, 2008; Hannah, 2007; Hebert, 1999; International Council of Nurses [ICN], 2015; IOM, 2003). Recognizing that nursing education plays an important role in students' development of NI competencies, several worldwide initiatives have been undertaken to incorporate informatics competencies into nursing education in order for students to become competent and to meet the demands of the healthcare environment (AACN, 2008; Australian College of Nursing, 2018; CASN, 2012; Honey et al., 2020; Nursing Council of New Zealand, 2007). In USA and Canada, the American Association of Colleges of Nursing and CASN have identified NI competencies which nursing students are expected to possess before they enter practice. In addition, the Technology Informatics Guiding Education Reform (Gugerty & Delaney, 2009) initiative provides a minimum set of informatics competencies for practicing and graduating nurses to improve the delivery of healthcare through the integration of digital/informatics tools. According to TIGER (Gugerty & Delaney, 2009) competencies specific to NI include basic computer competencies, information literacy, and information management. These components will be discussed in Chapter two.

In Canada, the accreditation agency for nursing programs, CASN, in partnership with Canada Health Infoway developed the CASN NI Entry-to-Practice competencies (2012) based on extensive reviews of the literature and cross-country consultation with key stakeholders (Nagle et al., 2014). This document identifies the minimum knowledge, skills, and attitudes that all nursing students should have acquired before graduation from a baccalaureate nursing

program. These core consensus-based NI competencies include: 1) the use of relevant information and knowledge to support the delivery of evidence informed patient care, 2) the use of information, and communication technologies in accordance with professional and regulatory standards and workplace policies, as well as 3) the use of information and communication technologies in the delivery of patient care (CASN, 2012). In addition, these competencies can also provide guidance in curriculum development to assist in the integration of informatics competencies. Resources such as *CASN/Canada Health Infoway Nursing Informatics Teaching Toolkit: Supporting the Integration of Nursing Informatics Competencies into Nursing Curricula* (CASN & CHI, 2013), *the Consumer Health Solutions: A Teaching and Learning Resource for Nursing Education* (CASN, 2016), *Digital Health e-modules* (CASN & CHI, 2019) and the Digital Health Nursing Faculty Peer Leader Network were created to support the uptake and integration of NI by both practicing nurses and nursing faculty. The *CASN NI Teaching Toolkit* (CASN & CHI, 2013) contain specific teaching strategies and application examples that nursing faculty can use to support teaching and learning about informatics concepts and the use of digital/informatics tools to facilitate development of students' informatics competencies. Furthermore, Kleib and Nagle (2018a) developed the Canadian Nurse Informatics Competency Assessment Scale (C-NICAS), a 21-item instrument, based on CASN NI Entry-to-Practice competencies to measure nursing students and nurses NI competencies. In parallel to the development of national entry-to-practice NI competencies, some provincial nursing associations have also updated their Entry-to-Practice competencies, thereby endorsing CASN NI competencies (College and Association of Registered Nurses of Alberta, 2019; BCCNM, 2021; College of Nurses of Ontario, 2019) and again highlighting the need to develop informatics competencies among nursing students

Nursing Education

The growing interest in the use of digital/informatics tools for educational purposes and their relevance in developing nursing students' competencies, as well as the characteristics of the 21st century learners and a shift in nursing pedagogy have challenged nursing faculty to re-examine their role, current teaching strategies as well as the quality of teaching and learning (Benner et al., 2010).

Shift in Nursing Education. The Carnegie Foundation for the Advancement of Teaching report outlined a call to action in order to transform teaching and learning practices in nursing education to meet the complex challenges of the healthcare system and the nursing profession (Benner et al., 2010). In this report, Benner et al. (2010) highlight that faculty need to shift to a learner-centered approach based on experiential `and situated learning in which learning becomes contextualized. From this approach, the learner becomes an active participant in their own learning, enhancing interactions among peers and faculty while the faculty becomes the mentor and facilitator of learning experiences and encourages students to work through complex real-life problems.

The New Media Consortium Horizon Report: Higher Education Edition (Becker et al., 2018) has also appealed to educators to shift from the traditional teacher-centered learning to learner-centered approach. Benner et al. (2010) and Becker et al. (2018) challenge nursing faculty to employ digital/informatics tools, such as learning management systems, e-books, interactive Whiteboards, classroom response systems and simulations in their teaching to maximize students' engagement in learning. It has been suggested by Day-Black et al. (2015) that 21st century learners prefer active learning where digital/informatics tools are integrated into teaching and learning. Nonetheless, these strategies must be based on sound pedagogical

practices to augment the learning process and improve educational outcomes. According to Diaz and Bontenbal (2000):

> Using technology to enhance the educational process involves more than just learning how to use a specific piece of hardware and software. It requires an understanding of pedagogical principles that are specific to the use of technology in an instructional setting. (p. 2)

To this end, the integration of digital/informatics tools should be pedagogically driven (Kennedy et al., 2008). In response, nursing faculty are exploring new ways of thinking about pedagogy that critically examines how nursing faculty integrate digital/informatics tools while fostering active learning and a learner-centered digital-approach pedagogy.

***Digital Pedagogy*.** Digital pedagogy is defined as the "engaged and reflexive practice and scholarship of teaching and learning through digital technologies," such as digital/informatics tools (THATCamp Liberal Arts 2012, as cited in Hunter et al., 2012, para. 1). It is about critically examining which digital/informatics tools should be used, in what context, and their impact on students' learning outcomes rather than simply adopting them for their own sake.

There are several benefits for the students when nursing faulty integrate these tools in their teaching practices. They promote active learning and a learner-centered approach (Jensen et al., 2009; Williamson & Muckle, 2018). Students reported feeling more confident in understanding the course material (Strawser, 2017), in their ability to gain knowledge independently (Chioh et al., 2013), and in their perceived that they facilitated their academic performance (Williamson & Muckle, 2018). Students also reported improved critical thinking (Fisher & Koren, 2007; Johansson et al., 2014). While these tools can engage the learner, faculty must critically examine how to incorporate them into teaching practices to effectively shape the

learning environment for nursing students (Arnold, 2018), as well as to ensure that learning is meaningful. This necessitates that their integration should be guided by learning theories.

Learning Theories. Learning theories help faculty understand the complexities of learning by explaining how the learners acquire, organize and use knowledge (Schunk, 2012). Their application in the design of a digital educational intervention provides structured theoretical foundations that make learning more relevant and conducive to students' learning. They also help with the implementation and evaluation of the effectiveness of digital educational interventions (Bajpai et al., 2019). In the absence of clear theoretical foundations, it becomes difficult to measure change in students' learning outcomes.

The use of learning theories to support the integrating of digital/informatics tools seems to be limited in the literature. Bajpai et al. (2019) conducted a systematic review of randomized control trials and quasi experimental studies examining the application of learning theories in digital health professional education interventions between 2007-2016. Digital education interventions included online-offline-based, mobile digital, and digital-simulation education modalities. Of the two hundred and forty-two studies included in the study, only one third of the studies (n=81) reported using a learning theory in the design of the digital educational intervention. Lavoie et al. (2018) conducted a theoretical review to identify which learning theories were used to explain learning in simulation from 182 papers. The most commonly cited learning theories or frameworks were the NLN/Jeffries Simulation Framework Kolb's Experiential Learning Theory, Learning Style Inventory followed by Bandura's Social Cognitive Theory. The authors concluded from the review that "most studies did not include an explicit theory of learning or were framed in an instructional design framework" (p 246).

It is important to examine how nursing faculty are using learning theories to support the integration of digital/informatics tools to support the development of students' NI competencies. Without this foundation, faculty run the risk of misinforming the curricular integration of systematic digital educational intervention with learning outcomes. Thus, this study will examine which theoretical perspectives faculty members are using to help with the integration of digital/informatics tools to facilitate teaching and learning.

***Students as Digital Natives*.** The 21st century learners, also referred to as "digital natives", have grown up in a digitally enriched environment which has influenced their behaviours and attitudes toward learning (Montenery et al., 2013; Prensky, 2001). In higher education, students' usage of digital/informatics tools, such as smartphones and laptops, has increased over the past few years to support their learning needs. Some studies have demonstrated that students prefer to use these tools as they feel their use for learning purposes increases their learning capabilities. For instance, in 2018, the EDUCAUSE Center for Analysis and Research (ECAR) surveyed 64,536 undergraduate students from 130 institutions in nine countries about their experiences with technologies in the academic setting. The researchers found that 95% of undergraduate students have access to a smartphone, while 91% can access a laptop (Galanek et al., 2018). Of the students using laptops, 95% had used them in at least one of their courses and 94% of students perceived the use of laptops as very or extremely important for their academic success. The previous year, students reported using digital/informatics tools for note taking as well as to help make connections with the learning material (Brooks & Pomerantz, 2017).

McGraw-Hill Education (2017) surveyed 1,005 U.S. college students regarding their digital/informatics tools habits. Similar findings indicated that 88% of college students consider

laptops “very or extremely important” for studying. The majority (61%) of students found their use “very or extremely helpful” in their academic life. More importantly, 94% of students reported that digital/informatics tools helped them retain new concepts, while 60% of students believed that these tools contributed to improved grades. In regards to students’ usage, most students reported utilizing these tools to complete research for class assignments, to communicate with faculty, as well as to prepare for exams. As a result, faculty can expect new methods of interacting with students and different expectations and preferences as to how students are acquiring knowledge and skills.

Even though digital natives, including nursing students, have been immersed in technologies, it should not be presumed that they are ready to work in a technologically rich and information intensive healthcare environment. Existing literature suggests that many nursing students do possess knowledge and skills in computer literacy, however, there is a need to advance students’ abilities beyond technical literacy to having a greater understanding of and a better ability to apply technological competency in the context of patient care. They need to develop the knowledge, skills and attitudes for safe, responsible and appropriate use of digital/informatics tools, as well as to develop their abilities to critically engage with these tools and intuitively adapt to new complex and dynamic healthcare contexts. Elder and Koehn (2009) found nursing students tend to overestimate their level of computer competency and have little exposure to digital/informatics tools, specifically used to support care delivery. Other researchers found some knowledge gaps in information literacy among nursing students in areas of accessing digital information and regarding literature databases and resources, such as clinical information systems needed for effective clinical decision making (Benner et al., 2010; Bond & Procter, 2009; Borycki et al., 2015; Desjardins et al., 2005; Fetter, 2008; Saranto & Hovenga, 2004). For

example, in a U.S. study Choi and De Martinis (2013) reported that undergraduate nursing students were competent in basic computer skills such as searching the Internet, word processing and multimedia presentations, but deficient in other aspects of informatics competency, including information literacy as well as information management and application.

Evidently, these reports highlight the need for revisiting current approaches for developing informatics competency in nursing students by focusing on all components of NI (Desjardins et al., 2005; Fetter, 2008). Competency in nursing informatics is more than possessing basic computer skills. It also includes information literacy and the use and application of digital/informatics tools to manage data, information and knowledge in the context of patient care (Thompson & Skiba, 2008). As a result, students will be able to adapt to the rapidly changing technological healthcare environment and increase their chances of success in providing optimal and safe care in complex care environments. Inadequately developed NI competency, on the other hand, disadvantages nursing graduates, and limits their ability to effectively use digital/informatics tools and resources, and may potentially increase risks for medical errors and or patient harm.

Nursing Informatics. As previously mentioned, NI consists of three dimensions: computer literacy, information literacy as well the use and application of digital/informatics tools. Based on a review of the nursing informatics literature, findings suggest that the scope of NI in nursing education has largely been confined to the application of basic computer and or information literacy skills (Kleib & Nagle, 2018b; McKinney et al., 2017; McNeil et al., 2006; Nagle et al., 2020a, 2020b; Thompson & Skiba, 2008) with little attention as to how these skills translate into clinical contexts (Kleib et al., 2013). It is important for nursing curriculum to

address all components of informatics. In addition, examining factors that impact whether or not nurse educators integrate informatics is also warranted.

In a study examining the factors associated with nurses' (n=2844) informatics competency, results reported that less than one-third (29.9%) of participants received formal informatics content during their nursing education (Kleib & Nagle, 2018b). Nursing education programs have a responsibility to prepare nurses to be competent in all aspects of nursing care such as having the requisite knowledge, skills and abilities to work in a technological rich healthcare environment. Accordingly, NI competencies should be integrated into nursing curriculum and adopted by nursing faculty however the literature indicates their integration has been relatively limited (Bove, 2020; Harerimana et al., 2020; Hunter et al., 2013; Kleib et al., 2013; Kleib & Nagle, 2018b; McNeil et al., 2006; Nagle & Clarke, 2004; Nagle, et al., 2014; Nagle et al., 2020a; Peltonen et al., 2019; Pobocik, 2015; Williamson, & Muckle, 2018).

Current literature suggests that integration of informatics in nursing curriculum remains a challenge. Bove (2020) provided an update on Hunter et al., (2013) status report on the integration of NI in nursing education. The author found a 24% increase in informatics content in graduate programs, however only a 2% increase in undergraduate programs. Peltonen et al. (2019) surveyed NI specialist in academia and practice (n=507) from 46 countries, and concluded NI education at the undergraduate level needs to increase in order to meet the practice demands.

In one of the first Canadian studies of informatics in nursing education, Nagle and Clarke (2004) reported that only 30% of Canadian nursing undergraduate programs had integrated NI into their curriculum, however at the time of the study the CASN NI Entry-to-Practice competencies (2012) had yet to be introduced. Resources and toolkits to help nursing programs

integrate informatics into curriculum were also limited. Furthermore, the use of digital/informatics tools in the clinical environment was limited. In 2018, Nagle et al. (2020a; 2020b) re-examined the current state of informatics content integration within Canadian undergraduate programs from the perspectives of nurse educators (n=360) and administrators (n=35). This study reported 82% of administrators indicated that informatics content had been integrated into nursing curriculum. Interestingly, nurse educators reported that only 44% of them taught some NI content within a course, while very few (4.7%) reported teaching an informatics focused course in their undergraduate program. These studies suggest that there are significant discrepancies between the perception of how informatics is being integrated into nursing curriculum among educators and administrators. The authors of the study assert that NI curricular integration would appear to be sporadic. In regards to faculty current use of CASN NI Entry-to-Practice competencies (2012), only 31% of nursing faculty use (moderately to extensively) the competencies to support students learning of NI competencies (Nagle et al., 2020a).

In light of these reports, it can thus be concluded that formal NI education is not fully integrated into Canadian nursing undergraduate curriculum, suggesting graduates of these programs are likely to have gaps in their knowledge and skills required to work in today's clinical environment.

Use of Digital/ Informatics Tools. In the U.S., the National League for Nursing (2015) recently called on nursing education programs, stating that "nursing curricula and teaching strategies need to teach with and about technology to better inform healthcare interventions that improve healthcare outcomes and prepare the nursing workforce" (p. 4). The CASN *National Nursing Education Framework* (2015), which set expectations for baccalaureate programs in

nursing education in Canada, articulates that students must be knowledgeable in the use of digital/informatics tools to support patient care and have the ability to communicate with the interprofessional team using these tools. Furthermore, RNAO *Best Practice Guideline for Practice Education in Nursing* (2016) recommended that nursing programs provide the opportunity for students to work with these tools and that faculty need to be prepared to use them. Yet it has been reported in the literature that nursing students are entering the workplace with gaps in knowledge regarding the use of digital/informatics tools and the management of information (Benner et al., 2010; Choi & De Martinis, 2013; Elder & Koehn, 2009; Fetter, 2009a; Fetter, 2009b; Nagle & Clarke, 2004; Shin et al., 2018; Thompson & Skiba, 2008).

The integration of NI could be achieved through the systematic and purposeful application of digital/informatics tools in nursing education to help cultivate desired competencies needed to support evidence-informed practice (Borycki et al., 2015; CASN, 2012; CNA & CNIA, 2017; IOM, 2000, 2001; Kleib & Nagle, 2018b; Kupferschmid et al., 2020; Nagle et al., 2020a, 2020b; Repsha et al., 2020). Digital/informatics tools support the retrieval, management and use of clinical data and information to support clinical judgment, knowledge acquisition, evidence-informed practice, and client education (RNAO, 2012); the foundation of nursing practice. The Canadian *e-Nursing Strategy* posits that having access to and using digital/informatics tools in addition to participating in digital health initiatives are key strategies for developing nurses' informatics competencies (CNA, 2006). For example, in the U.S., Bakken et al. (2004) conducted a pre- and post-

implementation study focusing on the development of informatics competencies through the use of digital/informatics tools. The researchers reported that students use of these tools increased

their competence in informatics, suggesting that this approach can help develop nursing students' informatics competencies.

Nursing faculty members who draw explicit links between classroom learning and clinical experience with the use of digital/informatics tools used for educational purposes can assist students in developing their informatics competencies. Faculty can also create a digital learning environment for the students to learn about the applications of digital/informatics tools to support the development of students' skills, knowledge and attitudes so that it is transferable to their future clinical practice. Furthermore, students will be introduced to the possibilities that digital health holds for improving patient safety and care delivery. Examples of types of digital/informatics tools that can be used by nursing faculty are found in Table 1 (CASN & CHI, 2013; Weiner & Trangenstein, 2009).

Table 1

Digital/Informatics Tools Applications in Education and Healthcare

Examples of Digital/informatics tools applications and tools in nursing education	Examples of Digital/informatics tools applications and tools in the healthcare setting
Learning management systems (Blackboard, Moodle) Presentation software Word processing, spreadsheets Smart classroom (Computers, Projectors, Microphones, SmartBoard technology, Polling devices) Social Networking tools and networking (Facebook™, Twitter™) Online courses and resources (e-textbooks, e-modules, e-reference) Communication applications (E-mail, texting, discussion boards, podcasting, Skype™, Web 2.0 apps) Mobile technologies Simulation Virtual reality (Second Life, Augmented Reality) Online test administration (HESI Testing, course-based testing) Simulated EHRs	Telehealth, telenursing, tele-homecare Clinical information systems (EHRs, Clinical Decision Support Systems) Patient monitoring devices: (capillary blood glucose, hemodynamic monitoring, fetal heart monitoring devices) Social Networking tools (Facebook™, Twitter™) Wearables and portable monitoring Mobile or mHealth Personal Digital Assistants, Laptop, Tablet, Computer, Workstation on Wheels.

The integration of these tools in nursing curriculum has been identified as a key strategy for enhancing informatics competenc

ies among future nurses (Brown et al., 2020; Hebert, 1999; Kinnunen et al., 2017; Nagle & Clarke, 2004; Kleib et al., 2013; Staggers et al., 2001, 2002). For example, adopting a teaching tool such as simulated EHRs which has functions of a true EHR could enable students to navigate the technology and document electronically in a classroom, thereby applying informatics skills in a realistic learning context (Borycki et al., 2009; Chung & Cho, 2017). Providing these hands-on opportunities for students to practice informatics skills in a safe

learning environment increases their ability to understand informatics in the context of patient care and see the relevance to future nursing practice. The use of digital/informatics tools can assist students in gaining proficiency in digital health content and enables them to merge theory to practice (CASN & CHI, 2013). Early and frequent exposure to digital/informatics tools during students' educational experience fosters students' confidence (Chung & Cho, 2017). As a result of using these tools, the competence they develop during their nursing education can then be transferable to clinical practice more seamlessly. However, the use of digital/informatics tools such as simulated EHRs in Canadian nursing education is still limited (Borycki et al., 2009; Nagle et al., 2020a). Furthermore, Williamson and Muckle (2018) stated that there are limited research findings related to the use of digital/informatics tools in nursing education. For example, in the Nagle and Clark (2004) study entitled *Assessing Informatics in Canadian Schools of Nursing*, this work provided some insights into tools being used by nursing faculty including computers and software program to access email, the Internet and library but there was limited understanding as to how these tools were being used to support the development of students' NI competencies. Fifteen years later, the national survey, *Digital Health in Canadian Schools of Nursing study* (Nagle et al., 2020a), reported less than 20% of nurse educators used simulated EHRs in their teaching practice. Furthermore, participants reported that students have limited access to simulated EHRs in the clinical environments, or that the healthcare organizations do not have a fully functional EHR, thus limiting students' abilities to develop their informatics skills. In addition, when participants were asked how they assisted students with their informatics competencies, more than 50% reported minimal to no support to students in the use of EHR, mobile devices, social networking applications and digital tools to collect, document and retrieve data. The study also reported that more than 50% of participants

moderately to extensively supported students to identify credible websites, used digital/informatics tools to support nursing practice and decision support tools. However, there is a need for research that examines how faculty perceive the usefulness of digital/informatics tools in the development of students' informatics competencies.

Role of Nursing Faculty in Promoting Informatics and the Use of Digital/Informatics Tools. As stated before, nursing faculty are central to the successful integration of digital health content into nursing programs and in the development of nursing students' informatics competencies (CASN, 2012; Kinnunen et al., 2012; Skiba et al., 2010; Tubaishat, 2014; Vargo-Warran, 2016). Nursing faculty are also called upon to keep abreast of workplace technologies and to develop ways of integrating digital health content into the classroom and practice settings across the curriculum (Benner et al., 2010). Nursing faculty can help students apply digital/informatics tools to patient care and assist them in developing and building their informatics competencies based on CASN Nursing Informatics Entry-to-Practice competencies (2012). In addition, CASN (2012) contends that nursing faculty should also be able to apply technologies appropriately and to become conversant with digital/informatics tools, resources, and approaches in both the classroom and practice settings. Faculty can help support the development of NI competency by building on students' existing NI knowledge and experiences to scaffold learning. Learning activities could be intentionally designed to foster the development of all dimensions of NI competency. Faculty can then guide students in accessing and gathering the right data and information at the right time; critically analyze and evaluate the information, and then apply it in the patient care context. An example of how faculty could assist in developing students' NI competencies in the academic context includes performing online searches, critically appraising the literature, using simulated EHRs, accessing data from

clinical information systems in clinical settings, and evaluating websites for patient education. These activities contribute to developing information literacy and the use and application of digital/informatics tools. Furthermore, faculty should also anticipate the development of future digital health applications and help students cultivate curiosity for learning about these technologies as they become available.

The majority of studies of nursing informatics has focused on attitudes of nursing faculty and students, the utility of digital/informatics tools, and the evaluation of resources such as drug reference guides and e-books. Nevertheless, related studies that have specifically researched faculty role in digital health report that nursing faculty may not have the competencies in NI to help students develop their own competencies. According to Hebda and Calderone, "nursing faculty and new graduates entering the workforce lag behind in informatics skillsm" (2010, p. 56). In Canada, Nagle and Clarke (2004) reported that only one third of schools of nursing reported faculty as having adequate NI competencies, and good to very good knowledge of informatics. In a recent study, over half (54%) of nurse educators (n=360) self- rated their NI competencies at the beginner level, 48% of respondents reported they felt confident in their ability to integrate digital health content into their teaching and 34% felt they had the required competence to teach digital health content (Nagle et al., 2020a). These results suggest that faculty may not be well prepared to help students develop their NI competencies.

Researchers have also found that nursing faculty may have an unclear understanding of the scope of NI (Hebda & Calderone, 2010; RNAO, 2012). There seems to be a limited focus and a general misunderstanding from nursing faculty that the use of PowerPoint or learning management systems is the same as using digital/informatics tools in the patient care context. The recognition of all core NI competencies could assist nursing faculty in successfully

integrating digital health content into undergraduate nursing programs (Pilarski, 2010). This study has helped to shed some light on the relevance for using digital/informatics tools for learning purposes and their role in development of NI competency within academic settings for teaching and learning purposes, and their role in contributing to the development of NI competencies. This research study has explored this dimension.

It also appears that nursing faculty are underprepared for the use of digital/informatics tools in the healthcare environment (Austin, 1999; De Gagne et al., 2012; Fetter, 2009a; Kinnunen et al., 2017; Nagle & Clarke, 2004; McNeil et al., 2005; Ornes & Gassert, 2007; Saranto & Hovenga, 2004; Thompson & Skiba, 2008; Webb et al., 2017). Consequently, it is critical to identify factors that determine nursing faculty's usage of digital/informatics tools, such as their knowledge, attitudes, and beliefs; as well as contextual factors that may enable or hinder digital/informatics tools integration (Kowitlawakul et al., 2014). Once these factors are identified, one will be better able to understand the needs of nursing faculty to then better integrate digital/informatics tools into the curriculum.

In several studies in the U.S., researchers have explored nursing faculty experiences of adopting digital/informatics tools in the academic setting, focusing mainly on the barriers. For example, some have shown that lack of time to learn about digital/informatics tools (Blake, 2009; Kowitlawakul et al., 2014; Lilly et al., 2015), lack of knowledge, skills (McNeil et al., 2003; Nguyen et al., 2011; Thomson & Skiba, 2008), competing workload demands, lack of digital/informatics tools (Blake, 2009; Lilly et al., 2015), training (Foster & Sethares, 2017) and funding (Nagle et al., 2020a). In addition, faculty's unfamiliarity with the nursing informatics competencies frameworks such as the TIGER initiative (Fulton, Meek & Walker, 2014) have hindered the integration of digital/informatics tools. Furthermore, students' access to these tools

in the clinical settings (Fetter, 2008) can also impede their integration such as EHRs and other informatics tools integration. Some researchers have also suggested that most nursing faculty are considered to be “digital immigrants”, and may have been underexposed to digital/informatics tools or received inadequate informatics education in their former nursing education (CASN, 2017; Prensky, 2001), or may not have had the opportunity to learn about digital health content (Benner et al., 2010). In Canada, cited barriers to the use of digital/informatics tools incorporation include lack of resources, faculty training and funding (CASN 2012; Nagle & Clarke, 2004; Nagle et al., 2020a).

While the above reviewed studies have shed some light on factors impacting integration of digital/informatics tools into nursing curriculum, there is a gap in nursing research in relation to faculty experiences in utilizing digital health applications in nursing education particularly in how this integration serves to improve nursing students’ informatics competencies (Fiedler, Giddens, & North, 2014). Furthermore, it seems that studies often lack theoretical underpinnings that inform the use of digital/informatics tools for teaching and learning purposes, which may suggest that faculty might be missing on opportunities to improve teaching and learning for their students (Parker & Myrick, 2009). Therefore, the proposed research is warranted to address these knowledge gaps.

Statement of the Problem

Despite calls from national nursing organizations (CASN, 2012; CNA & CNIA, 2017; NLN, 2008, 2015) for nursing students to become competent in NI before they enter the workforce, several reports point out limitations in graduates’ preparedness in informatics competency (Hunter et al., 2013; Kleib & Nagle, 2018b; Kleib et al., 2013; Kinnunen et al., 2017; McNeil et al., 2006; Nagle & Clarke, 2004; Nagle et al., 2014; Nagle et al., 2020a;).

Nursing faculty are central to the success of nursing students' developing NI competence and to integrating digital/informatics tools into nursing education. It is thus imperative to explore nursing faculty perception of their utilization of these tools, both in teaching and learning, to enhance development of NI competencies among nursing students. It is also important that faculty's practice is informed by a theoretical foundation to support this integration in teaching and learning (Ally, 2013). Learning theories can help explain, analyse, and challenge taken-for-granted assumptions and determine when, why and how to integrate digital/informatics tools in nursing education; successful integration depends on a strong theoretical foundation.

Purpose of the Study

Given the shortfalls in what is known about developing NI competencies in nursing education, the purpose of this study was to explore nursing faculty experiences in integrating digital/informatics tools to support students' learning in undergraduate nursing programs, and the development of students' informatics competencies. The broad research question that guided the study was: "What are the experiences of nursing faculty in integrating digital/informatics tools to support undergraduate students' learning and the development of informatics competencies?" Specifically, this study sought to answer the following sub-questions:

1. How are nursing faculty currently integrating digital/informatics tools in teaching and learning?
2. What do nursing faculty perceive as enabling or hindering factors to integrating digital/informatics tools into teaching and learning?
3. How do nursing faculty perceive the usefulness of digital/informatics tools in nursing education?
4. How do nursing faculty perceive that using digital/informatics tools can contribute to the integration of nursing informatics competencies in nursing curriculum?
5. How do nursing faculty perceive that the use of digital/informatics tools for learning and teaching purposes enhances students' nursing informatics competencies?

6. What are the theoretical perspectives that support nursing faculty's decision to integrate digital/informatics tools in teaching and learning?

Significance of the Study

Nursing faculty have been urged by national nursing associations (CASN 2012; NLN, 2008, 2015) to integrate digital/informatics tools in their teaching and learning practices to help develop future nurses' informatics competency, thus ensuring graduates have the requisite competencies to work in a technologically rich environment. There is yet limited research to inform about the role of nursing faculty in this process. While some studies have been conducted in other countries, such as the U.S. (Fetter, 2008, 2009a, 2009b; McNeil et al., 2005; Nguyen et al., 2011) and Australia (Eley et al., 2008), little is known about nursing faculty's current utilization of digital/informatics tools to help support the development of students' informatics competencies. In this research, the focused ethnographic approach provided an opportunity to understand how nursing faculty perceive and integrate digital/informatics tools and informatics competencies into nursing curriculum. In addition, it enabled a better understanding of the challenges that should be overcome for faculty to integrate digital/informatics tools and NI competency requirements into their teaching. Identifying these barriers may assist nursing undergraduate program leaders in providing appropriate support and resources to nursing faculty. The ultimate goal is to provide current evidence to help guide educators and nursing programs on how and why integration of digital/informatics tools and NI competencies in Canadian nursing education is vitally important and urgently needed. Lastly, findings from this research contributes to the body of nursing knowledge by adding to the existing body of literature relating to digital health integration within nursing curriculum in Canada.

Assumptions of the Study

Assumption is defined as “researchers making their values known in a study” (Creswell, 2013 p. 20). An important assumption within ethnography is that there will be an interplay between participant and researcher. Both parties come into the study with their own beliefs, values, knowledge and assumptions about teaching with digital/informatics tools that will influence the meaning of their experiences. It is also assumed that faculty who perceive their use as beneficial are more likely to use them in their teaching practice. Conversely, faculty who perceive barriers to the use of these tools will be less likely use them in their teaching practice. Furthermore, faculty's use of digital/informatics tools for teaching and learning purposes may contribute to enhancing students’ NI competencies. It is assumed that if nursing faculty incorporate measures to integrate NI into their teaching, students will gain informatics knowledge, skill and attitudes. As such, it is also presumed that students use of digital/informatics tools in nursing education will assist them in developing their informatics competencies.

As a researcher, I believe that active learning is beneficial to students learning and that the use of digital/informatics tools encourages active learning. I also assume that the use of these tools has intended and unintended consequences on faculty’s teaching and students learning. I value the use of digital/informatics tools in my own teaching practice. The use of reflective journaling allowed me to address my assumptions and reduce the potential threats that might have an influence on the research process.

Summary and Organization of the Remainder of the Study

The use of digital/informatics tools in healthcare is becoming increasingly prevalent and is anticipated to continue growing. There is an increasing expectation for nurses to work with these tools, such as EHRs, electronic medication records, telehealth and others in their everyday

practice. Accordingly, there has been a persistent call for nursing faculty to embrace informatics (CASN, 2012; CNA & CNIA, 2017; Greiner & Knebel, 2003; NLN, 2008, 2015). Nursing faculty are expected to prepare the next generation of nurses, and therefore need to be responsive to the changes occurring in the healthcare environment.

This chapter set the foundation for the need to explore nursing faculty integration of digital health content into undergraduate nursing education. I have reviewed the importance of digital/informatics tools and informatics in nursing education, which led to the research questions, purpose and significance of this study. The literature suggests that nursing faculty are slow to integrate the use of digital/informatics tools and place greater emphasis on certain dimensions of informatics in undergraduate nursing programs. The use of a focused ethnography study enabled me to explore nursing faculty experiences in integrating the use of digital/informatics tools to support students' learning in undergraduate nursing programs and the development of students' informatics competencies

Chapter 2 includes a brief history of the use of digital/informatics tools in nursing education and nursing informatics, as well as a discussion of the literature reviewed on the topic of the use of digital/informatics tools in nursing education. Chapter 3 outlines the research methodology used in this study, including an overview of the underlying philosophical perspective, the research design, description of sampling procedure, setting, entry to the field, data collection and data analysis. I also provided a discussion of trustworthiness, and ethical considerations, followed by a summary. The findings of the study, including the descriptions of themes that resulted from the data, are presented in Chapter 4. Finally, Chapter 5 constitutes the discussion of the results, limitation, implications and recommendations.

Chapter 2: Review of the Literature

In this chapter, I provide a review of relevant research with the aim of gaining a better understanding of the research problem, to identify gaps, analyse, and synthesize knowledge regarding the use of digital/informatics tools in nursing education (Machi & McEvoy, 2016) to better inform the research question. This chapter is divided into four sections: (a) the literature search strategy used, (b) the historical and contextual literature beginning with integration of digital health content from a macro perspective then focusing on their integration in nursing education including nursing informatics, (c) a brief description of digital pedagogy, the characteristics of the 21st century learner and theoretical perspectives in nursing education, and (d) a review of the literature concerning the integration of NI in nursing education.

Search Strategy and Selection of the Literature

A broad review of the literature was conducted using EBSCO Education Resources Information Center (ERIC), Cumulative Index to Nursing and Allied Health Literature (CINAHL) Plus with Full Text, MEDLINE via Ovid, Scopus, Web of Science Core Collection and Google Scholar. In this review, searches were conducted in July 2018 and updated in February 2021. I used various combinations of key terms including information technology communication, learning theories, nursing education, education, nursing faculty, nursing curriculum. Additional key terms included nursing informatics, simulated EHRs, informatics competencies and informatics competence. Table 2 outlines key search strings. No date constraints were applied to the search; English and French language articles were considered. Only scholarly, peer-reviewed journals were used for this review. Reference lists of the relevant articles retrieved through the database search were examined for the inclusion of further studies. In addition, I hand searched three key online journals in the fields of nursing and nursing

informatics including: the Canadian Journal of Nursing Informatics; CIN: Computers, Informatics, Nursing; and the Online Journal of Nursing Informatics to identify potential articles that may have been missed in the databases and reference list searches.

The following grey literature sources were searched for additional relevant studies. Sources included websites such as nursing informatics.com, the American Nursing Informatics Association, Canadian Nursing Informatics Association, Canadian Association of School of Nurisng, Ontario Nursing Informatics Group and Registered Nurses Association of Ontario. The literature pertaining to distance learning was excluded from this search as most baccalaureate nursing programs in Canada are offered on campuses, and distance delivery was beyond the scope of this study. In addition, nursing simulation literature is extensive and was not examined except for simulated EHRs as they relate to NI.

Table 2

Search Strings

Search terms
information technology communication AND nursing education OR education
information technology communication AND nursing education OR nursing curriculum
information technology communication AND nursing faculty
information technology communication AND teaching and learning theories AND nursing education OR nursing curriculum
nursing informatics AND nursing faculty
nursing informatics AND nursing education OR nursing curriculum

Historical Perspective of the Use of Digital/Informatics Tools

Advancements in technologies have had significant impact on society throughout history and have transformed how we live and interact with each other. Digital/informatics tools have

also created a series of revolutions and with each successive revolution, these tools have become more powerful and efficient, adding new dimensions and capabilities to the technology itself. The following section summarizes key technological developments including the five generations of computing.

The Industrial Age (1760-1840) was marked by the First Industrial Revolution evident by industrialization and several technological advances in mechanization such as the spinning jenny, the invention of the telegraph, and the development of the steam engine capable of powering ships and locomotives (History.com, 2009). Charles Babbage, an English mathematician in 1821, invented the first rudimentary computer. He developed a programmable machine using punch cards to input data capable of calculating and printing results automatically (Nelson & Staggers, 2016).

In the late 19th and early 20th centuries the Second Industrial Revolution, or Information Revolution arose. Electricity was the primary source of power; automobiles were manufactured through assembly lines and the telephone, the telegraph and the typewriter were invented (Pottenger & Hemmendinger, 2018). The Second World War marked the first generation of computers (1940-1956) used mostly for military purposes. Those computers used vacuum tube technology as circuitry and magnetic drums for memory. The vacuum tubes performed logic operations and had the ability to store data. They were very large, had very slow processing capabilities, and were unreliably prone to hardware failures (Hussey et al., 2015). Between 1956-1963, computers entered their second generation. These computers used transistors, thus reducing the size of computers, and making them more efficient, reliable, as well as cost-effective compared to first generation computers (Zimmermann, 2017). Computers were beginning to be used in hospitals for administrative purposes. By the mid-1960's, nurses were

beginning to use computer technology for patient care to monitor patients' health status, such as cardiac monitors and ventilators (Saba & Westra, 2011). The invention of Integrated Circuit technology, consisting of a silicon chip, laid the foundation of microchip technology (Thede & Sewell, 2010) and gave rise to the third generation of computers (1964- 1971). Again, computers became smaller, more reliable and efficient compared to the previous generation. Towards the end of this generation, hospitals were developing computer-based information systems, focused on financial and accounting functions, physician order entry, and reporting results. Hospital information systems were introduced, providing information about the patient history. Nurses were often involved in implementing these systems (Saba & Westra, 2011) and were beginning to use computerized nursing care plans (Hannah, 2007).

The digital age, or the Third Industrial Revolution, began in the later half of the 20th century to mid 21st century. Technologies were evolving rapidly. They transformed the way we live and work as we replaced electronic technology with digital technology. In the fourth generation of computers (1971-2010), the microprocessor was invented. This is also known as a central processing unit or the computer engine. The microprocessor gave rise to the personal computer; a smaller, more accessible and affordable computer (Thede & Sewell, 2010). Personal computers brought computer capabilities to the point-of-care in the healthcare system. Starting in the 1980's, EHRs and electronic medication records became a possibility across Canada driven by the First Ministers' Accord on Healthcare Renewal (First Ministers of Canada, 2003). This report stated that EHR and telehealth would improve safety and quality of care, utilization of resources and access to care in rural and remote communities. Although progress has been steady, the systems have not all fully migrated to EMRs. These new technological developments in healthcare led to a new field in nursing called nursing informatics. In the early 1990's, the

World Wide Web (WWW) was developing, allowing for increased access to information to support nursing practice. During this generation, the WWW evolved from Web 1.0 to 2.0. Web 1.0 was simply an information portal allowing the user to access information (TechTarget, 2018). In the early 2000's, Web 2.0 facilitated interaction between Web users and allowed them to better collaborate with each other (TechTarget, 2018). Web 2.0 encouraged participation, collaboration, and information sharing (TechTarget, 2018). Several Web 2.0 applications were also developed including YouTube, Wiki, Podcast and Blogs. Personal digital assistants (PDAs) and other small handheld computers were introduced in 1996. They are typically characterised by their ability to provide communication and information, their portability and the fact that they can be used without a connection to power or telecommunication services (Peters, 2009). PDAs became more persuasive and are presently considered part of the collective group of mobile technologies. Recognizing the many benefits of using mobiles technologies in healthcare, healthcare professionals began to adopt them for patient care. PDAs enabled immediate, real-time access to information at the point-of-care such as medication information, laboratory values, clinical assessments, and facilitate documentation at the bedside (Chang et al., 2015; White et al., 2005). They enable immediate, real-time access to information at the point-of-care such as medication information, laboratory values, clinical assessments, and facilitate documentation at the bedside (White et al., 2005). Mobile technologies also gained popularity in nursing education as more faculty are incorporating them into their pedagogical practice to enhance student engagement (Williamson & Muckle, 2018).

Web 3.0 is still evolving and has yet to be defined. Some of its characteristics include Semantic web, which is defined as "an extension of the current web in which information is given well-defined meaning, better enabling computers and people to work in cooperatively. It

enables the users to create data, store it, build vocabulary and write rules for handling data" (Hendler et al., 2002, para 1.). Development of Web 3.0 has marked the beginning of the Fourth Industrial Revolution which is characterized by use of robotics, genetic editing, artificial intelligence and increased connectivity through the internet of things, mobile and Cloud. Computers in this 5th generation (2010- onwards) are still in development. Some of the technologies that have emerge respond to human language and are capable of learning and sub-organizing (TechTarget, 2018). For example, robotics to support nursing care (Hussey & Hannah, 2021) as well as computers with Artificial Intelligence capability perform tasks similar to humans such as the ability to learn, reason, self-correct (TechTarget, 2018) and Other characteristics of this generation include applications such as voice recognition, virtual reality, wearable devices, smart homes, virtual personal assistants such as Siri and Google 3D graphic, as well as self-driving cars (Amuno, 2017; Booth et al., 2021).

In the past few decades, there has been a rapid pace of technological development and innovation which will continue to influence the healthcare environment (Risling, 2017). It is difficult for healthcare professionals and nursing students to keep up with this pace. Therefore, nursing students must develop the foundational nursing informatics knowledge, skills and attitudes to be able to adapt to future technological trends.

Digital Health and Canadian Health Policies

Since the 1980's, the advancement of digital health in the healthcare setting has led to the widespread use telehealth, clinical information systems such as EMRs, EHRs, electronic documentation, clinical decision support systems and even the use of WEB 2.0 by healthcare professionals. Black et al. (2011) characterize digital/informatics tools as having three main functions in healthcare: (1) to enable the storage, retrieval, and transmission of data; (2) to

support clinical decision making; and (3) to facilitate remote care. Evidently, digital health applications have become a vital part of modern healthcare and their use will only increase in the future as more technological advances transform how heath care is delivered.

In 1999, the Institute of Medicine released a report: *To Err is Human: Building a Safer Health System* indicated that approximately 98,000 patient deaths occur per year due to medical errors (IOM, 2000). This report stimulated action to improve patient safety, and quality of patient care and to better prepare healthcare professionals. Subsequently, the Institute of Medicine (2001) posited that digital/informatics tools such as EHRs could potentially reduce medical errors and improve patient care outcomes. For example, nurses can access laboratory results and medication information through clinical information systems and critically use this information in administering medications thus preventing medication errors.

Shortly thereafter the IOM report in 1999, Greiner and Knebel (2003) called for a reform on healthcare education and for the integration of five core competencies that all healthcare professionals should possess to deliver safe and quality patient care. These competencies include: providing patient-centered care, work as members of an interdisciplinary team, emphasize evidence-based practice, utilizing quality improvement approaches, and informatics. Informatics competencies charged all healthcare professionals to "communicate, manage knowledge, mitigate error, and support decision making using information technology" (p. 2). As the largest group of healthcare professionals in the healthcare system (Canadian Institute for Health Information, 2017), nurses can have a significant impact on patients' safety and their quality of care.

Meanwhile in Canada, in the later 1990s and early 2000s, a number of provincial and national reports were released regarding the state of the Canadian healthcare system. The reports

concluded that the government should invest in digital health to increase the quality of care of Canadians and to make the healthcare system more cost-effective, efficient, and sustainable. In 1997, a Health Canada report recommended the federal government to support the integration of digital/informatics tools to improve accessibility, quality and efficiency. As a result, the federal government funded Canada Health Infoway, a not-for-profit organization, mandated to increase the adoption of a pan-Canadian EHRs and to promote the exchange of clinical data such as pharmacy, diagnostic imaging and laboratory information in 2001. This organization primary goal was to implement EHRs for 50% of Canadians by 2010 and for all Canadians by 2015 (CHI, 2009).

Other provincial and federal reports continued the call for further investment of digital health applications in healthcare system. The Fyke Report (Fyke, 2001), *Caring for Medicare: Sustaining a Quality System*, advocated for the use of EHRs as a solution for sustaining Canada's publicly funded healthcare system, stated that EHRs are the "cornerstone of an efficient and responsive healthcare delivery system and quality improvement and accountability" (p. 68). In addition, the report acknowledged that EHRs could provide immediate access to information enabling better patient care decisions to be made. The same year, the Albertan premier released the Mazankowski report- *A Framework for Reform Report of the Premier's Advisory Council on Health* (Mazankowski, 2001) mandating reform to Alberta's healthcare system, urging the implementation of a provincial EHRs to increase the quality of the healthcare system, to enhance efficiency and improve cost-effectiveness. The report also encouraged long-term funding to support the implementation of digital health applications in the healthcare system. In 2002, the Kirby report (Kirby, 2002), *Building on Values: The Future of Healthcare in Canada,* was released. This report concluded that digital/informatics tools are key to the delivery of safe,

competent, ethical and sustainable healthcare. Kirby (2002) recommended additional funding to achieve the goal of pan-Canadian EHRs. Finally, *Building on Values: The Future of Healthcare in Canada* (Romanow, 2002), Commissioner Romanow asserted that "electronic health records are one of the keys to modernizing Canada's healthcare system and improving access and outcomes for Canadians" (p. 77), reiterating the importance of EHRs to provide safe, efficient quality care and improve the health outcome of Canadians.

Presently, EHRs is being used in 95% of settings across Canada and 60% of healthcare professionals are accessing EHRs for laboratory tests, diagnostic imaging, clinical reports, prescription information to assist them in provide care to patients. In 2017, more than 42% of nurses and primary care physicians reported having access to clinical information systems and this is expected to increase as healthcare professionals become more competent in the use of digital/informatics tools (CHI, 2018). Nurse leaders assert that a pan-Canadian EHRs will eventually incorporate nursing data relating to patient's assessment and nursing interventions (Hannah et al., 2009). The data and information entered by nurses into EHRs will capture what nurses do in their practice and allow nurses to see the impact of their efforts on patient outcomes thereby influencing the quality and efficiency of patient care.

In summary, the establishment of a pan-Canadian EHRs system is a clear priority for policy makers at the provincial, territorial, and federal levels in order to improve efficiency, and to provide safer and more effective patient care within the Canadian healthcare system. Nurses must be ready to accept the proliferation of EHRs and develop informatics competencies to effectively use digital/informatics tools in their nursing practice.

Nursing Informatics (NI)

The term informatics can be traced back to the German term “informatik” referring to computer science. It meaning refers to the “application of computers to store and process information” (Fourman, 2002, p.1). As digital/informatics tools began to be applied within various disciplines, the term “informatics” was being links to specific fields. It was gradually adapted to healthcare and identified as “healthcare informatics”. Healthcare informatics encompasses distinct sub-specialties of the discipline for example, medical informatics, dental informatics, and nursing informatics (Thede & Sewell, 2010).

NI is a concept integrating nursing science, computer science and information science (American Nurses Association, 2008). The earliest definition of NI was articulated by Scholes and Barber as “the application of computer technology to all fields of nursing-nursing services, nurse education, and nursing research” (1980, p.73) highlighting the use of computer in all domains of nursing practice. It seems this early definition focused only on one dimension of NI that of computer literacy with the little emphasis on information literacy or the ability to use digital/informatics tools to manage data, information and knowledge.

Since the earliest definition was published, many definitions of NI have emerged and evolved over the past three decades. Graves and Corcoran (1989) conceptualized the term as “a combination of computer science, information science, and nursing science designed to assist in the managements and processing of nursing data, information, and knowledge to support the practice of nursing and the delivery of nursing care” (p. 227). This definition is considered the seminal definition of NI (Thede & Sewell, 2010). This view focused on the purpose of digital/informatics tools in nursing as opposed to the technology itself (Staggers & Thompson, 2002). As previously mentioned, the concepts within this definition “data, information and knowledge” are the core concepts of NI (Saba & McCormick, 2006). The American Nurses

Association later modified this definition of NI for the development of the first scope of practice for nursing informatics for all nurses in the United States (Saba & McCormick, 2006).

The most commonly cited definition of informatics in Canada is from the International Medical Informatics Association, defining NI as "science and practice [that] integrates nursing, its information and knowledge, with management of information and communication technologies to promote the health of people, families, and communities worldwide" (2009, para 2). From this perspective, nursing informatics assists nurses in delivering appropriate nursing care and enhancing nursing knowledge development. It entails the gathering, assessing, analyzing, evaluating and transmitting patient data and information as part of their nursing care (RNAO, 2012), which nurses have done since the Nightingale era (Hussey et al., 2015).

In the 1990's, a Canadian nurse expert informatician Hannah as well as Ball, and Edwards (1994) elaborated on the role of informatics in nursing to include the

> ... use of information technologies in relation to those functions within the purview of nursing, and that are carried out by nurses when performing their duties. Therefore, any use of information technologies by nurses in relation to the care of their patients, the administration of healthcare facilities, or the educational preparation of individuals to practice the discipline is considered nursing informatics. For example, nursing informatics would include, but not be limited to, the use of artificial intelligence or decision-making systems to support the use of the nursing process; the use of a computer-based scheduling package to allocate staff in a hospital or healthcare organization; the use of computers for patient education; the use of computer-assisted learning in nursing education; nursing use of a hospital information system; or research related to information nurses use in making patient care decisions and how those decisions are made. (p. 5)

It is important to recognize in the above description of the role of informatics in nursing is relevant to all nurses in all settings, thus informatics should not be considered as a requirement for nurses with this specialization but rather as a foundational skill set that all nurses should possess (Gugerty & Delaney, 2009). This includes nursing faculty who use digital/informatics tools for teaching and learning (CNA, 2001; CNA & CNIA, 2017; Fetter, 2009c).

As noted, several definitions of NI exist; Turley (1996) documented 14 definitions of NI over the past 30 years. The multitude definitions may contribute to nursing faculty misunderstanding of the term (De Gagne et al., 2012). Findings reveal that students and faculty perceived NI definition as unclear (Morris & Hancock, 2013). Staggers and Thompson (2001) posit that a clear definition is fundamental in shaping a speciality and provides direction for practice, education and research (2002). Without a clear definition, nursing faculty may have

difficulty integrating NI into nursing curriculums. Nevertheless, the definition and the role of informatics will continue to evolve as the field matures and is influenced by new applications of information and communication technologies in nursing.

Nursing Informatics in Canada

The National Nursing Informatics Project, initiated by the Canadian Nurses Association in 1999, was the first formal dialogue of NI competencies in Canada (RNAO, 2012). This working group was mandated to develop a national consensus on the definition of NI, and informatics competencies for Canadian nurses, to identify nursing informatics education opportunities and to determine national nursing informatics education priorities (Hebert, 1999).

Forecasting the potential impact of digital health applications on nurses and the profession, the Canadian Nurses Association developed several position statements and reports regarding nurses' use of digital/informatics tools in healthcare. In 2001, the association issued, a document entitled: *What is nursing informatics and why is it so important?* It served as a building block to this new emerging field of NI in Canada, as it explained key characteristics of informatics, and its application to all four areas of nursing practice: clinical, research, administration and education as well as the need for all nurses to integrate informatics into their practice (CNA, 2001).

In 2006, the CNA released another document, *e-Nursing Strategy* outlining three specific strategies to integrate digital/informatics tools into nursing: access, competencies and participation. Nurses and nursing students must be able to access these tools to support patient care and be able to understand the benefits of integrating them into nursing practice. In addition, they need to develop informatics competencies to effectively work with these tools digital/informatics tools. It is important that nurses participate in their development of

digital/informatics tools to ensure they are appropriate for nursing practice and beneficial to patient care. The Registered Nurses Association of Ontario also developed resources such as the *Nurse Educators' e-Health Resources* (2012) to help faculty integrate, *CASN NI Entry-to-Practice competencies* (2012) to support faculty with the integration of digital health content into undergraduate nursing education. Nursing faculty can use these resources to help build nursing students' informatics competencies. In 2017, CNA and CNIA released a joint position statement: *Nursing Informatics* asserting that informatics competencies are essential for all nurses in all settings. In addition, it states that nurses must integrate digital/informatics tools into their practice to support decision-making in context of patient care.

Finally, in 2018, Canadian researchers, Kleib and Nagle (2018a, 2018b), developed a 21-item self-assessment tool, the Canadian Nurse Nursing Informatics Self Assessment Scale (C-NICAS), to measure perceptions of NI competencies among registered nurses in Alberta based on the CASN NI Entry-to-Practice competencies three main domains: foundational information and communication technology (ICT) skills, information and knowledge management, professional and regulatory accountability, and use of ICT in the delivery of patient care (CASN, 2012). Although this scale has not been validated among students yet, it can help nursing faculty understand undergraduate nursing students initial learning needs by assessing their levels of NI competencies. This tool can also guide nursing faculty to develop strategies corresponding to the students individual learning needs. This could also support the integration of NI competencies into their curriculum.

Nursing Informatics Competence. Nursing informatics competencies are the knowledge, skills and abilities necessary for nurses to effectively manage knowledge (Gugerty & Delaney, 2009). McKinney et al. (2017) posit that NI competencies include but are not limited to

computer and information literacy as well as the ability to use and apply digital/informatics tools to manage data, information and knowledge.

Computer literacy is the ability to work with computers and their applications such as word processors, spreadsheets, presentation software, electronic mail (Gugerty & Delaney, 2009) as well as patient care technologies. Nurses should be skilled at using patient monitoring devices as well as a variety of information systems such as decision support tools, EHRs and electronic medication records. Computer literacy is a foundational skill of NI as are the two other dimensions of nursing informatics competency (Gugerty & Delaney, 2009). Information literacy is the ability to know when information is needed, how to locate it, how to critically evaluate it as well as to effectively use that information. (American Library Association, 1989; Gugerty & Delaney, 2009). Nurses must be able to locate and access available resources in different formats such as electronic databases. In addition, nurses must critically appraise not only the information but also its sources and then integrate the information with existing knowledge and then apply it to nursing practice. Finally, nurses must evaluate outcomes of the information used (Gugerty & Delaney, 2009).

Information literacy, therefore, becomes critical to evidence-informed nursing practice. This component of informatics also involves assisting patients in using digital/informatics tools to help manage their health. Finally, the dimension of information management and application. Information management encompasses the 1) collection of data, 2) processing of data, and 3) presenting and communicating the processed data as information or knowledge (Gugerty & Delaney, 2009). It is the ability to manage data and information as well as how to work with clinical information systems. Examples of information management include: documenting patient's data into clinical information systems as well as protecting and securing the information

(CASN, 2012). The underlying concept of information management is the data to information to knowledge continuum (Delaney & Gugerty, 2010). This is the process of transforming data into information and then into knowledge, a process that forms the core of nursing informatics. Although nurses have always collected, documented, organized and interpreted data to inform nursing practice (CASN & CHI, 2013), it has not always been accessible or visible to other healthcare professionals. The application of digital/informatics tools such as clinical information systems can support the nurse in capturing, documenting and storing the data accurately, reliably that is accessible at the point-of-care. In addition, the data gathered by nurses through digital/informatics tools systems can be used to support clinical judgment and decision making to inform nursing practice (Thede & Sewell, 2010). These tools can help the nurse organize, analyze and even aggregate the data over time from multiple patients thus making it possible to look for new patterns and relationships which can inform future nursing practice. This then supports the development of nursing knowledge, thereby advancing the nursing discipline (CASN & CHA, 2013; CNA & CNIA, 2017; Pringle & Nagle, 2009). Finally, extracting data from the clinical information systems can provide evidence to policy makers of the positive impact of nursing contributions to patient care outcomes (Hannah et al., 2009).

NI Competencies Lists. As mentioned previously, several researchers and nursing organizations have developed informatics competencies lists to assist faculty in integrating them into nursing education. Presently, there are many NI competencies lists that exist for nurses and entry-to-practice level nurses (AACN, 2008; CASN 2012; Gugerty & Delaney, 2009; Kleib et al., 2021; Staggers et al., 2001; 2002). In addition, competencies related to nursing specific roles have also been identified for nurse leaders (Collins et al., 2017; Strudwick et al., 2019, Westra & Delaney, 2008), nurse managers (Hart, 2010; Jensen et al., 2016), nurse practitioners (Curran,

2003) telehealth nurses (van Houwelingen et al., 2016), psychiatric nurses (Repique, 2007), as well as nurse educators and researchers (Grobe, 1988). For proposes of this study, I will review Staggers et al. (2001, 2002) seminal competency list as well as Technology Informatics Guiding Education Reform (Gugerty & Delaney, 2009) and CASN NI Entry-to-Practice competencies (2012) lists as they focus on entry-level informatics competencies for nurses.

Informatics Competencies for Nurses at Four Levels of Practice. A seminal U.S. study by Staggers et al. (2001, 2002) published the first set of informatics competencies for nurses by conducting a Delphi study. The researchers identified 281 NI competencies within three core categories: (1) computer skills, (2) informatics knowledge, and (3) informatics skills levelling them into four distinct skills levels: (a) beginning nurse, (b) experienced nurse, (c) informatics nurse, and (d) informatics innovator. This set of 281 NI competencies serves as the basis for other NI competencies lists.

Technology Informatics Guiding Education Reform. In 2004, nurse leaders in the US recognised the increased demand for nurses to use digital/informatics tools in the healthcare environment. They formed an initiative known as the Technology Informatics Guiding Education Reform. One of their mandates was to promote inclusion of informatics competencies in nursing education and faculty development (Gugerty & Delaney, 2009) through the integration of digital/informatics tools (Gugerty & Delaney, 2009). Following an extensive review of the literature and surveying experts in the field of nursing informatics, three core competency categories were identified: (1) basic computer competencies, (2) information literacy, and (3) information management.

Informatics Competencies in Canadian Nursing Education. In 2012, CASN published the NI Entry-to-Practice Competencies, establishing the NI competencies that an entry-to-practice

nurse should possess upon entering the healthcare workforce. These competencies were established through a national iterative and consensual process. A work group, called the Competency Development Working Group' reviewed several competencies lists, such as Staggers et al. (2001), the Canadian Nurses Association (2011), the American Association of Colleges of Nursing (2021), and TIGER Initiative (Gugerty & Delaney, 2009; Nagle et al., 2014). The group identified one overarching competency: uses information and communication technologies to support information synthesis in accordance with professional and regulatory standards in the delivery of patient/client care. In addition, three core categories were identified: (1) information and knowledge management, (2) professional and regulatory accountability, and (3) information and communication technologies use. Each competency domain/category is complemented by a set of indicators. Computer literacy is not considered as a core competency according to CASN (2012) but is a foundational skill a student must possess upon entering an undergraduate nursing program. This document makes it clear which informatics competencies nursing students must acquire by the end of their undergraduate nursing programs to work safely, efficiently, and ethically in the technologically rich healthcare environment. The competencies also serve as a guide for developing curriculum and for patient and employer awareness of the practice expectations of the entry-level registered nurses (CASN, 2012; Nagle et al., 2014; Staggers et al., 2001).

Researchers have reported that some nursing students are entering nursing practice with insufficient NI knowledge and skills to meet the demands of the workplace (Choi & De Martinis, 2013; Elder & Koehn, 2009; Fetter, 2009a; Fetter, 2009b; Kleib & Nagle, 2018b). In addition, the literature commonly reports the integration of computer literacy and a few studies reporting the integration of information literacy in nursing education (McNeil et al., 2006; Thompson &

Skiba, 2008). As mentioned previously, NI also includes the ability to use digital/informatics tools to manage data, information and knowledge (McKinney et al., 2017). In addition, it appears that some nursing students have had little opportunity to work with these tools while in the clinical environment. For example, a Canadian study surveyed 131 college-level nursing students examining internal and external nursing informatics resources perceived by the nursing students (Jetté et al., 2010). The participants reported that very few had been trained on computerized nursing information systems (14%, n = 18), hospital information systems (11%, n = 14), or clinical or clinical-administrative applications (12%, n = 16). In a more recent study, only 35% of faculty members (n=84) used simulated EHR in their program and less than half (46%) of faculty reported that students were taught on how to use EHRs in the clinical environment (CHI, 2020).

If students have limited access to digital/informatics tools, this could impede their ability to understand the relevance of informatics to nursing practice roles. Nevertheless, faculty should not rely on the healthcare setting to teach students about the use of digital/informatics tools and informatics; rather these critical concepts should be endorsed by nursing education programs, especially that NI competencies are considered a requirement for entry-to-o,y practice.

This section highlighted the evolution of NI competency work and some challenges facing nursing programs, educators, and students. A recent scoping review pointed out that NI is a relatively new field in nursing, which may help explain why some nursing faculty may not be aware of it. Further, there are multiple definitions that continue to evolve, mostly in line with technology development, as well as the existence of multiple NI competency lists. While it appears that the dimensions of NI competency are similar across countries, there is still a lack of consensus and ambiguity regarding core informatics competencies, which may be creating

challenges for nursing faculty to integrate these competencies into undergraduate education (Kleib et al., 2021). However, in Canada, there are nationally approved informatics competencies: the CASN NI Entry-to-Practice competencies (2012); therefore, this may not necessarily be the case for Canadian nurse educators. Nonetheless, since the release of the Canadian NI competencies and its supporting resources, there have been limited studies investigating faculty's perception of these competencies and how do they integrate digital/informatics tools to support NI competency development in nursing students. This study examined faculty's perceptions regarding this aspect.

Digital/Informatics Tools in Nursing Education

Mirroring the application of digital/informatics tools in healthcare, nursing education has also adopted similar tools to support teaching and learning. The adoption of technology in nursing education followed the progression of the Web and computer developments. Computer-based learning, or learning assisted by computers, was first reported in 1963. Bitzer and Boudreaux (1969) developed an obstetrical simulation computer program using a computer-based education system, called the Programed Logic for Automatic Teaching Operations (PLATO), in teaching an obstetrical course. During this study, the researchers found that half of the nursing students preferred using PLATO as opposed to traditional lectures. Nursing students perceived the program easy to use. In addition, the students reported that they retained the same amount of information in less time than it would take using the traditional lecture method. In the late 1960's, Human Patient Simulator—Sim One—was first introduced. This was a computer-controlled simulator having the ability to produce a blood pressure, a heart rate, respirations, and a variety of palpable pulses (Sanko & McKay, 2017). Also, during this time period computer programs focused on drills, tutorials, and simulation (Sanko & McKay, 2017).

During the 1970's, many nursing curricula developed and evaluated computer-assisted instruction lessons to meet specific needs of nursing students (Hussey et al., 2015). Web 2.0 had several important applications in nursing education. It enabled students to share resources and collaborate with each other on projects. Google Docs, for example, enables learners to collaborate on assignments. In addition, faculty had a number of teaching tools at their disposal such as blogs, wikis, YouTube videos, podcasts and gaming all of which could be accessed to supplement learning and allow students to learn at their own pace. Web 2.0 also supported online learning, making distance education more accessible and engaging through virtual reality experiences and interactive web-based approaches to clinical education (Dutile et al., 2011). Distance learning or e-learning has also had a significant impact on nursing education as students from various locations can engage in learning through digital/informatics tools.

During the 1990's, PDAs were increasingly used to support nursing students' learning with software applications, such as medical dictionaries and drug guides that could be accessed at anytime and anywhere, such as at the patient's bedside. In addition, De Groote and Doranski, (2004) surveyed PDA use among health science faculty and reported that 59% of nursing faculty used PDAs for time management, email and web access.

In the early 2000's a virtual nursing learning community known as Second Life, was launched. Students immersed themselves in a virtual hospital caring for virtual patients (Baker & Brusco, 2011). Findings from an integrative review, reported Second Life was the most common platform used for virtual simulation (Shin et al., 2019). The application of virtual learning environments allowed nursing students to practice in a safe environment and shift the focus from a faculty centred to a learner centered approach. We are also experiencing a shift to mobile learning, as the majority of students do own mobile devices, and are using them to access

learning materials. Furthermore, some nursing faculty use mobile applications through mobile technologies, such as personal response systems, which encourage students' engagement and allows students to respond to quizzes and polls (Hart, 2012). According to Buchanan et al. (2021) scoping review, there is a growing trend in the use of artificial intelligence in Canadian nursing, in particular in clinical practice.

Within the history of the use of digital/informatics tools in nursing education, it has become more evident that technology has become much more complex as it evolves. Technologies are also becoming more engrained in every aspect of nursing practice. Nursing students as well as faculty need a solid understanding of informatics competencies to ensure they are equipped to use these diverse technologies.

Digital/Informatics Tools, Nursing Informatics and Education

Preparing nursing students to enter the workforce with informatics competencies already taught at the academic level could help improve quality and safety of patient care, as well as critical for ensuring career progression (Edwards & O'Connor, 2011). Providing nursing students with informatics experiences by using digital/informatics tools during their undergraduate nursing programs has many benefits. For example, their use has been associated with improved students' informatics competencies (Hwang & Park, 2011). In addition, the use of digital/informatics tools can assist students in feeling comfortable and confident in working with technologies, and to view them as useful tools to support patient care (Kowitlawakul et al., 2014). Ultimately "students immersed in high-technology education settings will be better prepared to practice in tomorrow's healthcare environment" (Simpson, 2002, p. 15).

Nursing faculty can assist nursing students in developing their informatics competencies by moving beyond simple digital applications of word-processing and presentation software, and

taking advantage of those technologies currently used to simulate the healthcare environment. Nursing faculty can also use digital/informatics tools to actively engage the learner and help them develop informatics skills in a learning context towards the goal of achieving overall competence. Although the type of digital/informatics tools used in the education setting may vary from the practice environment the underlying principles and intent of these tools use are generally the same (RNAO, 2012).

Supporting previous statements, Hebda and Calderone (2010) also posited that nursing faculty should facilitate nursing students' exposure to informatics through the use and application of digital health to help them develop their informatics competencies. Nursing students need to be educationally prepared to work with digital/informatics tools and incorporate all dimensions of NI. Limited exposure to applications of these tools and informatics amplifies the theory-to-practice gap and impacts students' ability to work effectively in technology-dense and complex healthcare environments. Both practicing nurses and student nurses need to be informed of the applications of information technology and their advantages. McNeil et al., (2003) also suggest that this could be accomplished through integration of digital/informatics tools into nursing education. Presently, there is a gap in the Canadian literature examining faculty perceived usefulness of digital/informatics in helping develop students' informatics competencies.

Digital Pedagogy

Digital/informatics tools have become entrenched in the lives of the 21st century nursing students and have impacted their educational environment and learning. They offer the potential for nursing faculty to be innovators in the use of learning material by allowing learners to personalize and customize their own learning experiences (Johnson & Bushey, 2011). The use of

these tools in nursing education can also foster creativity, problem solving, as well as encourage participation, collaboration and student engagement (Morris, 2014). McGonigle and Mastrian (2015) reminded us that they can be used as teaching tools to actively engage the learner, but that we must cautiously consider the diverse student population, teaching and learning styles, learning needs, learning outcomes and other pedagogical concerns. Otherwise, the use of digital/informatics tools will have no educational value.

Digital pedagogy is defined as the use of digital/informatics tools and its applications to enhance or transform the learning experiences for students (Morris, 2014). In addition, digital pedagogy approaches the use of digital/informatics tools for teaching and learning from a critical pedagogical perspective (Hybrid Pedagogy, n.d.) and raises the questions about what kinds of digital/informatics tools impact students' learning, what the role they have in facilitating learning, how learning occurs with the use of these tools, and how they support learning outcomes. It is concerned with how pedagogy drives the integration of digital/informatics tools and not how the use of these tools' dictates pedagogy (Hallowell, 2014; Morris, 2014).

The literature suggested that most nursing faculty use digital/informatics tools as a method to distribute content (Arrigo et al., 2013; Glen, 2005; Nagle et al., 2020a) as well as a repository of content. Some have banned their use in the classroom (Brooks & Pomerantz, 2017) and in practice, citing the tools as distractions (Cho, & Lee, 2016; Rossing et al., 2012), unprofessional (McNally et al., 2017) and linked with privacy concerns. From a digital pedagogy perspective, digital/informatics tools are encouraged but nursing faculty must guide students in understanding how best to use these tools and in what context to facilitate their learning from a critical standpoint and not to blindly accept their use.

Criticism of digital pedagogy included the time and resources required to invest in digital pedagogy (Sinacori, 2020; Sword, 2012). Faculty need to be cognizant of the digital divide and issues related to safety for students, faculty and patient such as patient privacy, recognizing errors associated with digital/informatics tools use and illegally accessing information from healthcare institutions (Cambridge International, 2014). Nursing faculty have also vocalized their frustration about the constant changes associated with the use of new digital/informatics tools in the classroom and clinical practice leaving faculty to feel overwhelmed and inadequate (Sword, 2012; Wingo, 2016).

Digital pedagogy can be further understood from application of traditional learning theories. In the section below, I provide a brief description of traditional learning theories including: behavioural, cognitive and constructivist approaches while examining these learning theories through a lens of digital pedagogy and how it may influence nursing faculty teaching practice. But first, we must also consider some key characteristic of the current nursing student, the 21st century adult learner.

Characteristics of the 21st Century Learner

Each generation shares a unique set of characteristics that distinguish them from other cohorts, as they share similar life experiences. The majority of 21st century nursing students were born between 1980 and 2000, meaning that they have grown up immersed in digital/informatics tools which have influenced their behaviors and attitudes toward learning and access to information. They see technology as a necessity of everyday life and as an extension of self. The majority of nursing students own several technological devices (Galanek et al., 2018). Brooks and Pomerantz (2017) studied the use of technology of over 43, 000 students worldwide, reporting that 97% of students owned a mobile technology. This generation of students are often

labelled as digital natives. Digital natives are defined as “native speakers of technology, fluent in the digital language of computers, video games, and the Internet” (Prensky, 2001, p. 8).

According to Prensky (2001), digital natives think and process information differently than those born in the previous generation and further asserts, that their brains are “wired” differently than those born in previous generations. They are apt at multi-tasking, process information quickly, and connectivity is important to them. They learn by participating, collaborating, and experiencing. They acquire knowledge by trial and error, searching and manipulating information to construct their own knowledge (Mangold, 2007; Skiba, 2005). Brown (2000) refers to this generation of learners as “an effective digital bricoleur”, as a “person who creates things from scratch, is creative and resourceful, a person who collects information and things and then puts them together in a way that they were not originally designed to do” (as cited in Skiba, 2005 para 11).

Digital natives are significantly different from digital immigrants who did not grow up in a digital environment but had to learn about technology later in life. They need to engage in one activity at a time and are slower at processing information (Prensky, 2001). Digital immigrants represent the majority of nursing faculty in Canada. CASN (2017) reported that 57% of permanent nursing faculty are 50 years of age or older. Their perspective of technology may differ from the digital natives

Despite digital natives being technologically privileged, some studies suggested that this generation has gaps in knowledge in basic informatics competencies (Benner et al., 2010; Fetter; 2008; Saranto & Hovenga 2004). The use of digital/informatics tools in nursing undergraduate education can provide students with a foundation to build their informatics competencies. Nursing students need to have opportunities to learn about the three dimensions of NI to enable

progressive development of these competencies (Carty & Ong, 2015). However, for this to occur, nursing faculty must be knowledgeable about their diverse student population as well as have adequate knowledge in the applications of digital/informatics tools in healthcare for them to teach this content. Further, effective integration of digital/informatics tools into nursing education requires an awareness of learning principles based on learning theories to enhance competencies in this area.

Learning Theories

Learning experiences should be supported by learning theories in order to create a richer and more meaningful learning environment. It is important to be purposeful and deliberate in considering why the use of digital/informatics tools should be applied in teaching and learning contexts. Learning theories help explain how and why learning occurs. Learning can be defined as "a change in mental processing, emotional functioning and/or behaviour as a result of a behaviour" (Braungart & Braungart, 2008, p. 52). Learning theories provide a framework that assists educators to guide the teaching and learning processes by describing, explaining and predicting how students learn. A solid understanding of learning theories can assist nursing faculty in the integration of digital/informatics tools in a systematic way. Without this theoretical foundation, nursing faculty's practice would likely be based on unverified assumptions as opposed to sound pedagogical practices that could help inform faculty about the effectiveness of their teaching and its impact on students' outcomes.

Several nurse leaders are concerned that the widespread use of digital/informatics tools, and the pressure to integrate them into nursing curriculum, have become the driver, and integration of such tools have not been informed by a theoretical perspective. Black and Watties-Daniels (2006) posited there has been a lack of research into the educational theories that guides

the integration of digital/informatics tools in nursing education. Furthermore, in a systematic review which examined how learning theory were used to design learning experiences with digital/informatics tools from 120 articles, only 16 studies referenced or mentioned a learning theory in the design or assessment of student learning (Kaakinen & Arwood, 2009). In another study which reviewed the literature on digital/informatics tools use in nursing, the researchers reported of the 47 articles reviewed only one research studies reported the use of a learning theory (Rourke et al., 2010). The use of digital/informatics tools should be critically examined from a theoretical perspective with a focus on teaching and learning for integration to be successful (Billings et al., 2001). Parker and Myrick (2009) asserted that if nursing education is to benefit from the use of digital/informatics tools and maximize its contribution to teaching and learning, nursing faculty need to address the underlying theories that serve to inform the learning modality.

There are several different views on how learning can be achieved, including ideas about how students come to know and how nursing faculty can assist in students' learning. Applicable theories include those such as behaviourism, cognitivism and constructivism (Kanuka, 2008). Each of these theories offers a different perspective. Their ontological and epistemological perspectives of learning are explored by considering three key questions: What is learning and how does learning has occurred? What is the role of the learner and of the educator?

Behaviorist Learning. Behaviorism assumes that behaviours are learned through interactions with the environment. This perspective focuses on observable and measurable behaviours and learning, and is characterised by a change in behaviour (Schunk, 2012). An early behaviorist, Pavlov (1849- 1936), investigated classic conditioning based on the experiments on dogs. Pavlov believed that learning occurs as a result of a stimulus response thus, and behaviorist

now assume that learning will occur when the right stimulus is given to students (Pettigrew, 2015). Skinner (1904–1990), another behaviorist theorist, meanwhile believed that in order for learning to take place there must be consequences either reward or punishment. Specifically, the learner will repeat the behaviour if a positive reinforcement is given, and will avoid repeating the behaviour if negative feedback is given (Pettigrew, 2015). The learner therefore is relatively passive and responds through positive and negative reinforcements (Kanuka, 2008). Examples of positive reinforcements to promote learning are praises, rewards and tokens.

In nursing education, a practice-based profession, most skills are learned through a behaviorist approach. Students practice their skills through guided practice, drills, as well as through trial and error. They eventually gain the desired skill as it is reinforced into memory (Schunk, 2012). Educators, the dispensers of knowledge, promote learning by creating a climate that supports students' learning by giving positive or negative reinforcements and substantial opportunities to practice skills until they are learned and safely executed (Kanuka, 2008).

Faculty who use the behaviorist perspective to guide pedagogy can use digital/informatics tools to provide students with the opportunity to practice drills and skills. For example, during a simulation experience the learner practices drills and skills in a controlled environment and is provided immediate feedback on student's behaviour. Faculty could also provide students with digital badges to encourage positive reinforcements to students for completion of certain tasks (Chauvette, 2018).

Cognitivist Learning. Cognitivists believes learning occurs through the mental process of the mind such as thinking, knowing, memory and problem solving (Pettigrew, 2015). Unlike behaviorists, which view learners as passive and simply reacting to stimuli in the environment, cognitivists understand learning as the acquisition of knowledge in which the learner is an

information-processor functioning similarly to a computer. The learner receives, processes, stores and then retrieves information for later use (Bastable et al., 2014; Ertmer & Newby, 2013). This is also known as the information processing theory (Schunk, 2012). The role that faculty have is to plan activities that help the learner remember the information being taught by structuring and organizing it to allow for the processing of information to occur. It is suggested that faculty keep in mind the level of cognitive development of their students when planning learning activities, because learning is dependent whether the learner fully grasps what is being taught and guide learning accordingly (Ertmer & Newby, 2013; Pettigrew, 2015).

Faculty teaching from the cognitivist perspective can use digital/informatics tools to assist students in learning and organizing the information being taught such as developing a video or audio material (Keskin & Metcalf, 2011). For example, the learner could supplement their learning by watching an online tutorial on a certain skill. Quizzes could be created through student responsive systems in order to reinforce their learning.

Constructivist Learning. Constructivist learning theory views the learner as an active participant in the learning process. The learner constructs their own knowledge, drawing from their previous experiences, social interactions and motivation (Schunk, 2012). Learning occurs best when it can be contextualized and connected between past and new learning experiences (Cobcroft et al., 2006). Faculty can use a constructivist theory to engage the learner to help them create their own knowledge. Faculty can incorporate challenging activities that require students to collaborate and cooperate with others. From this perspective, learning is learner-centered (Kala et al., 2010). The faculty's role is interactive, building on what the learner already knows and acting as a catalyst to guide and facilitate the learning process. The role of the learner is to

cooperates and collaborate with others and become active participants in their learning (Altuna & Lareki, 2015).

Constructivist learning can be facilitated by having the learners work with others and developing a patient teaching video or engaging in a digital case study or a virtual simulation based on real clinical scenarios. The learner can create and post information in an online discussion group and encouraging interaction and reflecting on what was learned on a given topic (Kala et al., 2010; Keskin & Metcalf, 2011). This process can facilitate knowledge construction between classmates and faculty while encouraging collaborating, cooperative and inquiry.

Adult Learning. Adult learning theory must also be considered among educators of higher education to better meet the needs of the adult learner, appropriately assisting the adult learner, and enabling them to succeed. Prior to the 1970's the approach to teaching and learning of the adult was based on psychology, educational psychology, and views from a pedagogical perspective that adults learn in the same way as children (Merriam, 2001). Adult learning theorist, Knowles, argued that the adult learner has unique characteristics that are significantly different from children. Furthermore, Knowles et al. (2005) posit that adult learning should be based on a learner-centered approach, where the learner is self-directed and takes responsibility for their own learning. In addition, their experiences influence their learning (Taylor & Kroth, 2009). Adult learning theory referred to as andragogy is defined as the "the art and science of helping adults learn" (Knowles et al., 2005, p. 61). Its roots can be traced back to 1833 when a German educator, Alexander Knapp, described a Plato method of instruction with young adults (Knowles et al., 2005). Further, it evolved other theorists such as Linderman who proposed key

assumptions of adult learning and laid the foundation of modern-day adult learning (Knowles et al., 2005).

Knowles et al. (2005) describes five underlying assumptions of the adult learner as someone who: (1) is motivated to learn as they experience needs and interests that learning will satisfy; (2) his/her orientation to learning is life-centered; (3) experiences are a rich source for adult's learning; (4) has a deep need to be self-directing; and (5) individual differences among people increase with age. Based on these characteristics of the adult learner, he further developed his adult learning with the following six key assumptions of adult learning. These assumptions are integral to understanding how adults learn and to differentiate them from the child learner (Knowles et al., 2005). The adult learner is driven by: (1) a need- to know the relevance for the learning; (2) their self-concept- adults generally have a need to be self-directing; (3) their prior experience – the learner previous experience influences learning; (4) their readiness to learn- adults decide they need to learn when they experience a problem or some issue with which they are unfamiliar; (4) the orientation to learning—adults are practical, problem-centered focus, they seek opportunities to solve problems; and (5) motivation to learn- learning is driven by internal factors such as increased job satisfaction, self-esteem, quality of life or personal development.

Furthermore, Knowles et al. (2005) suggest that adult learning should be driven by the following four principles when designing a curriculum in keeping with the characteristics of the adult learner: (1) the adult learner needs to be involved in the planning and evaluation of the learning experience; (2) experience (including mistakes) provides the basis for the learning activities; (3) adults are most interested in learning subjects that have immediate relevance and impact to their job or personal life; (4) adult learning is problem-centred rather than content-oriented. Knowles et al. (2005) identified many assumptions of adult learning and principles of

curriculum design that can be applied to the integration of technology and the development of informatics in nursing education. For each assumption, nursing faculty can design, implement and evaluate learning activities that focus on digital/informatics tools with the adult learner

After considering the various schools of thought, each of which offers a different pedagogical view, and by reflecting on their value to the integration of informatics/digital tools in nursing education, it can be concluded that nursing faculty should draw on multiple learning theories. According to Ertmer and Newby (2013), the "behavioral approach can be used to teach the "what" (facts), cognitive strategies can be used to teach the "how" (processes and principles), and constructivist strategies can be used to teach the "why" (higher level thinking that promotes personal meaning and situated and contextual learning)" (p. 60).

Studies Reviewed

In this final part of Chapter Two, this section presents the findings from studies addressing nursing faculty perceptions and experiences of the use of digital/informatics tools, its benefits, challenges and the integration of informatics in nursing education. Gaps in the literature were identified to support the need for this current study.

Twenty-seven peer-reviewed research studies describing nursing faculty use of digital/informatics tools in nursing education published between 1998 and 2020 were reviewed. Locations included the US, Canada, Korea, Brazil, Nigeria, Singapore, Australia, Israel, New Zeland and the United Kingdom with most studies using a single site sample. The methods used by the reported studies include 20 quantitative (descriptive, cross-sectional), three qualitative, three-mixed method, one integrative review and one systematic review. Most studies used convenience sampling and a self-report survey. Power analysis was documented in only one study. Five overarching themes emerged from the literature reviewed: (1) integrating of

digital/informatics tools and informatics in nursing education; (2) the use of digital/informatics tools to support the development of NI competencies; (3) faculty preparedness (4) facilitators of the use of digital/informatics tools in nursing education; (5) and finally, the challenges to the use of digital/informatics tools use in nursing education. The research findings within these themes are presented in the following section.

Theme #1: Integration of Digital/Informatics Tools and Informatics in Nursing Education

During undergraduate nursing education, nursing students acquire their foundational nursing knowledge in preparation their professional practice. Nursing programs are responsible for assisting nursing students in developing their competencies that will facilitate the transition of the nursing graduate to the workplace; this includes nursing informatics (NI) competencies. It appears from the reviewed literature that nursing faculty agree that NI competencies are important for nursing students to acquire prior to entering the nursing workforce (Nagle et al., 2002a, 2020b; McCannon & O'Neil, 2003; Saranto & Tallberg, 1998), but its integration has been limited. A brief overview of each study will reveal a general consensus that progress has been slow over the past 20 years in undergraduate nursing education. Most studies reported that less than 50% of Canadian and U.S. academic institutions had plans to integrate NI in the future (Carty & Rosenfeld, 1998; McNeil et al., 2003, 2005; Nagle et al., 2020a; Nagle & Clarke, 2004). In only two studies, about half of the participants reported informatics being integrated into the curriculum (Nagle et al., 2020b; Thomson & Skiba, 2008).

The study by Carty and Rosenfeld (1998) used a stratified random sample among 190 U.S. nursing programs including diploma, associate, baccalaureate, and master programs in order to determine the status of digital/informatics tools integration in nursing education. It was reported that less than one third (26%) of U.S. nursing programs reported incorporating

informatic into their curriculum while only 17% of schools had future plans to incorporate digital/informatics tools into their curriculum. The researchers concluded from the results of this study, that informatics was not adequately addressed in nursing education.

In Canada, Nagle and Clarke (2004) conducted a national online survey to examine the current state of NI uptake in undergraduate nursing programs among 77 schools. Most Canadian undergraduate nursing programs 30% of undergraduate reported having integrated informatics through their curriculum but were unsure in which course or for how many hours. In a recent mixed-method study (Nagle et al., 2020a, 2020b) examining the perception of nurse administrators' (n=35) and nursing faculty's (n=360) integration of informatics in Canadian undergraduate nursing education, 82% of nurse administrators self-reported that informatics had been integrated into the classroom (66%), clinical (60%) and lab (51%). Although, faculty reported less integration, as only 44% of faculty were teaching some aspect of informatics and less than five percent reported teaching an informatic course. It is also important to note from this survey, there were difference between what nurse administrators and what faculty reported.

A descriptive Brazilian study (Sanches et al., 2011) examined the integration of NI in undergraduate nursing courses whose curriculum was available online (n=100). The researchers found that only 35% of the 35 nursing programs offered informatics-related courses. The researchers concluded that most Brazilian nursing programs do not offer enough NI content. However, the researchers only reviewed curriculum that was available online, with some programs perhaps not listing their course content online.

Hunter et al. (2013) conducted a study to gain a better understanding of NI integration in 24 school of nursing in the United States. The researchers searched the programs websites for course title reflecting informatics-related courses. The results indicated that six programs had no

informatics content while 10 had informatics-related courses at the baccalaureate level. Although, the researchers only reviewed course titles, which may not be a true reflection of NI integration, however, this study does show a lack of NI coverage in nursing education.

Fulton et al. (2014) surveyed 114 deans and directors from Doctor of Nursing Practice programs across the U.S. in a descriptive study examining the integration of the NI TIGER competencies into their nursing programs. Forty percent (n=45) of schools reported integrating these competencies into their curriculum. This study, examined doctoral and not an undergraduate program yet finding reveals that NI integrating is limited at a high academic level

In another U.S. study (Miller et al., 2014), researchers surveyed both novice nurses (n= 222) and their nurse manager (n=326) about their perceived level of NI competence using a descriptive design. The research was guided by three research questions: (1) what extent do new/novice nurses believe they demonstrate the informatics knowledge and skills required to use electronic health records effectively in acute-care settings? (2) What extent do nurse managers believe new/novice nurses demonstrate the informatics knowledge and skills critical to use electronic health records effectively when initially hired in acute care settings? (3) What gaps exist between new/novice nurses' reported informatics knowledge and skills and the knowledge and skills reported by nurse managers in acute-care settings? Based on these guiding questions, the researchers developed a self-reported survey which examined 28 knowledge and skill related to the use of EHRs. Nurse managers only felt that novice nurses were proficient in seven areas out of the 28. Areas that the nurse managers perceived novice nurse to lack competence in included medication and treatment documentation, accessing lab, diagnostics results and patient charts. These results from this study suggest that graduate nurses may lack some NI competencies to work in the healthcare environment.

One study examined the integration of Quality and Safety Education for Nurses (QSEN) competencies into nursing education. Quality and Safety Education for Nurses Institute developed competencies to enhance graduate nurses' competencies as a national response to the IOM report Health Professions Education: A Bridge to Quality (Greiner & Knebel, 2003). The six competencies include patient-centered care, teamwork and collaboration, evidence-based practice, quality improvement, safety, and informatics. They were set forth in 2005 to enhance nursing curriculum and nursing students' preparedness for practice. Altmiller and Armstrong (2017) surveyed 2,037 undergraduate nursing faculty integration of the QSEN competencies and found that, out of the six competencies being taught, informatics had the lowest representation (67%) while patient-centered care, evidence-based practice, and safety were the most frequently identified, reported by 93% of the respondents. It can be concluded from this study that more emphasis is placed on evidence-based practice and patient safety, however nursing students need to be competent in all aspects of NI to practice evidence-based practice and improve patient safety.

Some researchers (De Gagne et al.; 2012; Kleib et al., 2013; McNeil et al., 2003, 2005; Thompson & Skiba, 2008) examined how digital/informatics tools and NI are being integrated into nursing curriculum. It appears from the studies described below that nursing curricula are integrating only one or two dimensions of nursing informatics: computer literacy and or information literacy.

McNeil et al. (2003, 2005) conducted a national U.S. study assessing the level of NI integration into nursing curriculum. An online self-report survey and focus groups were used among 266 deans and directors of nursing programs at the baccalaureate and graduate levels. Most respondents identified themselves as nursing program administrators (65%, n=172), while

28% (n=74) were nurse educators. The findings indicated that one-third reported teaching computer literacy skills, while half (50%, n=132) reported teaching information literacy. The reported results indicate that faculty had placed greater emphasis on computer literacy and information literacy as isolated skills with little evidence of developing student's informatics competence. This result was further supported in their qualitative analysis when researchers asked, "What specific informatics knowledge and skills are currently being taught in nursing education programs across the United States" (McNeil et al., 2006). The respondents indicated they were teaching students basic computer skills, such as the use of email, spreadsheets and PowerPoint.

Results from the Thomson and Skiba (2008) study appeared to show that the integration of NI in nursing curriculum increased but this was not the case. The researchers conducted an online survey among 540 deans/directors and 1,557 faculty asking how nursing programs at various levels of education LPN (7%), diploma (7%), associate (42%), BSN (31%), post BSN and graduate level nursing programs (11%) were addressing informatics in the nursing curriculum. Nursing faculty equated being exposed to digital/informatics tools, such as online courses or integrating learning management systems into courses to informatics educational preparedness.

Ornes and Gassert (2007) found similar results. The researchers completed a comprehensive evaluation of one U.S. nursing curriculum by mapping out NI competencies as proposed by Staggers et al. (2001, 2002). Results suggested that faculty encourage students to use basic computer skills (50% use email; 72% use the internet locate patient care information for courses) but very little (11%) stressed information literacy skills. The authors concluded students had little exposure to NI, and their competencies were not being developed.

In an integrative review exploring the adoption of informatics in nursing BSN programs, De Gagne et al. (2012) reviewed 19 original reports between 2000 and 2010. After their analysis, four themes emerged: 1) lack of consensus of which NI competencies should be included in nursing curriculum, 2) influence on patient outcomes, 3) faculty development and organizational partnership, and 4) global inequalities in informatics education. Within the theme of faculty development, the authors identified several barriers: mixed perception of NI competencies, unclear expectations of faculty NI competencies, limited NI knowledge, skills and attitudes, and lack of administrator vision and support. It is also clear from this review that nursing curriculum emphasizes computer competency and information literacy as opposed to nursing informatics. The authors recommended that nursing faculty integrate informatics throughout the curriculum, and not only some of its components.

In a systematic review conducted by Canadian researchers studying the status of NI integration in undergraduate programs found similar findings (Kleib et al., 2013). Four themes were revealed from a review of 42 research articles. They include: (1) theory and clinical informatics content being offered, (2) method and strategies for teaching informatics, (3) evaluation/ assessment of learning outcomes and (4) evidence on the effectiveness of informatics education. The authors concluded that nursing informatics education was directed towards computer and information literacy.

It is important to note that the integration of digital/informatics tools and informatics into nursing education has been slow and a long-standing concern among nursing leaders. In addition, curricular gaps exist in regard to NI, as only one component of NI appears to be integrated – computer literacy and occasionally information literacy from the studies found as part of this review. The development of the other dimensions of NI, information management and

application of digital/informatics tools in delivery of care remains a challenge in nursing education (RNAO, 2012). There is an expectation that nurse graduates are competent in all components of nursing informatics. Further research is needed to examine the current state of use of digital/informatics tools in nursing education and they contribute to development of nursing informatics competencies. In addition, the research proposed was completed to specifically identify where gaps exist in Canadian undergraduate nursing education.

Theme #2: The Use of Digital/Informatics Tools to Support the Development of NI Competencies

In several studies nursing faculty were asked what pedagogical strategies they were using to teach NI related content (McNeil et al., 2003, 2005, 2006; Nagle et al., 2020a, 2020b; Thomson & Skiba, 2008; Smith et al., 2007). Most common strategies included using spreadsheets and accessing databases, as well as informatics literacy such as evaluating websites related to healthcare (McNeil et al., 2003, 2005, 2006). When the researchers analyzed the qualitative data however, it became clear that faculty lacked extensive understanding of what constitute NI. In Ornes and Gassert (2007) study, nursing faculty reported using email and the Internet to locate patient care information for courses. While, Smith et al. (2007) reported that the most common learning strategy used to develop student's informatics skills was web-based learning (68%), lectures (59%) and in practice settings (51%). Additional studies also found that faculty perceptions offered more insights into the integration of NI in nursing education. More specifically, Kowitlawakul et al. (2014) used a qualitative approach to explore faculty perception towards an simulated EHRs through semi-structured interviews. The researchers used a purposive sample of seven nursing faculty teaching, in a Singapore undergraduate nursing program. Results indicated that faculty members did perceive simulated EHRs as a useful tool

for teaching. Some faculty members felt simulated EHRs helped prepare students before they entered the practice environment and made students feel more comfortable using simulated EHRs. Interestingly, students also used this tool to reflect on their documentation errors; therefore, becoming more aware on how to use EHRs proficiently.

Several researchers have also studied the use of mobile technologies in nursing education but the majority of research on these technologies have focused on evaluating the effectiveness of implementing mobile devices (Raman, 2015) both the classroom and in the clinical setting. Mobile technologies can be used to assist the integration of NI competencies (Doyle et al., 2016; Williamson & Muckle, 2018). For example, mobile technologies can provide nursing students with a wealth of information on medications, nursing procedures, treatments, and disease information to help students in decision making. It enables them to access current evidence-based resources at the bedside (Foster & Sethares, 2017).

In Canada, CASN developed several resources to support nursing faculty use of digital/informatics tools and the development of NI competencies; however, researchers have reported few educators used the resources developed by CASN to support the integration informatics into nursing curriculum. More specifically, Nagle et al. (2020a) found that only 31% of educators indicated they (moderately to extensively) used the CASN NI Entry-to-Practice competencies (2012) whereas 21% of them (moderately to extensively) used the CASN Faculty Teaching Toolkit to support students learning but most administrators reported (63%) of their faculty used these entry-level competencies to guide their teaching (Nagle et al., 2020a; 2020b). Regarding the use of EHRs and simulated EHRs, the majority of nurse administrator (68%) reported nursing students being exposed to EHR during student's clinical placement, most (62%) reported that students received informatic training prior to their clinical placements. Only 32%

reported using simulated EHRs in their program while 30.4% of administrators had no concrete plans to offer this to students in the future. Interestingly, in the survey comments of this study, faculty reported that many healthcare agencies do not have a fully functioning EHR and that students were unable to access them while in the clinical setting. Furthermore, less than 20% faculty indicated they used simulated EHRs; 12% less than what administrator had reported. Again, there seems to be a disconnect between the perception of nurse administrators and that of faculty who are teaching nursing students. It was also reported that nursing faculty also used digital/informatics tools such as website (65.7%), legal and regulatory requirement/ethical standards (45.7%) and multimedia applications such as You Tube (34.3%) to help develop students informatic competencies. These results suggest that participants focused more on technologies used for teaching and learning as opposed to using technology to deliver and manage patient care.

Faculty were also surveyed on the integration of 15 CASN informatics competency indicators to support students' informatics learning. It was interesting to note that faculty reported gaps in 10 informatics competencies. For example, this included minimum or no support in use of mobile devices, understanding standardized terminologies, nurse's role in the design, selection, implementation and evaluation of digital/informatics tools, how these tools are used to collect, document and retrieved data. As well as how these tools may improve the healthcare system and patient overall health and responsibilities to reporting system error are all areas felt to be critical to the component of information management and application. While only five areas were reported moderate to extensively used to support students learning of informatics, these areas mostly focused on computer literacy and information literacy. Findings from this study suggest that nursing faculty are not integrating all components of NI and may assume

students are digitally savvy has they report giving no support to students in the areas of mobile devices, social networking applications and the use of ICT.

From the studies reviewed related to the use of digital/informatics tools to support the developments of NI competencies, these studies have indicated that some faculty are using digital/informatics tools to support the development of students' informatics competencies but, there is a need to better understand how nursing faculty are presently integrating digital/informatics tools in undergraduate nursing education as there had been conflicting reports.

Theme #3: Nursing Faculty Preparedness

The third theme describing nursing faculty use of digital/informatics tools is related to nursing faculty preparedness. Faculty are being urged to teach nursing students informatics competencies yet to teach students competently faculty must possess the necessary knowledge, skills and attitudes. The following studies address faculty's preparedness to teach NI.

Knowledge. Several studies reported that faculty members perceived themselves as novice or advanced beginners, and less than 40% of nursing faculty as being competent in NI (McNeil et al., 2003, 2005; Thompson & Skiba, 2008). Other researchers found that only 37% of faculty self-assessed their knowledge as "competent" (Thompson & Skiba, 2008). It was not a surprise that that the majority of faculty (86%) disclosed that they taught themselves how to use digital health applications. Smith et al. (2007) surveyed 195 U.S. nurses (88% program directors or deans; 12% faculty) from pre-licensure nursing programs regarding the current state of nursing education relating to the six QSEN competencies. The researchers asked respondents 1) "what is the perceived level of faculty preparedness to teach each competency?" A third of respondents (27%) reported being "novice/uncomfortable" with informatics competencies while 26% stated they were expert/very comfortable.

In a more recent U.S. study, Nguyen et al. (2011) surveyed 193 nursing faculty across 43 nursing programs (vocational, associate, baccalaureate, and graduate programs) regarding their usage, knowledge and training of digital/informatics tools. Only 29 % identified themselves as "competent" and 36% as "experts". While in Canada, Nagle and Clarke (2004) indicated that less than one-third schools perceived faculty to have adequate NI competencies while one-third reported "no to poor knowledge". Interestingly, some nursing faculty questioned the relevance of NI in nursing. Fifteen years later, in another Canadian study, 54% of nursing faculty self-rated their informatics competencies at the beginner level, only 6% identified themselves being expert, 21% of faculty reported having completing course work in digital health (Nagle et al., 2020a) and 43% of faculty reported being confident in their ability to integrated informatics.

Hern et al. (2015) conducted a study exploring one U.S. undergraduate nursing program integration of simulated EHRs. They examined 27 nursing faculty and students' perception of knowledge, skills, and attitudes regarding informatics and EMR using a pretest/post-test program evaluation design. Results from faculty indicated that in general their knowledge of NI increased but that of EHRs did not. The item measuring "NI competencies are important to me" increased only slightly (pre means=2.7; SD=0.7 post means=3.4; SD=0.6) but there was a more significant increase regarding the item measuring "I understand how to integrate NI into my curriculum (pre means= 3.5; SD=0.8; post mean= 3.8; SD=0.6) and items "I have a good understanding of NI competencies" increased (pre means=2.4; SD 0.8; post means= 3.5; SD= 0.6). This study revealed that with training in the use of digital/informatics tools, faculty knowledge of informatics can increase. These studies also suggest nursing faculty perceive themselves as lacking confidence in NI competencies and perceive themselves as novice or advanced beginners; thus, they may not be prepared to integrate digital/informatics tools into nursing

curriculum and to develop nursing students' informatics knowledge, skills, and attitudes to work in a technologically rich healthcare environment. Furthermore, as noted previously, some studies indicated that faculty lack awareness of what constitutes NI (McNeil et al., 2003, 2005, 2006; Nagle et al., 2020a; Thompson & Skiba, 2007).

Nursing faculty who lack competence and knowledge in NI may find it difficult for them to teach the subject to nursing students. It is possible that nursing faculty are not incorporating informatics content into coursework because they lack informatics knowledge. These results support the need for further exploration of nursing faculty experience with digital/informatics tools integration in developing students' informatics competencies.

Attitudes, Self-efficacy and Acceptance. It is critical to examine faculty's attitudes towards the use of digital/informatics tools. If nursing faculty are resistant, unaccepting or have a negative attitude towards the use of digital/informatics tools, NI learning outcomes may not be met (Kowitlawakul et al., 2014). If, however, nursing faculty have a strong sense of self-efficacy or one's belief about being successful in performing a task (Bandura, 1977), they may be more likely they are to use digital/informatics tools in their teaching practice (Bond & Procter, 2009).

Fetter (2008, 2009a, 2009b) conducted a small-scale, US multi-stage evaluation study in one baccalaureate nursing program. The project surveyed nursing faculty, nursing students and clinical agencies based on Staggers et al. (2001, 2002) NI competencies. The graduating nursing students (n=42) (Fetter, 2009a) claimed that faculty were unfamiliar with NI in the clinical setting. Students also viewed NI training in the clinical area as infringing on clinical time. In another survey among 22 clinical agencies (Fetter, 2009b), the clinical agencies identified 10 factors influencing students' learning of digital/informatics tools skills. Clinical facilities indicated that faculty and administrators lacked the appropriate attitudes, motivation, knowledge

and skills to integrate informatics into nursing curriculum and were perceived as “out of touch with IT realities” (Fetter, 2009b, p. 80). The agencies also requested nursing programs take more responsibility in developing nursing students’ informatics competencies. Although, this was a small-scale study, it did offer multiple perspectives on its integration in one curriculum.

In other US studies, Tacy et al. (2016) used Davis' Technology Acceptance Model to test the variables of technostress (technology stress), job satisfaction, and intent to leave teaching using hierarchical regression**.** The results from the online survey among 1,017 U.S. nursing faculty indicated that technostress, perceived usefulness, perceived ease of use, attitude toward using, and behavioral intention to use digital/informatics tools explained 80% (R2) of faculty adoptions to use these tools. These results suggest that these variables may be important to the use of digital/informatics tools. While, Roney et al. (2017) explored faculty (n= 272) technological self-efficacy and use of digital/informatics tools in undergraduate nursing education in the US using a descriptive correlational study. Most (63%) faculty members rated themselves as having high levels of technological self-efficacy (M=9.66; SD=3.26) suggesting that faculty with high levels of self-efficacy will be more likely to use or accept their use.

Gonen and Lev-Ari (2016) examined nursing faculty self-efficacy, innovativeness, attitudes, intention to use, actual use and faculty’s perception about their work climate among 109 Israelian nursing faculty from a convenience sample. Results indicated a positive correlation between innovativeness, attitudes, self-efficacy and intention to use digital/informatics tools. This result reveals that faculty who had a positive attitude, a higher sense of self-efficacy, the more likely they will use them.

In Canada, Kenny et al. (2012) used a cross-sectional survey design to assess students and faculty’s current use of mobile technologies in teaching and learning and their readiness to

engage in mobile learning by measuring their mobile self-efficacy among 17 faculty members and 83 nursing students. Results revealed that nursing faculty's strong sense of self-efficacy was positively correlated with the use of digital/informatics tools and their self-confidence. The authors concluded that nursing faculty are ready and motivated to integrate mobile technologies into teaching and learning. While Nagle et al. (2020a) reported that 68% of participants agreed (somewhat to strongly agreed) that NI competencies were essential. Likewise, 71% recognized the integration of informatic content to be a valuable component of nursing curriculum. However, results from the interview (n=10) differ. Participants expressed that integration digital health content was not a priority.

In summary, faculty acceptance, positive attitude, high self-efficacy and intention to use digital/informatics tools are critical to their integration into nursing education. Consequently, faculty with a high sense of self-efficacy were more likely to use these tools (Gonen & Lev-Ari, 2016). Furthermore, faculty are important role models for nursing students. Cibulka and Crane-Wider (2011) and Miller et al. (2005) noted that student use of these tools increased when they observed faculty using them.

Theme #4: Facilitators of Digital/Informatics Tools in Nursing Education

Several studies have described facilitators to integrating digital health into nursing curriculum. For example, Herbert and Connors (2016) studied the facilitators and challenges of adopting simulated EHRs among 45 U.S. nursing faculty (response rate 29%) using a descriptive design based on Roger's Diffusion of Innovation theory. The authors identified having a champion (100%), program administrative support (94%), as well as faculty training and support (80%) as important facilitators to the use of digital/informatics tools use. Koitlawakul et al., (2014) also reported allocating time for faculty to integrate of them into curriculum and

administrative support as facilitators. In a qualitative descriptive study (MacKay et al., 2017) exploring six U.S. clinical faculty members' perceptions and experiences of digital health content to support student learning. Thematic analysis revealed that enablers to the use of digital/informatics tools were resources and technology as well as management and technological support. Finally, in a Canadian study, faculty identified 'nurse administrators as key resources to successful integration of informatics in nursing undergraduate education (Nagle et al., 2020a).

Theme #5: Challenges to the Use of Digital/Informatics Tools in Nursing Education

Several studies have identified a number of challenges to integrating informatics into undergraduate nursing education. Some of the main challenges identified in this review were nursing faculty, curriculum barriers and the clinical setting. Researchers indicated that faculty were one of the greatest barriers to the use of digital/informatics tools and informatics curricular integration (Ornes & Gassert, 2007). In particular, lack of faculty knowledge (Lilly et al. 2015; Thompson & Skiba, 2008), limited faculty engagement and experience with technologies (MacKay et al., 2017), limited faculty preparation (Hebert, 1999), fear of digital/informatics tools (Saranto & Tallberg, 1998), lack of qualified faculty (McNeil et al., 2003) and nursing faculty time constraints to learn the about the use of digital/informatics tools (Kowitlawkul et al., 2014) were all noted as barriers. Finally, Fetter (2008) found that a lack knowledge, training and skills lead to faculty resistance to the use of digital/informatics tools.

Other studies cited curriculum barriers, such as lack of support from administration (Nagle & Clarke, 2004), lack of funding (Herbert & Connors, 2016; Nagle & Clarke, 2004; Nguyen et al. 2011), lack of resources to support faculty to teach and apply informatics (Altmiller & Armstrong, 2017; McNeil et al., 2003; Nagle & Clarke, 2004), too many other work

demands of faculty (Lilly et al., 2015), too much time to learn about digital health applications (Lilly et al., 2015), lack of faculty release time (Herbert & Connors, 2016), no room in the curriculum for NI content, and finally, the integration of digital/informatics tools was not a teaching priority (Thompson & Skiba, 2008).

Studies cited digital/informatics tools as an in additional barrier. For example, some faculty found it difficult to keep up with continual and rapid change of technology (Hebert, 1999). Digital/informatics tools were also reported as being too costly (Lilly et al. 2015; Kenny et al., 2012; MacKay et al., 2017), challenging to use (Kowitlawakul et al. 2014), and inconvenient (Kowitlawkul et al., 2014). The clinical environment is another challenge for faculty to use of digital/informatics tools to assist nursing students gaining competence in informatics. Studies reported limited opportunity for nursing students to be exposed to EHRs as a result of lack of training and limited of access (Fetter, 2008; Hebert & Connors, 2016; Nagle et al., 2020a; Shin et al., 2018). In addition, hospital policy prohibited students' use of mobiles technologies for fear of interfering with medical equipment (Kenny et al., 2012), and the culture of the unit, including nurses' attitudes toward the use of these tools were identified as barriers to their use (Nagle et al., 2020a; Shin et al., 2018).

Fetter (2008) reported that faculty and students need to be orientated to clinical information systems by staff member, and that this alone could take up to 15% of clinical time taking time away from students-patient interactions. This was problematic as a larger number of faculty needed to be trained with minimal staff available thus creating bottlenecks. In addition, some agencies even prohibited or limited faculty and student access to clinical information systems. Consequently, if nursing students are not exposed to EHRs, this may eventually limit their clinical experience (Hern et al., 2015).

Esewe and Adejumo (2014) examined the challenges that Nigerian nursing faculty faced in using digital/informatics tools. In this exploratory descriptive survey among 36 nursing faculty in one undergraduate nursing program barriers to their use included erratic power supply (n=29; 85.3%), unstable connectivity (n= 27; 79.4%) and lack of digital/informatics tools resources (n=24; 70.6%) were reported as barriers. From a Korean perspective, Jeon et al. (2016) examined the status of nursing informatics education using a descriptive survey design among 72 deans of nursing education programs. The most frequently reported barrier to nursing informatics education was a lack of awareness of the importance of nursing informatics (n=9), followed by limited administrative support from the school (n=5). Finally, Shin et al. (2018) explored nursing graduates' NI needs upon entering the workplace from the perspective of six clinical nursing faculty using focus groups. They reported poor access to hospital systems, discouraging ward culture and lack of exposure to system in the clinical as significant barriers in developing students NI competencies.

In summary, nursing faculty face significant challenges in the academic setting. In addition, these studies suggest that students have inconsistent exposure to digital health applications in the clinical setting; however, nursing faculty cannot only rely on the clinical setting to develop students' NI competencies (Shin et al., 2018). Identifying the facilitators and challenges of integrating the use of digital/informatics tools in nursing education does provide faculty with a better understanding of their use. This would assist nursing faculty to determine which strategies would be needed to integrate digital/informatics tools and help develop nursing students' informatics competence. Although, there are several studies that have addressed the facilitators and barriers, there is a need for further research on examining faculty perception of integration of digital/informatics tools in nursing curricula in relation to informatics

competencies. Furthermore, Fiedler et al. (2014) assert there are limited studies exploring faculty member's experience of adopting technology in nursing curriculum and that there is an ongoing need to examine these experiences for successfully integrating digital/informatics tools. This study will examine these relationships and identify positive or negative influences affecting the use of digital/informatics tools and also examine how this integration influences NI competency development among Canadian nurse educators.

Summary

In this chapter, I provided a historical review the use of digital/informatics tools in nursing and the status of the literature on nursing informatics within undergraduate nursing curriculum. The literature indicates NI competencies are necessary requirements in the current and future healthcare environment. Nursing faculty must facilitate the development of nursing informatics competencies through systematics and purposeful integration of digital/informatics tools. A review of the literature was sought to determine the current state of integration of digital health in nursing education. Many of the studies were limited by small sample size, in a single setting using primarily self-report surveys. Five themes were identified based on this review. The first theme integration of digital/informatics tools and informatics in nursing education, identified that there was a lack of integration of NI competencies in undergraduate nursing education and that current research is needed within the Canadian context. The second theme identified was the use of digital/informatics tools to support the development of NI competencies. Nursing programs in the review reported greater emphasis on basic computer applications and the use of tools to retrieve evidence-based information. The use of tools focused only on two dimensions of NI. The third theme, nursing faculty preparedness suggested that nursing faculty perceived themselves as novice or advanced beginners in NI and integration of

digital/informatics tools. In addition, it suggests that nursing faculty may not have a good understanding of what constitutes NI and this may contribute to the slow integration of informatics into nursing curriculum, despite being recommended and in some countries a requirement in order to prepare students to work in the healthcare environment. The fourth theme, facilitators of the use of digital/informatics tools in nursing education, indicated that some facilitators to the integration of these tools included having a champion, faculty training, time funding, resources, and technological support. The fifth and final theme, challenges to the use of digital/informatics tools in nursing education revealed that faculty are faced with numerous barriers to integrating these tools in nursing curriculum such as curriculum, the clinical environment and themselves.

It can be concluded that a gap in the literature exists regarding nursing faculty use of digital/informatics tools in Canadian undergraduate nursing programs, including facilitators and barriers. A focused ethnographic study to gain insights into how nursing faculty integrate digital/informatics tools to support undergraduate students' learning and the development of informatics competencies in nursing students is therefore warranted.

Chapter 3: Research Method

Given the challenges in integrating the use of digital / informatics competencies in nursing education as illustrated in the gaps found in the literature, the purpose of this research study was to examine and describe the experiences of nursing faculty's utilization of digital/informatics tools in selected Western Canadian Universities. This chapter details the method of this study including an overview of the underlying philosophical perspective, the research design, the sampling procedure, the setting, entry to the field, data collection and data analysis. Efforts to conduct a rigorous study, the commitment to trustworthiness, and ethical considerations for the research process are also discussed.

From the current body of knowledge, preparing future nurses for digital health and informatics is crucial for them to be able to work competently in the present and future healthcare environments. Nursing faculty are at the heart of preparing nursing students for their future professional roles; thus, it is important to understand their use of digital/informatics tools from their point of view. As noted in the previous chapter, some gaps in the literature have been identified relating to nursing faculty utilization and experiences in integrating digital/informatics tools to support teaching and learning and the development of students' informatics competencies in undergraduate nursing programs. This formed the basis for the research question: "What are the experiences of nursing faculty in integrating digital/informatics tools to support undergraduate students' learning and the development of informatics competencies?" From this standpoint, I made a number of decisions aligning the research question with an appropriate research method. First, however, I will discuss my philosophical perspective.

Philosophical Perspective

Research is guided by a set of beliefs or a way of thinking called paradigms. Paradigms offer a solid foundation for a research study as they help to rationalize the methodology and strengthen the credibility of the research (Guba & Lincoln, 1994; Jackson, 2013). There are several paradigms discussed in the nursing literature, such as positivism, post-positivism, constructivism and critical theory (Guba & Lincoln, 1994). Each paradigm is based on its own set of ontological, epistemological and methodological assumptions. The choice of paradigms directs the research study as it essentially "determines the purpose, motivation, and expectation of the research" (Mackenzie & Knipe, 2006, para 4). The paradigm used in this study was the constructivist perspective.

A researcher using a constructivist lens recognizes that multiple subjective realities or truths exist (Patel, 2015). Guba and Lincoln (1994) state that from a constructivist perspective reality comes from "multiple, intangible mental constructs, social milieu, and is experientially based" (p. 110). The researcher views reality as being socially constructed through interactions with the social environment (Greenberger, 2014). Reality is created, not discovered, by different individuals; meaning that there is no single reality. Thus, multiple realities exist or can be constructed (Hall et al., 2013). Constructivism therefore welcomes and values a plurality of perspectives.

Furthermore, from a constructivist lens, knowledge is transactional, subjective (Guba & Lincoln, 1994) and contextual (Hall et al., 2013). The term 'transactional' means that knowledge is constructed or created through interactions between the individuals and the researcher. Knowledge is created throughout the research process, and at different points in time (Guba &

Lincoln, 1994). It is 'subjective', as the "knower and respondent co-create understandings" (McMillen, 2008 as cited Denzin & Lincoln, 2005, p. 24).

Methodology

A qualitative study was appropriate to uncover experiences of nursing faculty related to the research questions being asked in this study. Qualitative research enables the researcher to gain insight into the complex human nature, and the subjective experiences of the participants occurring in a naturalistic setting. The goal is to uncover meanings of the participants' experiences through their descriptions or interpretations. Qualitative researchers are encouraged to follow an established methodological approach to suit the research question and philosophical perspective, and to enhance the trustworthiness of the study (Creswell, 2013). In addressing my research questions, "What are the experiences of nursing faculty in integrating digital/informatics tools in undergraduate nursing education and the development of informatics competencies?" I believed it aligned with the tenets of focused ethnography.

Ethnography is derived from two Greek words "*ethnós"*, which means nations or people, and "*graphei*" means "to write" (Smith, 2013). This methodology grew out of anthropology, in which the ethnographer studies the culture or subculture from the standpoint of its members. According to Fetterman (1998), ethnography is "the art and science of describing a group or culture" (p.1). Ethnographers immerse themselves into the participants' natural setting for a prolonged period of time, observing and exploring rituals, rules, attitudes, behaviours, and beliefs (Schensul & LeCompte, 2012). Through participant observation, conducting formal and informal interviews and analyzing documents, the researcher constructs a thick description of the local culture (Hammersley & Atkinson, 2007) and interprets the participants' way of life (Roper & Sharpira, 2000). In doing so, the researcher comes to gain a holistic understanding of the

particular group in an everyday context (Hammersley & Atkinson, 2007). Savage (2006) posits that ethnography is unique from other qualitative methods in that it makes links between the micro and the macro, connecting everyday interactions with the wider cultural patterns through its emphasis on its context.

In ethnography, the aim is to gain an understanding of the beliefs, values, and practices embedded within a culture in a natural setting (Hammersley & Atkinson, 2007). The culture can be understood from an *emic, etic or eclectic* perspective. The *emic* perspective is one where the researcher discovers "insiders" knowledge by accessing the culture and "looking at a thing through the eyes of the members of the culture being studied" (Willis, 2007, p.100). It allows the researcher to view culture from a member of that cultural group. The members of the group become the main source of information. This perspective is central to ethnography (Roper & Shapira, 2000). The *etic* perspective is the outsider's view. An external lens, usually the researcher, makes sense of patterns of behaviours and interprets (Roper & Shapira, 2000) the overall culture (Creswell, 2013) using an existing theory. In the *eclectic* approach, the *emic and etic* approaches are combined to discover and develop knowledge about a culture (Roper & Shapira, 2000). Ethnography researchers typically use this last approach (Roper & Shapira, 2000). To achieve this, the researcher will rely on verbatim transcripts of the participants (*emic*), which the researcher will then code and categorize. This enables the researcher to make meaning of the culture (*etic*) (Roper & Shapira, 2000).

There are many different genres of ethnography, such as focused, critical, and feminist (Savage, 2006); each having unique characteristics for the focus of the research, sample, context, data collection and analysis, and the researcher; yet, they all share the fundamental characteristics of traditional ethnography. Focused ethnography was the methodological

approach used for this study. Focused, micro or mini-ethnography, permits an in-depth examination of experiences in distinct issues within a specific context among a small group of people (Knoblauch, 2005). The ethnographer has implicit and explicit background knowledge of the cultural milieu and seeks to answer questions that are posed before going into the field. In addition, the researcher is in the field for a shorter time period (Knoblauch, 2005). These short interval periods in the field are supplemented with data collected through audio or video recordings to help strengthen the data collected in the field and to deepen the analysis of the data (Knoblauch, 2005). This differs from traditional ethnography, whereby the researcher spends an extensive time in the field. Table 3 described the difference between traditional and focused ethnography (Cruz & Higginbottom, 2013; Knoblauch, 2005; Wall, 2014).

Its other main feature, as described by Knoblauch (2005) is that researchers are typically interested in the social phenomena observing the way the members interact and communicate with each other in social situations. Finally, researchers using focused ethnography may also limit or remove participant observation from the study (Morse, 2007). This was the case in this study.

Table 3

Traditional versus Focused Ethnographic Characteristics

Feature	Traditional	Focused
Focus	Thick description of the culture understood in the full context. Holistic.	Focus is on one particular aspect of the group or sub-culture within a specific context.
The role of the researcher	Researcher is unfamiliar with the cultural setting. The researcher is neutral, distant, reflective observers and it is assumed that ethnography is best conducted by researchers that are not part of the cultural group.	Researcher has background knowledge of the cultural group.
Research question	Researcher does not enter the field with a formally specified research question	Researcher enters the field with a specific research question.
Context	Researcher unfamiliar with the cultural setting	A focused ethnography usually attends to a distinct problem in a specific context and is conducted among a small group of people. The researcher is familiar with the context.
Sources of data	Field work/notes, participant observation, interviews, thick description, event and document analysis	Field notes, episodic participant observation, interviews (recorded) and event and document analysis.
Data collection	Long-term participant observation	Short-term or absent field visits with intensive methods of data collection and analysis.

Philosophical and Methodological Relevance to the Study

I recognize that my unique position of the constructivist perspective fits well with focused ethnography. From this perspective, it is assumed that faculty interviewed in this study have socially constructed realities from multiple perspectives which cannot be divorced from their context. Thus, their reality concerning the topic is subjective. Furthermore, using the *emic-etic* perspective, knowledge was co-constructed between myself and the participants using semi-structured interviews which were then validated with the participants. In this study, I used semi-structured interviews and artifacts review, providing multiple sources of data, which was consistent with the view of multiple realities (Guba & Lincoln, 1994).

The characteristics of focused ethnography are congruent with several aspects of this research study. First, this type of research method requires an insider knowledge of the phenomena (Cruz & Higginbottom, 2013). My current background as a faculty member for the past 21 years and integrating digital/informatics tools in my own teaching practice indicates that I have a deep knowledge of some aspects of these sub-cultures. Secondly, focused ethnography focuses on a shared meaning of a specific cultural sub-group. In this study, the faculty group shares unique beliefs, values, and practices, thereby holds specific knowledge of the phenomena in nursing education (Cruz & Higginbottom, 2013). The cultural sub-group that I studied consisted of nursing faculty. Nursing faculty is a sub-group of a larger group of nurses. In addition, nursing faculty hold unique knowledge which integrates nursing with nursing education. Thirdly, this type of inquiry method is context-specific (Cruz & Higginbottom, 2013). In this case, the context was related to educational institutions and the clinical agencies where nurses practice. Focused ethnography is also particularly useful when the researcher has a specific research question derived from a specific problem prior to the research study (Cruz &

Higginbottom, 2013). A specific problem was identified from the literature review related to this study nursing faculty utilization of and experiences in integrating digital/informatics tools to support teaching and learning and the development of informatics competencies in an undergraduate nursing program. Lastly, in focused ethnography data collection occurs in intermittent, short-term field visits (Cruz & Higginbottom, 2013). In this study, I conducted limited intermittent short visits due to academic timetables, faculty availability, and restrictions to field visits due to the COVID-19 pandemic.

Sample and Setting

In the initial research plan, participants were going to be recruited from a convenience sample of faculty teaching in an undergraduate nursing program at three universities in Western Canada. Inclusion criteria included part-time, full-time or sessional /contractual and tenure /non tenured track nursing. Convenience sampling aims to select participants based on accessibility and voluntarism (Grove et al., 2013). Convenience sampling is also used in qualitative research to access participants of a particular phenomenon (Lobiondo-Wood et al., 2018). In this case, I explored the experiences of nursing faculty integrating or not integrating digital/informatics tools in their teaching practice. In addition, it was important to consider faculty members who used digital/informatics tools as well as those who did not use them. Therefore, a convenience sample was appropriate for this study.

During the first few interviews some participants stated “you should talk to [P12], they might have information to share with you, I will ask them to email you” (field notes January 30th, 2020). As a result, some participants started to refer their colleagues to participate in this study. Snowball sampling is done by asking participants to mention the study to colleagues who they think may be interested in participating in this study (LoBiondo-Wood et al., 2018).

As for sample size, Morse (1994) suggested 30-50 interviews to obtain the richness of data for a traditional ethnographic study. Focused ethnography may, however, include only one case and the sample size is usually not predetermined (Cruz & Higginbottom, 2013; Higginbottom, 2004). Data saturation can direct the sample size, implying that if no new data was being generated by the participants or new data become redundant, or no new themes are being observed, then data collection will be saturated and therefore discontinued (Boddy, 2016). Towards the last few interviews, it was evident that saturation had been achieved as no new information was obtained and there was a consistency in the types of participants' responses. In discussion with my supervisors, it was decided to stop recruiting additional participants. In this study, the sample size was 21 participants.

Entry into the Field

Entry into the field was initiated in January 2020 by contacting the Deans and Associate Deans in the faculties of nursing via email at each site. This email included a brief introduction of the research, the proposed activities time frame of the study, and requesting approval to invite faculty member to participate in this study (Appendix A).

Recruitment

Once approval was obtained from the Deans or Associate Deans, they or I emailed faculty inviting them to participate in the study (Appendix B). The email outlined the purpose of the study and asked faculty to contact me directly by telephone or email if they were interested in participating in the study. In my reply email to interested participants, I provided the information letter along with the consent form to further explain the purpose of the study, and started to negotiate date, time and location for an interview (Appendix C). Participants who identified themselves as part-time, full-time or sessional /contractual and tenure and /non-tenure-track

faculty were included in the sample. A reminder email was also sent to faculty members two weeks after the initial email to participate in the study (Appendix D). Finally, I asked permission to put recruitment posters in strategic locations at the participation sites, however some sites prohibited this due to COVID-19 restrictions [Pro00091981_AME1] (Appendix E).

I anticipated challenges in recruiting faculty members, as they typically assume a variety of roles during the academic calendar year thus restricting their availability. Recruitment began in January 2020 and it was initially slow. Additional challenges included trying to recruit participants during the COVID-19 pandemic in March 2020, potentially rendering faculty less available to participate in the study as many were transitioning face-to-face classes to online teaching. In March 2020, I met with my supervisors to strategize about recruitment strategies. Consequently, an amendment of the research study from University of Alberta REB [Pro00091981_AME1] was made to lengthen the data collection period from April 2020 to July 2020 and to extend the recruitment of nursing faculty members teaching in all undergraduate nursing program in Western Canada.

Data Collection

A focused ethnographer researcher typically collects data from interviews and examination of related documents (Cruz & Higginbottom, 2013; Roper & Sharpira, 2000). Participant observation is also an important part of focused ethnography as it allows the researcher to gain an inside view of the phenomena in the participant's own context by observing, recording and analyzing events (Fetterman, 1998). It was decided for this study that participant observation was not going to be carried out, as it would not add significant information. Furthermore, the geographic distribution of participants and the financial cost

associated with such observations would be too prohibitive for this study. In addition, COVID-19 pandemic restrictions further precluded me from completing this type of observation.

Interviews

Fetterman (1998) asserted that interviews are one of the most important methods to collect data in ethnography. Semi-structured interviews are most useful when the researcher has background knowledge of the topic (Fetterman, 1998). In this study, data was collected via semi-structured, one-on-one interviews. The semi-structured one-on-one interviews allowed a deeper exploration of ideas and gave the participants the opportunity to describe their thoughts and experiences about the integration of digital/informatics tools in nursing education.

To prepare for the interviews, three pilot interviews were conducted with three faculty members to practice the process and test the interview questions. At the end of interviews, I asked them "How did you find the interview questions?" and "What should I have asked you that I did not?" Lessons learned from these pilot interviews included adapting the ordering of questions for better flow, questions refinement for clarity, sending reminders of the interview, and the need to be organized with study documents and recording devices. Issues raised by faculty members included lack of clarity on what was meant by NI competencies, the benefits of sending CASN NI Entry-to-Practice Competencies documents prior to the interview, and reviewing this document during the interview.

Interview Guide. Creswell (2013) postulated that in qualitative research, the researcher does not rely on instruments developed by other researchers; hence a faculty interview guide was developed. The guide was intended to ensure that the same general areas of information were collected from each interviewee (McNamara, 2009). The interview guide, containing nine interview questions and associated probe questions, was generated from the literature review,

and in consultation with my supervisors (Appendix F). The interview guide began with a general question exploring nursing faculty integration of digital health in nursing education, and then transitioned to specific questions capturing a more in-depth response (Cruz & Higginbottom, 2013). For example, “Could you tell me about your experiences of integrating digital/informatics tools in nursing education?” to more specific questions “How do you perceive using digital/informatics tools to support the integration of nursing informatics competencies in nursing education?” The interview guide also consisted of several open-ended questions and additional probing questions. Open-ended questions allowed the participants to share their experiences in-depth, for example (Turner, 2010), while probing question were asked in response to the primary open questions to obtain more information, to explore the phenomena and to seek clarification of a participant’s response. For instance: “You mentioned…why did you say that?” (P18 transcript) or “are there any other barriers that you noticed?” (P15 transcript)

Feedback about the interview guide was solicited from my supervisors, who are experts in education and nursing informatics, to eliminate vague and misleading questions. Furthermore, the interview guide was pilot tested with a small group of faculty members to further refine the tool as previously mentioned.

Interview Process. Data collection occurred between January 2020 and July 2020. Interviews were scheduled at a convenient date and time for the participant. Prior to the start of each interview, I used McNamara’s (2009) eight principles to interviewing: (1) choose a setting with little distraction; (2) explain the purpose of the interview; (3) address terms of confidentiality; (4) explain the format of the interview; (5) indicate how long the interview usually takes; (6) tell them how to get in touch with you later if they want to; (7) ask them if they have any questions before you both get started with the interview; and (8) don't count on your

memory to recall their answers. These principles were reviewed prior to each interview as a reminder for the interview process and for consistency across interviews (Fetterman, 1998).

The interview began by engaging in social conversation with the participant to help establish rapport, to create a more relaxed environment and to reduce pre-interview anxiety. Informed consent was reviewed, and any questions were answered prior to obtaining consent (Appendix G). Once the purpose and process of the interview were explained and the recording devices were initiated when participants indicated their readiness. Demographic data was collected to provide background information of the participants, including age, gender, level of education, years of experience teaching and working as a registered nurse. The participants also identified their position within the faculty and primary teaching responsibility. The interviews then proceeded with questions from the interview guide. During the interviews, participants had access to the CASN NI Entry-to-Practice Competencies, including a definition of NI and associated competencies. Throughout the interview, I summarized the participants responses to allow for clarification and accuracy of the interpreted data. Towards the end of the interview, I invited the participants for their insights about the research topic and whether they had anything else to add. At the conclusion of each interview, I thanked each participant for their time and involvement in the research process. I informed them that if any other questions surfaced from the data, a second short interview may be scheduled and that I would provide them with a transcript of the interview for confirmation that the data was accurate. A thank you email was sent to each participant after interview thanking them for their willingness to contribute to the study (Appendix H).

A total of 21 interviews were conducted. Three were face-to-face, thirteen interviews were conducted via telephone, and five were conducted using videoconferencing. All interviews

were digitally recorded and transcribed verbatim by myself, with the participant's consent and saved as a Microsoft Word document. Interviews were recorded on two separate devices to prevent loss of data from mechanical failure. No names were used during the transcription process. Instead, a unique identifier code was given to each participant. For example, "P2". All digital recordings were labelled and stored on a password protected computer and digital files on the recorder were erased. Each transcribed interview was carefully checked with the digital file for accuracy. The interviews lasted between 45 minutes and 1hr and 25 minutes, as long as the participants had something they wanted to share about their experiences. Initially, more face-to-face interviews were planned; however, the COVID-19 restrictions prohibited this type of interview by the University of Alberta [Pro00091981_AME1]. All the interviews were listened to twice for accuracy, and thoroughly re-read several times to gain an overall understanding of the content. This helped me to become immersed in the data. Transcripts of the interview were forwarded to participants to confirm accuracy. This added to the credibility and rigor of the study (Creswell & Miller, 2000). The researcher field notes were analysed in conjunction with the transcribed data and checked for accuracy and saved in an electronic folder in Microsoft Word. The transcripts were then entered into a password protected software program, Quirkos for data management, and analysis.

Field Notes. Field notes are used to document observations (Patton, 2015) and contextual information. Field notes allow the researcher to record a detailed description of the setting and behaviours of the participants, and to develop a thick description of observations and interviews (Phillippi & Lauderdale, n.d). The researcher is also able to record comments, behaviours, and nonverbal cues that may not be adequately captured through the digital recording. Mills and Morton (2013) assert that field notes can help the researcher in combining the 'being', 'seeing'

and ‘writing’. Consequently, they assist the researcher in developing insight of the phenomena over time. The field notes also enable the researcher to collect and analyze the data reflexively (Fetterman, 1998). Finally, field notes also increase the auditability of the data, therefore adding to the trustworthiness of the study.

The notes for this study were used to describe the context, setting and participants which were guided by the “five W's and an H”—who, what, when, where, why, and how principles (Agar, 1980, p. 92). Specifically, I documented the participant demeanour such as posture, facial expression, and body movement, as well as tone of voice during the face-to-face and videoconferencing interviews. Interviews via telephone did not allow me to observe the participants, however I was able to note differences in the participants tone of voice, pitch and pauses during the interview process. Following the three face-to-face interviews, I asked the participants if I could visit their office, classroom, and laboratory. This provided me the opportunity to observe what types of digital/informatics tools were available to faculty. These observations were recorded in my field notes. When face-to-face contact was not possible with the participants, I asked them to describe their office and classroom. Immediately after the interview, I included a personal reflection of my observations or participants description of their office, classroom and laboratory where they teach.

Journal. Journaling enables reflexivity (see section on reflexivity p.101), helping to reflect on how I may have influenced the interviews. A reflective journal was kept throughout the research process. Entries were made before and after each interview, as well as after the transcription, replay of the digital recording, and as many times as needed to reflect on my thoughts and feelings through the research study. The reflective journal was kept on my computer which was encrypted and secured with a password.

Prior to the first interview, I examined my personal values and beliefs related to the use of digital/informatics tools and the development of nursing students NI competencies using a self-reflection journal. The questions by Roller (2014) were the focus of my writing in the reflective journaling. An example of the usefulness of journaling was an entry made after my first interviews "I was drawn in by her enthusiasm of using digital/informatics tools and her discovery of new tools that she was using in her teaching practice. I started asking more questions about these tools, but as this was not the focus of my research, I needed to stay focused on my research questions". This journal entry allowed me to be more consciously aware and to re-connect with the purpose of my study and to further explore my biases more honestly. Furthermore, I journaled about my anxiety prior to the interviews, particularly when I became aware that some participants had significantly more experience in qualitative interviewing then me. Journaling helped relieve my pre-interview anxiety. I also recorded questions regarding the interview process, trends in data, and technical problems that occurred during the interview. Finally, while reviewing my journal, I noticed certain common themes and that some of the data were becoming repetitive.

Examination of Related Documents and Artifacts. Documents "are used to confirm and contrast interviews and observations" (Cruz & Higginbottom, 2013, p. 5) to better understand the context. Textual documents can be used to compare, complement, or explain the findings of the interviews (Cruz & Higginbottom, 2013). With permission obtained from the deans or associate deans as well as the participants, certain documents were collected including course syllabi and outlines of learning activities related to the use of digital/informatics and NI. Furthermore, information on curriculum components and the teaching and learning centers was obtained by visiting the websites for each setting. Documents and websites were analysed

considering the type of digital/informatics tools used, the integration of NI and NI competencies, as well as supports available to faculty. I viewed artifacts which included digital/informatics tools used within the educational setting such as computers, video cameras, IV pumps, glucometers, or other digital/informatics tools. When on onsite visit was not possible, I asked the participants to describe what types of digital/informatics tools were available to them in their workplace. These artifacts, documents Appendix (I) and websites Appendix (J) were reviewed once the interviews were completed to helped contextualize the findings from the interviews, provide additional understanding as well as to validate findings.

Data Analysis

According to Cruz and Higginbottom (2013), data analysis is an 'iterative, cyclic and self-reflective" (p. 6), multi-step process. In ethnographic studies, data analysis begins early in the research process, as soon as the researcher enters the field and data collection begins. Data analysis occurs concurrently with data collection. Data collection ends when data saturation is reached. My data analysis consisted of thematic analysis with constant comparison, aligning with Roper and Shapira's (2000) framework. Thematic analysis is a method of identifying and reporting patterns within the data (Aronson, 1995; Braun & Clarke 2006). During constant comparison, codes within each thematic grouping are analyzed and compared to other codes in the same group, and this occurs simultaneously with thematic analysis (Hammersley & Atkinson, 2007). The data analysis was done in consultation with my supervisors.

I followed the framework of data analysis for ethnographic data as outlined by Roper and Shapira (2000). This includes: (1) coding field notes and interviews, (2) sorting to identify patterns, (3) and generalizing constructs and theories. My focus, however, was thematic analysis; (4) memoing noting personal reflections and insights. Memoing is described as a last step in the

analysis, but it occurs throughout the process. Although these steps are organized in a linear plan, the researcher is meant to go back and forth among the steps.

Coding Field Notes and Interviews

Ethnographic research contains vast amounts of written words transcribed from interviews and from participant observations that are converted into written form through field notes. Consequently, it was important to organize and sort this data. Also coding enables the researcher to do this. Coding serves as a way to label words, summarize segments of words, sentences or paragraphs from the interview transcripts by means of a symbol, letter or word(s) (Roper & Shapira, 2000). Prior to coding, I re-read the transcripts and field notes to become more familiar with the content and to achieve immersion. After reviewing the interview transcript, the initial coding process began word-by-word and line-by-line using Quirkos. In vivo coding was used, placing emphasis on the spoken words of the participants and bringing out the emic perspective of the participants. I coded words, sentences, and paragraphs of the text from the transcript by assigning labels based on what was shared by participants. During this process, it was important for me to remain open and to allow for the discovery of new codes. I first began by highlighting key words or groups of words from the transcription that seemed to represent the phenomena under study. The criteria for assignment of a code and the definition of codes were recorded in Quirkos. I also documented any decisions that were made during the coding process in my journal. Once the interviews were coded in Quirkos, I printed a hard copy of the transcript, highlighted words and groups of words, and code the interviews in the right-hand margin of the paper copies for consistency. This improved the auditability of the study. After the preliminary coding I revised, reorganized, condensed, and added new codes if needed until no new themes emerged. My supervisors were sent the coding to ensure that I was coding correctly.

Sorting

As I became more immersed with the codes, common patterns were identified, and codes began to merge to form smaller sets of categories or subcategories. Once all the codes had been categorized, I reviewed the codes in each category to ensure all codes were consistent and appropriate for that category. The sorting and grouping reflect an *etic* perspective, as I was constructing the categories and making sense of the data. The categories were than named to capture the essence of what was communicated in the interviews. Outlier cases, or negative cases are cases that differ or contradict what was discovered with the rest of the data (Roper & Shapira, 2000). I was conscientiously looking for outliers or negative cases to form another category if needed.

Generalizing

The aim of ethnographic research is finding meaning in the patterns to help explain a phenomenon (Roper & Shapira, 2000). Upon further analysis, I linked categories together and began to understand the relationship within and between other categories, and discovered the bigger picture of the phenomena. At the end of this inductive analysis, I identified ten themes which are presented in the following chapter.

Memoing to Note Personal Reflections and Insights

Memoing was a step of Roper and Shapira's (2000) framework which was performed throughout the research process. Memos are personal reflections or insights about the research data (Roper and Shapira, 2000). While interviewing the participants, I wrote notes on the right side of the interview protocol of interesting comments made by the participant and notes to recall important points I wanted to come back to seek further information or clarification from the participants. Later, these notes were added to the journal. I also created memos about any

thoughts of what the data said and potentially what was meant; ideas and insights while listening to the digital files and reviewing the interview transcripts. I added the memos in Quirkos and to the right-hand column of the paper transcripts. I also found myself thinking about the data throughout the day, often writing memos on a piece of paper or on my smartphone. Through the use of memos, I was able to make connections between pieces of data. Roper and Shapira's (2000) framework provided me as a novice researcher with a map to work through large amounts of data. The systematic yet iterative steps from coding and generalizing was helpful to uncover the use of digital/informatics tools among nursing faculty to support nursing students' learning and the development of their informatics competencies.

Trustworthiness

Lincoln and Guba (1985) state that trustworthiness is important in establishing rigor in qualitative research. Trustworthiness can be established through four criteria: credibility, transferability, dependability, and confirmability (Lincoln & Guba, 1985). Procedures for monitoring the trustworthiness of this study were central to data collection and analysis through the use of member checking, peer debriefing, rich description, formation of an audit trail, and reflexivity.

Credibility is one of the most important aspects of trustworthiness. It is the reliability and accuracy of the findings. Member checking, triangulation, prolonged engagement in the field, and peer-debriefing are strategies used to enhance credibility in qualitative research. In this research study, member checking, peer-debriefing and triangulation were used. Prolonged engagement is not suitable for this focused ethnography study, as the researcher typically stays in the field for only brief periods. Member checking is when "data, analytic categories, interpretations, and conclusions are tested with members of those stakeholder groups from whom

the data were originally collected, [and] is the most crucial technique for establishing credibility" (Lincoln & Guba, 1985, p. 314). Member checking occurs when the researcher returns to the participant to seek clarification or confirmation of the interpretation of the data after the interview process. For this study, the transcripts were forwarded to the participants in Microsoft Word document to confirm the accuracy of the data. Triangulation aims to enhance the credibility of the research by using multiple sources of data in time, space and person for the same study (Korstjens & Moser, 2018). There are four different types of triangulation methods: (1) triangulation of sources, (2) method triangulation, (3) analyst triangulation and (4) theoretical triangulation (Patton, 2015). In this study, triangulation of sources was used. The researcher used multiple forms of data sources, such as semi-structured one-on-one interviews, field notes, documents, websites, and artifacts to triangulate the data. I triangulated the responses from the semi-structured, one-on-one interviews with the course syllabi, outlines of learning activities provided by the participants, as well as the artifacts. Furthermore, a codebook was developed, to record coding decisions made during the coding process. This process also enhanced the credibility of the study. Peer-debriefing involves soliciting feedback from another researcher to examine emerging themes, compare conclusions, and evaluate any biases (Billups, 2014). Knoblauch (2005) suggests research to engage in "data sessions" where the researcher presents the collected data to other researchers in which the data can become more "objective". De-identified interviews were shared with my two supervisors and reviewed at regular intervals where we discussed these findings.

Transferability refers to the applicability of the study findings to similar contexts and settings among other participants. Thick and rich descriptions of the participants and research process enable other researchers to assess whether the findings are transferable to their own

setting (Korstjens & Moser, 2018). Consequently, future researchers will make the judgment as to whether the study is transferable to their own settings or not. In this study, I provided rich descriptive data such as the context, setting, sample (size, strategy, demographic), and interview questions. Furthermore, findings were supported by the participants' quotes.

Dependability is the extent to which the study can be reproduced by other researchers. Dependability can be addressed through auditability. Auditability is when the researcher provides sufficient accounts of research decisions in the study (Beck, 1993; Cooney, 2011). Lincoln and Guba (1985) assert that the research is "auditable when another researcher can clearly follow the decision trail used by the investigator in the study" (as cited in Sandelowski, 1986, p.53). In addition, another researcher could arrive at the same or comparable but not contradictory conclusions given the researchers data, perspective and situation (Sandelowshi, 1986). In this study, the data management software, Quirkos, allowed for easy retrieval and recording of decisions made regarding data analysis. Furthermore, the memos and reflexive journaling further support the audibility of this study.

Confirmability is researcher's ability to remain objective or neutral while carrying out the research**.** Some of the most common techniques used to establish confirmability are the audit trail and reflexivity. Reflexivity is the process of examining what role the researcher has in the inquiry, being self-aware and critically examining biases, values, and interests (Creswell, 2013). It reminds the researcher "to be attentive to and conscious of the cultural, political, social, linguistic and economic origins of one's own perspective … and voices of those being interviewed" (Patton, 2015, p.70). It helps to examine oneself and the relationships to the participants, acknowledging that they shaped the research process. As a constructivist researcher who is trying to uncover meaning from the data, I was influenced by my own subjectivity. It is

important to honestly reveal any underlying assumptions of self as they may introduce bias into the study. Reflexivity helps to uncover those biases and assumptions. It is also used to help establish credibility and confirmability (Krefting, 1991). Grove et al., (2013) suggest that the researcher records their thoughts about potential influences in a journal. Reflective journaling prior to, during, and after data analysis and collection allowed me to uncover my assumptions and biases thus reducing potential threats that could have been introduced into the research process.

Researcher-as-the-Instrument

In focused ethnography, the researcher conducts the interviews and the observations, noting any nuances in the participants' interactions. The ethnographer also reviews the raw data, analyzes and interprets the data drawing on salient aspects of the phenomena that were observed in the field. The researcher then transforms the data into research findings and nursing knowledge (Barrett, 2007). Consequently, the researcher serves as an instrument.

The epistemological assumption of the constructivist perspective, in which knowledge is co-constructed between the participants and researcher, may pose some challenges. As I am a nursing faculty who uses digital/informatics tools in my teaching practice, I came into the research setting with my own set of assumptions, biases, beliefs, values and past experiences which could influence how the data is interpreted. Through journaling, I engaged in reflexivity to uncover any assumptions and beliefs about the phenomena throughout the research process.

Ethical Considerations

Qualitative researchers are placed in a privileged position due to their proximity to the participants which can create several ethical challenges that an ethnographer needs to consider, such as anonymity, confidentiality, and issues of informed consent. Consequently, measures

need to be put in place to ensure the protection of the participants from any harm. Ethical conduct for this study was guided by the Canada's Tri-Council– the Canadian Institutes of Health Research, the Natural Sciences and Engineering Research Council of Canada, and the Social Sciences and Humanities Research Council of Canada Policy Statement: Ethical Conduct for Research Involving Humans (2014), in addition to the Canadian Nurses Association Codes of Ethics (2017). Furthermore, as part of the University of Alberta Doctoral program, I was required to complete the Human Research Ethics Training. Successful completion of this course demonstrates an understating of conducting ethically sound research with human subjects. The research study was approved by University of Alberta REB (00091981, see Appendix K) in August 2019 and from other REB before proceeding with the study.

Researcher's Self-Disclosure

I was a faculty member at "University A" from where some of the participants were recruited. I worked, however, at a separate campus, 300 km away from the main campus. I presently have no direct contract with the nursing faculty. Participants were advised of my past role as a faculty member. Any participants uncomfortable with my past affiliation had the choice to decline to participate in the study, but none did.

Informed Consent

Informed consent was obtained prior to the interview (Appendix G). The potential participants received the informed consent along with the information letter from the researcher via email after the participants agreed to participate in the study. The potential participants were asked to read the consent and to contact me if they had any questions regarding the consent. Once they had reviewed the consent and questions were answered, the participants signed the consent form and sent it back to me electronically. Consent to the study was voluntary and

participants had the option to withdraw at any point during data collection, and up to two weeks after data transcription was completed by contacting me via email or telephone. This was communicated verbally at the beginning of the interview, and a statement was included in the informed consent. Participants were encouraged to retain a copy of the consent form. Participants were also informed that data collected from this study will be summarized into a dissertation, and that the findings will be presented at conferences and published. Participants had the right to refuse to answer any of the interview questions. Names of participants will not be used in any of the papers and presentations. I attentively removed anything in the data that could identify them. Participants were also informed that participating or not participating in the study would have no impact on their employment. Permission was also sought from the participants to digitally record the interviews.

Anonymity and Confidentiality. During transcription of the interview, participants were assigned a unique identifier code, thus no identifying information was in the transcription process. The unique identifier was known only to me to ensure anonymity. For example, the first faculty member I interviewed was given the code "P01". The list connecting the participants name to this code was secured by an encrypted and password protected file separate from the interviews. Transcription of interviews was conducted only by me. Paper documents, such as informed consent, were secured and locked in a filing cabinet in my office at my residence. Digital notes are kept on a password protected hard drive. All recordings of interviews were digitally formatted and encrypted, stored on a secure, password protected hard drive. The use of the Quirkos data management system provides secure storage of all digital data which is password protected. Data will be stored for five years after the end of the study at which point all digital files will be deleted and paper documents will be shredded as per University of Alberta

policy. For this study, data was only shared with my supervisors. Again, all identifiers were removed. My dissertation, future presentations, conferences, and potential publications will not include any identifiable information. The consent form also states that researchers may want to use unidentified data for further analysis in future studies. If so, they will need to seek further ethical approval first by a Research Ethics Board. Consent forms were kept separately in a locked cabinet and will be destroyed after five years as per University of Alberta policy.

Summary

Chapter Three included a discussion of the research purpose, design, sample, setting, data collection and analysis, trustworthiness, and ethical considerations. Data was collected through one-to-one semi-structured interviews and triangulated with documents and artifacts. Data was analyzed using Roper and Shapira (2000) framework. Several measures were used to strengthen the trustworthiness of the study such as triangulation, member checks, and reflexivity. Ethical consideration also discussed informed consent, anonymity, and confidentiality. The findings are reported in Chapter Four along with supporting quotes from the participants. In Chapter Five I discuss the results, limitations, and recommendations for nursing faculty, nursing leaders and national nursing organizations.

Chapter 4: Findings

The purpose of this study was to explore the experiences of nursing faculty in integrating digital/informatics tools to support undergraduate students' learning and their development of informatics competencies. In this chapter, I describe the participants' demographics, research setting and the broad themes identified from analysis of participants' responses. Excerpts from the transcripts of the participants' interviews are integrated throughout this chapter. I also provide an analysis about documents that were included in my data collection, and of observations made during the conduct of these interviews and site visits. Some aspects of this analysis are integrated while presenting the "themes." An overview is also presented at the end of this chapter.

Research Setting

The setting used for this study was nine sites that offered undergraduate nursing education in Western Canada. These sites were located in Alberta (n=4) and British Columbia (n=5). Some sites were located in universities (n=6) and others in colleges (n=3). The college sites were affiliated with degree granting universities, and therefore offered undergraduate nursing education. During the course of data collection, the COVID-19 pandemic restricted my site visits to two institutions, Site A and Site B. During the site visits, I was able to view two faculty offices, two nursing laboratories and three classrooms which better informed my research.

Site A is located in a larger urban center on the main campus of a university. This site offers undergraduate and graduate nursing programs. The nursing programs are located in the same building as some other healthcare programs. Site B is located in a mid-size urban area and

offers undergraduate and graduate nursing programs. The nursing programs are located in several different buildings and shared spaces with other departments.

I interviewed seven participants from sites A and B. In addition, 14 participants were from other locations in Western Canada. Five of the sites where these participants taught were located in major urban areas, and four were located in mid-sized urban areas. Finally, five of the locations offered both undergraduate and graduate programs, while four offered only undergraduate programs. During the data collection period, nine participants were interviewed prior to the COVID-19 pandemic, while twelve participants were interviewed during the COVID-19 pandemic. Some of the participants' responses to the interview questions varied during this time period as will be reported in later pages. The pandemic becomes in itself a theme that was revealed from the data.

Demographics

A total of 21 nursing faculty teaching undergraduate nursing programs in Western Canada were interviewed for this study. Most of the participants (n=20) were female. Of these, 15 participants were in the age group of 50 and over. Other participants ranged in age from the 31-35 years age group (1 participant), 36-40 years age group (3 participants), and 41-45 years age group (2 participants). Ten participants had a doctoral degree as their highest level of education, 10 participants had a masters degree as their highest level of education and one participant had a baccalaureate degree as the highest level of education. All participants were in continuing faculty positions, thus in permanent positions within their academic institution.

Participants had varying years of nursing experience, years spent teaching undergraduate programs, and types of teaching responsibilities. The number of years that participants had been registered nurses ranged from 11 to 41 years, with the average number of years as a registered

nurse being 28.6 years. Six participants had 11-20 years of nursing experience, five had 21-30 years of experience, eight had 31-40 years of experience and two had 41+ years of experience. Participant years of experience teaching in an undergraduate program ranged from one and half years to 38 years of teaching experience, with the average length of time teaching in being 15.6 years. Nine participants had 1-10 years of experience, seven had 11-20 years of experience and five had 21-40 years of teaching experience at the undergraduate level. Ten participants taught exclusively in one setting: eight in classrooms only, one in laboratory only, and one in clinical only. Seven participants taught in two settings: six in classroom and clinical, and one in laboratory and clinical. Finally, four participants taught in all three settings. Almost all participants worked full-time (19 participants). See Table 4 for the demographic information of the 21 participants.

Table 4

Demographic Characteristics of Interview Participants

Characteristics	Interview Participants (n = 21)
Gender	
Male	1
Female	20
Age of Participants	
31-35 years	1
36-40 years	3
41-45 years	2
46-50 years	0
>50 years	15
Highest Level of Education	
Baccalaureate	1
Master	10
Doctorate	10
Employment Status	
Full Time	19
Part Time	2
Type of Faculty Appointment	
Continuing	21
Sessional	0
Years of Nursing Experience	
11-20	6
21-30	5
31-40	8
41-50	2
Years of Teaching Experience	
1-10	9
11-20	7
21-30	3
31-40	2
Type of Teaching	
Classroom only*	8
Classroom and Clinical	6
Classroom, and Laboratory [a]	5
Clinical only	1
Laboratory only [a]	1

[a] Includes face-to-face and online

Thematic Presentation of the Findings

Thematic analysis of the coding along with constant comparison of the participants' transcriptions led to the identification of ten themes: meaning of the term nursing informatics, faculty perceived NI competence, perceived usefulness of digital informatics tools, facilitators, challenges, developing students' NI competence, building connections, teaching approaches, the learners, and the pandemic. Each theme is composed of sub-themes and supporting statements from the transcripts of the participants' interviews. Table 5 presents a summary of the themes and sub-themes identified from the analyses.

Table 5

Themes and Sub-themes

Themes	Sub-themes
Meaning of the Term Nursing Informatics	Use of digital tools
	Use of data and information to inform nursing practice
	Use of information and digital tools to improve patient outcomes
Faculty Perceived NI Competence	Beginners
	Novice to comfortable
	Proficient
Perceived Usefulness of Digital/ Informatics Tools	Liven it up
	Support teaching and learning
	Impact
Facilitators	Support from others
	Resources
	Faculty's attributes
	Norms and expectations
Challenges	The clinical environment
	Steep learning curve
	Technologies
	The effects of tech
	Faculty attributes
Developing Students' NI Competencies	Preparing for practice
	Not doing a good job
	Strategies used
Building Connections	
Teaching Approaches	Engaging the learner
	Critical perspectives
The Learners	The tech savvy student
	Not so tech savvy student
The Pandemic	Adaptability
	Seeing the benefits
	Missing Face-to-Face Interactions

Theme: Meaning of the Term Nursing Informatics

As discussed in Chapter Two, there are several definitions of nursing informatics which have changed over time and continue to evolve with the advancement of digital/informatics tools. Faculty conceptualization of nursing informatics (NI) can support students' understanding and application of informatics concepts. To determine participants' own understanding of the meaning of NI, they were asked what NI meant to them. Then later during the interview, I asked how they were developing students' NI competencies, but faculty did not seem to know how to answer this question. Consequently, we reviewed the CASN NI Entry-to-Practice competencies along with their indicators. After some discussion about NI competencies, participants began to realize that they were already integrating NI into their teaching practice, albeit unintentionally, and that their understanding of NI did not correspond with what they were teaching. Participants' definition of NI fell into three sub-themes: use of digital tools, use of data and information to inform nursing practice, and the use of informatics and digital tools to improve patient outcomes.

Use of Digital Tools. Some participants defined NI as the use of technology for nursing practice. Technology was perceived as the focal point of defining NI. For example, a participant explained her understanding of NI in the following manner, "nurses are users of technology for practice, teaching, administration, research. Nurses use technology for the purpose of accomplishing nursing related activities" (P3).

Use of Data and Information to Inform Nursing Practice. The second sub-theme related to the 'meaning of the term NI' was associated with using data and information to inform nursing practice. Some faculty members identified NI as the ability to find and use patient-

related data through the application of digital/informatics tools as the focal point of defining NI. A participant summarized NI as:

> We can use [nursing informatics] to inform ourselves about the patient. We access patients' files from online charting systems to see if they have had lab work done and other diagnostics. In addition, who they might have seen or to review their recent history to find out where they have been in the community in terms of accessing services (P21).

While another participant associated NI with being able to also understand and evaluate data, "Being able to use the digital tools to access data, save, interpret, critically appraise, and use the data" (P26).

Use of Information and Digital Tools to Improve Patient Outcomes. A participant captured the third sub-theme, using information and digital tools to improve outcomes, by simply articulating nursing informatics as "information and communication technologies that inform our world to improve patient care and safety" (P15). From this perspective, NI informs the delivery of care, creates a safe patient care environment and improves patient care outcomes.

Overall, participants' understanding of the term of NI varied. In addition, in my observations of the participants through video conferencing and noting their tones of voice, it appeared that some participants felt uncomfortable about articulating a clear definition of NI. For example, when I asked one participant (P26) to define NI, she turned away from the screen, paused and seemed to laugh uncomfortably. She then started answering the question stating a few words, and the paused again before finishing the sentence with a high tone of voice. Finally, some participants seemed to want validation in their response to the question.

Theme: Faculty Perceived NI Competency

The following section presents findings of faculty's perceived NI competency. Perceived NI competency was a reflection of the participants' judgment of their own NI knowledge, skills and abilities. After conducting the first two interviews and meeting with my supervisors, we wanted to know more about how faculty perceived their level of NI competency. It was important to ask this question as it may influence how they integrate NI competencies into their teaching practice. From the sample of 21 participants, four participants did not answer the question because two of them were not asked it and the two other participants elected not to answer the question. Of the 17 responses, a variety of levels of perceived NI competency was identified by participants. Four participants identified themselves as beginners, seven as novice to comfortable, and five participants identified themselves as proficient. One participant felt her level of competency was restricted to the use of digital/informatics tools that were available to her in her work environment. A summary is presented in Table 6.

Table 6

Faculty Perceived NI Competency

Perceived level of NI competence	Interview Participants (n = 21)
Beginner	4
Novice to comfortable	7
Proficient	5
Not asked/did not answer	4

Beginners. Three participants perceived themselves as beginners in relation to their informatics competence, and this was related to their ability to use digital/informatics tool for educational purposes. Participants described themselves as "low tech" (P18) or as "neophyte/beginner" (P16). One participant expressed that she integrated few digital/informatics tools into her teaching practice, and that she often felt frustrated by this. She stated: "the only

thing I am competent with is Kahoot! and bringing up videos". Another participant stated "I get frustrated with the learning management system" (P7).

Novice to Comfortable. Participants who reported themselves as novice to comfortable in NI was related to their ability use of digital/informatics tools or to their knowledge of CASN NI competencies. One participant who identified herself in this category equated her level of competency with being comfortable in the use of digital tools for teaching and research. She stated:

> I can accomplish what I need to do for my work well enough… I'm able to access the knowledge that I need for teaching and research. My access to technology is sufficient, I wouldn't say that I am highly proficient, but sufficiently independent (P3).

Another participant described herself as a novice in regards to her knowledge of CASN NI competencies and her ability to develop and implement strategies to help students develop their own NI competence, "… somewhere between beginner and intermediate. I know the competencies [CASN NI competencies]. I would like to work on implementing and developing strategies. I think my strategies could fit in a small box for how to help students develop these competencies" (P17). Similarly, another participant perceived herself in this category as well, stating that she integrated the CASN competencies into her teaching practice but felt she needed to learn more about engaging students through the use of digital/informatics tools. She stated "I use these CASN competencies. I think that I fulfilled them quite well. I have more to learn about technology in healthcare … in the application of healthcare" (P10).

Proficient. Participants who viewed themselves as proficient felt this way based on their use of digital/informatics tools in the clinical environment, their perception of themselves as

innovative and being ‘tech savvy’, as well as having an accepting attitude towards digital/informatics tools:

> I think mine is pretty high, but I've had the privilege of being able to work on electronic health records implementation teams in other settings. I've always been a more curious, tech savvy person. On the diffusion of innovation scale, I'm an early adopter of technology… I think that attitude is helpful if you view technology as a barrier to solving problems. It can affect the way they are going to interact with that technology (P11).

Another participant rated her NI competence as 8/10, as she enjoys working with digital tools and her colleagues often come to her for assistance:

> I like technology, it's fun! I do not get frustrated when there are problems. I view them as a challenge to try and figure out. I’m not really afraid to go look for new things, try them and play around with them. I learn how to fix problems and how to troubleshoot when things aren't working properly … and for that reason I think a lot of times I find my colleagues coming to me when things aren't working. I can help other people in either finding resources or problem solve (P12).

Faculty perceived themselves at varying levels of NI competency. It seemed that most participants viewed their proficiency level based to their ability to work with digital/informatics tools in different contexts. The next theme that will be discussed is ‘perceived usefulness of digital/ informatics tools’.

Theme: Perceived Usefulness of Digital/ Informatics Tools

Faculty’s perception of the usefulness of digital/informatics tools needs to consider the belief by faculty that these tools would enhance their teaching performance and students’

learning. This theme includes three sub-themes: liven it up, support teaching and learning, and impact.

Liven it Up. Some participants perceived digital tools as useful in their instruction as a means to enhance the content and render the process of learning more interesting, interactive and engaging for students. P21 stated, “it’s something that wakes up the class”, while P11 said, “I use a few different technologies to engage classes in different ways”. Another participant noted:

> What I have learned from this is that you can liven up and help them [students] absorb the dryer content that they wouldn't normally learn if you did not let them use innovative technology… it can make your teaching more dynamic and more interesting for the students (P15).

Digital/informatics tools also helped engage students. Participant P1 shared an example of how she livens up the subject matter by encouraging students to be actively engaged with the content. In addition, it permitted students to learn navigational techniques as they searched for information on websites:

> I teach about professional organizations and the content often seems to make the students glaze over, but by using an App I have them go to professional websites and take a screenshot photo to show where they found the information…I use tech to liven it up (P1).

On the other hand, participant P10 shared how she uses digital/informatic tools to help with student’s engagement.

> “you have to keep them engaged, you can't just stand there and lecture at them … I have used a lot of [online] games in my classroom for review, as such as collaborative quizzing, word searches, match the definition, and Kahoot!”

These examples illustrated how digital/informatics tools can encourage multiple ways of engagement with course content while promoting active learning. In my journal, I noted that participants seemed excited in sharing these experiences as their tone of voice and their facial expression became more animated.

Support Teaching and Learning. Several participants reported that digital/informatics tools were useful to support their teaching practice by enabling faculty and students' convenient access to information. In addition, these tools were perceived by educators as helpful to assess students' knowledge and to provide students with more opportunity to reinforce the subject matter learned. Consequently, sub-themes of the theme 'support teaching and learning' include: access to information, assess student's activity and knowledge, as well as reinforcing students' learning.

Access to Information. Participants stated they used tools such as learning management systems (LMS), as a resource repository for convenient access to class material, such as PowerPoint slides, multi-media content, study material and online examinations. For example, participant (P22) explained:

> the learning management system is a central place to disseminate the same information to all of the students". Participant P28 on the other hand, pointed out that "it's convenient, actually … It's like a library. I house a bunch of materials there. It's like a one stop shop for them [students] to go to", whereas another participant reiterated "the students are able to easily access the materials they needed to learn [using a LMS] (P3).

In clinical practice, faculty described digital/informatics tools as being useful to access patient data and reliable information. For example, they accessed patient information through electronic health records, and "when they [students] aren't sure of the patient's diagnosis, they

can look for information on the computer. They look up their labs in [Electronic Medical Record] and allergies online" (P18). This provided students with information to help care for their patients. Students also used a variety of programs or applications on their mobile devices, such as diagnostic tests or drug guides, to check safe dosages of medications as well as to explore why the patient was receiving a particular medication. One participant explained how she helped developed students clinical reasoning by accessing information from the electronic drug guide and making connections to the patient diagnosis. She voiced the following:

> We look up information with the students, if there's a condition that the student doesn't understand, whether it is in clinical, or the classroom or in lab. I can always pull that up on technology, or I can help them look it up. I say, "I know you're not giving this drug but take your phone out, go to your Davis drug book App, and look up this drug so you know how it works on your patient (P10)."

This example illustrated how technology becomes important to access and gather data in the moment in order to provide safe patient care.

Assess Student's Activity and Knowledge. Faculty also perceived digital/informatics tools to be useful in assessing student understanding of subject matter in real time. For example, P21 spoke about how she found the tools useful as a 'temperature check', while others explained it as a "barometer" or" knowledge check-in" to assess student's knowledge. This allowed for immediate explanation and clarification of misunderstood concepts. Specifically, one participant stated:

> We use Kahoot! an online quiz, where they can respond [to questions] using their mobile devices. It is a knowledge check-in. I find them particularly [LMS] useful as you can

> monitor what students are learning because you can track what they have completed (P11).

In a statement, another participant eagerly expressed:

> I instituted polls and clickers everywhere. Students can interject during the lecture. Also, I can get a sense of whether or not I can move on. Quizzes help me! I would take a quick peek before class started to see the questions they were not getting and figure out a way to weave that in to my class that day (P13).

This participant used digital/informatics tools to access student's data prior to her class to help inform her of what course concepts needed more explanation. Another participant stated she accessed students' information on the LMS to track students' activity:

> From a tech perspective, I can actually see how many students have accessed the readings on the course reserve. It gives me a barometer of what is happening. Sometimes a little disappointing barometer, but I can see that after the midterm that only half of the class had read their readings (P1).

Reinforce Students' Learning. Participants believed it helped to reinforce student learning, as they were able to repeat learning activities as many times as they wanted to increase their competence.

> We use a deliberate practice model for our psychomotor skills. The idea is that prior to lab, students do the reading, complete [an online] pre-test and watch a video as many times as they want. Then, they practice the skill in lab. Then they can do a [an online] post-test as many times as they want (P17).

Another participant shared how in her undergraduate nursing program students evaluated their own psychomotor skills by reviewing a video recording of their own performance; thus, promoting self-directed learning. The participant explained:

> One of the ways that we help students to learn, …they are expected to go into the lab and video record themselves using their own handheld devices doing a head-to-toe assessment. Then they upload it into the system…. There is a learning annotation system where they can stop and annotate their video by writing a comment, such as "I did this wrong" or "I forgot to do something". Then they submit it to their teacher. The teacher can add more annotations and feedback on how the students did (P12).

Furthermore, participants perceived that using digital/informatics tools helped bridge the theory to practice gap. The following participants' excerpts described how these tools facilitate that:

> [The clinical digital experience], it's more real and more immersive. I think it fits well with what we are doing in class. The patient care pulls all of it together in the acute care environment. There is an electronic medication record built into it, and students can assess patient's lab values and vital signs within the program (P1).

> [In lab] High fidelity simulation is for skills acquisition, for applications to work together, apply, manage clinical situations, make mistakes, and debrief. Then when they get to the clinical setting, they report feeling more confident, less anxious, and more appreciative of having had the experience in a simulated environment so they can use that information and translate it to the clinical settings (P4).

Another participant explained that students can learn from their mistakes and feel supported from repetitive practice of simulation experiences, "I think that's a good way to learn even if it's not a real person. They can go back and do it again" (P18). Participant P8 expressed

how simulation helped students recognize the deteriorating patient in a safe, controlled learning environment: “with the simulation, you can simulate the situation of a patient is deteriorating vitals … You can't do that on a human”. On the other hand, one participant elaborated on the perceived usefulness of these tools as an ‘alternative model’ for clinical experiences, as students have increasingly limited exposure to the clinical environment. “Our nursing students are getting less and less clinical hours, so these virtual simulations are important. I think it can encourage that translation of knowledge” (P13).

Digital/informatics tools can support different learning styles, “students have their own unique learning needs. Some like to listen to audio recordings or video recordings. Others want to be reading PowerPoint slides, summaries or handouts. You provide the students with the same opportunity to meet their needs” (P13). This participant added:

> Everybody has a different learning style. Students for whom English is their second language benefit from the podcast lectures because they can go back, find the slide with the word that they didn't really understand, and look it up. They use it as a learning tool (P13).

Participants also explained that digital/informatics tools were useful for students to engage in discussions and learning about sensitive topics, lessening fear and embarrassment related to how they answered or posed a question. For example:

> I find the polling technology useful. For example, when we talk about sexuality related content, it can be difficult for the most mature people to open up and talk. Using the anonymous poll Kahoot! enables people to ask questions that maybe they wouldn't feel comfortable asking in an open forum. It is totally anonymous, and then we can have a

> discussion around a question that nobody would have been brave enough to ask. I think it can be transformational around those specific sticky topics (P11).

Impact. Digital/informatics tools were reported to be efficient at managing subject content, class time, and at facilitating communication. Participants also found there were some costs saving for students and had a lesser impact on the environment. Participants stated that students reviewed class content using digital resources, such as videos, prior to attending lab. This made time in the lab more efficient, as students could focus on practicing the skills. One participant noted, “I think technology is very useful. It's way more efficient. Students access the videos at home before they even come to lab, which has made labs more efficient because you're not spending all this time showing videos” (P4).

Participants also perceived digital informatics tools as useful as it helped facilitate communication between faculty members and students making it more efficient. For example, one participant indicated:

> There is the advantage of being able to update things rather than sending out the paper copy or 15 emails. I post updates on the learning management system, making the communication effective and consistent as everybody gets the same stuff (P4).

Another participant shared their approach in communicating with students, stating “I post a welcome video introducing myself and how to contact me before the course starts” (P18). Furthermore, P10 shared how she maintained communication with her students in a busy clinical environment, “in acute care, they [students] will text me and say I am ready to do an assessment or whatever it is. I can get a hold of a student when I don't know what room they are in”.

Finally, participants perceived a cost savings to students using digital/informatics tools and a reduced impact on the environment. For example, “students don’t need to buy course packs

and save on the environment" and P4 further explained, "I think the biggest one is the environmental saving of paper … students used to have a 100-page course pack for every lab. With 1400 students in our program, that's a lot of paper" (P1).

In summary, participants perceived digital/informatics tools as useful, as the tools helped liven up the content, provided support for teaching and learning. The tools were also perceived to have an impact on the management of subject content, class time, facilitated communication between faculty and students, reduced students cost and the impact on the environment. The next theme that will be presented is the facilitators.

Theme: Facilitators

Facilitators are described as any factors making faculty's integration of digital/informatics tools easier. In this study, faculty described several facilitators assisting their process of integrating digital/informatics tools into their teaching practice. These facilitators are represented under four sub-themes including support from others, resources, faculty's attributes, and norms and expectations.

Support from Others. Some participants described support from others as a facilitator towards digital integration into their instruction. The availability of the institution's information technology (IT) department for technical support, teaching and learning centers for instructional use of technology, as well as peers, nurses, students and others assisted faculty members in utilizing digital/informatics tools. In addition, these supports helped them overcome the challenges they faced as they tried to integrate the tools into their instruction. It seemed that all participants had access to IT services and teaching and learning centers based on information provided by the participants and the information posted on the sites' websites.

Participants identified technical support from the institutional IT center as a facilitator to integrating digital/informatics tools into their teaching practice by helping them with hardware and software applications. Recognizing the importance of IT services and online support, one participant shared:

> I had a problem a few weeks ago with trialling a digital clinical experience. My virus program kept blocking me from using it. I just walked over to IT services and said "can you show me how to?" I also found that because the University is a large institution, there are a lot of help guides online and I usually manage to find what I need. These guides walk me through and explains how to use something step by step (P1).

P8 mentioned ongoing support from a simulation technologist to help her integrate simulation scenarios:

> They [simulation technologist] help with the setup of the mannequins. They attached all the equipment to the mannequins to simulate the patient situations, and then they ran the computer, changed vital signs and different assessment parameters, as well as played the voice of the patient.

Some participants also reported teaching and learning centers within their institutions as facilitators. Of note, some participants considered these Centers as important resources to enhance their digital/informatics proficiency. Specifically, P11 explained how he consulted with the teaching and learning center to help him develop strategies to implement his ideas:

> I find an idea and I take it to them [teaching and learning centre] and they help me make it a reality. They have all kinds of ideas and tools they can recommend… I'm quite grateful for that team… they've enabled me to do things that I don't think I could have done with technology in the classroom.

Other participants who engaged with their teaching and learning centers stated they assisted them in aligning specific technological applications with their learning objectives through workshops or one-on-one training. For example, P1 commented the following:

> I think the center of teaching and learning is a good resource on campus. Their view of the educational use of the tech, not just tech for tech's sake. Like IT, they work with your course objectives and help students achieve the learning outcomes which I think is really good…they are the teaching and learning experts. They often bring up really good ideas.

P1 also recognized the benefits of peer support from mini teaching sessions, in which faculty members share resources, insights, practices, and materials. She stated, "my colleague, she organized some mini tech sharing sessions. We discussed new things that faculty used in their classrooms, how it worked for them, and demonstrated how to use them... I think I learned a lot from colleagues" (P1). Similarly, P15 shared her enthusiasm (as noted in the interview transcripts) of her experiences when working with a younger group of peers who helped her problem solve technical issues and provided some guidance:

> I have been lucky enough to be working with three colleagues who are younger. They don't have the same nursing experiences, but their technological ability to use all of the resources was really amazing. We have done an exchange of information and they helped me get up and running with the LMS (P15).

Another participant remarked that her peers had encouraged her to try new digital/informatics tools and influenced her perspective on integrating digital/informatics tools into her teaching practice:

> To be very honest, I needed some encouragement. My colleagues, who were about 10 years younger, … we were talking in our little group, and they asked "what about using

> it?" At first, I was like 'no', but then I thought I needed to look into this more. So, I started with Kahoot! Then, a professor from another institution came to one of our teaching and learning days for faculty. He showed us how he used technology. I just found him inspirational. I think it was a combination of younger colleagues encouraging me and helping me, and this visiting professor. I was just blown away with what I experienced with him (P21).

Participants were also supported by the nurses in clinical environments. Nurses supported participants as they were more knowledgeable about the use of certain digital/informatics tools used for patient care. The following statement reflects the description support by nurses:

> I try to keep current with some of the [digital/informatics tools], but sometimes there are new things that I have not had the opportunity to learn about. I am often reliant on the nurses on the floor who have had that education and training to support the students (P1).

Students also offered support to faculty members by assisting with the functionality of digital/informatics tools, as suggested in the following statement: "our younger students are really comfortable and confident, they fix my laptop when I can't get it to work properly" (P1). Likewise, P16 shared this example of her students supporting her integration of digital/informatics tools: "I have teaching assistants [graduate students] who often assist me with the online platforms for coursework that have become more complex".

Finally, family members and friends also supported participants when technical issues arose. P23 explained how a friend's husband assisted her with the functionalities of a digital/informatics tool when she could not get support from her institution's IT department as she was working with a different type of personal computer. "I had to go to a nurse educator

whose husband has a Mac [personal computer]. He talked me through it, and how to get it to work".

Resources. A number of participants perceived that several resources facilitated the integration of digital/informatics tools into their instruction. These resources included online learning modules, workshops, toolkits, and books. For example, most participants stated that students were required to access and complete online modules regarding the use of glucometer and electronic medication systems prior to coming into the clinical environment. P8 shared, "the [Health Authority] gives us a list of 'ilearn' [online] modules that our students need to have completed before they enter their practicum". To support this statement, P1 provided an example: "we use a lot of the Health Authority online learning modules, for example 'online glucometer training'. Furthermore, participants described the importance of developing students' ability to access these online resources to help them transition to practice more easily, "they will then be familiar with some of the resources that they will use as a registered nurses to support clinical decision making" (P12).

P15 participated in an online workshop to help her with integrating digital/informatics tools. She expressed, "my institution is really good at having workshops that include topics such as assessments, and how to engage the online learner". She further commented that her department had encouraged their faculty members to read books on how to integrate digital/informatics tools for healthcare professionals:

> We [faculty members] are supposed to read a couple of really good books for teaching health professionals. Topics included online frameworks and strategies for engaging the online learner. We also had a faculty meeting this morning where we discussed tips for

> online learning. We shared what we're doing with our courses, and what resources we used.

One participant partook in a few in-services on how to work effectively with digital/informatics tools, such as high-fidelity mannequins. P8 stated “in regards to the high-fidelity mannequins, we have had a few in-services on how they work”. Only one participant reporting using the CASN NI Teaching Toolkit (CASN & CHI, 2013) to help her integrate digital/informatics tools into her teaching practice.

Faculty Attributes. Personal characteristics described the manner in which participants’ past experiences, knowledge, attitudes, curiosity, willingness to learn, and motivation to use digital/informatics tools facilitated their integration of these tools into their instruction. For example, P8 discussed how her past experiences with and knowledge of using digital/informatics tools made her more comfortable and willing to adopt and work with these tools:

> I think that the fact that I'm familiar with them now, they're easy for me to use. It hasn't always been that way. When the new technology comes out, the learning curve is huge…but I think the familiarity that I have now allows me to be more comfortable with it.

Some participants had a positive attitude towards integrating digital/informatics tools. P12 keenly explained how experiential learning helped her to familiarize herself with these tools:

> I like technology! I find it's fun! I do not get frustrated when there are problems. I view them as challenges to try to figure it out. I'm not really afraid to go look at new things, and to try new things, and to play around with them; and then when that happens, I learn how to fix problems and to troubleshoot when things aren't working properly.

Participants also shared similar attitudes towards digital/informatics tools and wanting to learn more about them, “I am really a big believer in using technology. In fact, I am going to be taking an instructional design workshop” (P20). When asked about other enabling factors, a participant voiced that professional development opportunities created an awareness of what is available to her: “being aware of what's out there, knowing what the trends are, what people are using, what new developments are in the field, and then capitalizing on that” (P5).

Other participants reported a willingness, and this helped facilitate the integration of digital/informatics into their instruction. According to the participant, willingness to overcome technophobia and stay current with the latest technologies helped her integrate the tools into her instruction. Recognizing the importance of willingness and fostering a positive learning environment, P26 shared:

> …because technology is a big challenge for me, I get very emotional. I feel like I am a loser. To help me understand, I walk over [to the teaching and learning center] with my computer. They would say you have to do it yourself, and I say I am going to do it here. It showed them that I was determined to learn. I also think the attitude level seen in other people who have an open mind and a willingness to engage is enabling.

Finally, some participants challenged themselves as to how to use and integrate digital/informatics tools into their teaching practice and take ownership of their learning: “I didn't take any courses, I just learned as I went … learning by experience” (P3). Likewise, P10 noted, “I learned along the way in my workplace. I didn't take any courses, I just learned as I went.”

Norms and Expectations. This sub-theme includes expectations from the workplace, clinical environments, and students. Participants commented that expectations encouraged them

to integrate digital/informatics into their teaching practice, as asserted by the following participant: "…you're expected to be skilled and proficient at it" (P16).

All faculty members interviewed used learning management systems (LMS) to assist in the delivery of course materials. "Student access to course syllabus, course materials and quizzes through a "[LMS], it is mandated, you [students] cannot opt out" (P4). When asked about the use of digital/informatics tools in teaching, P10 firmly asserted "in this day and age, you can't teach without it!" P8 expressed how she perceived that working with digital/informatics has become the norm:

> I guess it depends on your generation. Computers weren't even around when I did my first diploma program. When I did my bachelor degree, I had to learn to work with computers because they were an expected part of learning. I imagine new technologies are always going to be coming. We need to be comfortable with them, then adopt them and learn how to use them (P8).

There is also an expectation from students for faculty members to use digital/informatics tools to facilitate their learning. P5 shared how students were upset when she decided not to use PowerPoint in one of her classes. "Students like to have PowerPoint… it can be a crutch that students lean on…When I chose not to use PowerPoint, I had lots of backlash from the students. I had to switch back".

Finally, some participants reported that the use of digital/informatics tools are an expected part of nursing practice. This will be discussed further down, under the sub-theme: Preparing for Practice. In summary, the participants described several facilitators to the integration of digital/informatics tools into their teaching practice. This includes: support from

others, resources, faculty's attributes, as well as norms and expectations. In the following section, I discuss participants' views regarding the challenges they faced.

Theme: Challenges

This section addresses faculty challenges in integrating digital/informatics tools into their teaching practice. All participants readily shared their stories about the challenges they faced, and their effects on their abilities to learn and use digital/informatics tools. The following sub-themes was identified from the data analysis: the clinical environment, faculty development, steep learning curve, technology, the effects of tech, and faculty attributes.

The Clinical Environment. This sub-theme examined the challenges of working with digital/informatics tools in the clinical environment. In particular, learning in a digital-paper environment, limited student access to digital/informatics tools, and time to develop proficiency in using the tools surfaced are discussed below

Learning in a Digital-Paper Environment. A digital-paper environment refers to nursing students having to access patient data from both paper charts and from the electronic health records (EHR). Learning in a digital-paper environment was described as a significant challenge by most participants. First, accessing patient data in a timely manner was a challenge. Secondly, students often had to access patient data through digital patient medical records as well as through paper-based medical records. For example, one participant described how challenging it was to teach students where to find the patient data:

> It's hybrid. In the paper chart, they will find doctors' orders, physician's history, and narrative charting; then the electronic part of the chart will have consultations and the vital signs. It is quite challenging to teach students where the information goes and where to find it (P17).

Other participants reported that it was difficult to teach students about digital/informatics tools, such as electronic health records in the academic setting, as the clinical environments had students using paper and pencils: “we haven't been doing a lot of that [simulated electronic health records (EHRs)] because students are using paper and pencils [in practice] (P5). To further support this, P4 explained why their nursing program had not adopted simulated EHR, as they are not working with them in the clinical environment:

> “It's not friendly from an educational standpoint. We were going to do it sooner or later [integrate simulated EHR]. It was more that our predominant clinical sites didn't have it [EHR]. It's hard to teach about electronic health records in a curriculum, and then they [students] go [into the clinical environment] and they are looking for a pen. You don't want your clinical sites to drive your program, but the reality is it's hard for students if they are never going to see it until they are actually using it in a clinical setting. It gets pushed in the back of your mind.

Limited and Timely Access. Another significant barrier to using digital/informatics tools as voiced by participants was gaining and maintaining access to digital/informatics tools in the clinical environment. This included access to computers…. (perhaps in given general areas). Many participants described how this occurred. P5 provided one example limited access to digital/informatics tools “students don’t necessarily have access to those computers. It was a huge barrier to their learning, because a lot of the information is actually on the EHR”. Another participant reported that students may not have timely access to EHR:

> It is the ratio of the number of students per unit, to other staff. For example, [nursing] students [from other nursing programs] are there, my students are there, then Med

> students, and then the nurses and there's one pod [computer]. They can't access the computers in a consistent and timely fashion (P15).

P1 also reiterated similar challenges to access digital/informatics tools:

> The environment that we are currently teaching in is challenging. It is possible for a student to do an entire day in practice and never use a computer… It is just so limited. They are often really slow...and something is just about getting the time and the space to get logged on and access the patient lab values and operative reports, or whatever else they are looking for (P1).

In addition to the limited access to digital/informatics tools in the clinical environment, P17 described the challenges of not being able to access point-of-care resources, stating: “there are lots of computers, but they are often in use. There isn’t a computer where the student and I can go and look at a policy, or plan a skill. I find that quite challenging, getting time with the technology”. While, P4 expressed their frustration regarding the lack of access: “the disadvantage of technology is that you can teach it and students can be exposed to it in their program, however if it's not in the clinical settings they don't become comfortable and mastery never happens”.

In some clinical areas, students are prohibited to document in the EHR, thereby again limiting opportunity to develop their skills, as noted by a participant who stated: “in the clinical setting, it is hard because they [students] weren't allowed to chart in the systems that exist…they missed out on that opportunity” (P21). In other cases, students can only access them through their instructor or nurse’s login information. P5 highlighted “we have to sign them in [into EHR] as an instructor when they're doing the practicums… Our students didn’t have access to the computers”. Similarly, the following participant raised concerns about students using instructors’

log-in information, as they were not modeling best practice: “students were not able to get access to the computers. The hospitals think they should use the registered nurse’s login… they weren't role-modeling best practice and best information usage” (P26). Another faculty member explains the outcome when a student was denied a passcode to access digital/informatics tools by the provincial health authority. “Consequently, the students could not access patient’s information or medications through the electronic medication system; thus, restricting the students’ ability to care for patients and their ability to continue in the nursing program". This was clearly underscored, when a participant further explained that “a student was denied access to the hospital. She could not complete the program” (P17).

In the community setting, P7 reported that students have minimal access to digital/informatics tools: “in community, they [students] don't use technology. They do manual blood pressures …we are like *Fred Flintstone* in a community that is very basic”. She further explained that due to her teaching area she has limited opportunity to work with digital/informatics tools, and that the students have limited access in the clinical environment, “I think I am really limited because of what I teach. I do not teach intense clinical skills. I teach OBS skills. I'm limited that way”.

In addition to the inability to access certain tools, P7 described her annoyance that students could not access Wi-Fi to research patient information: “No, we don't use anything at all [use of digital/informatics tools]. It's like archaic. We use paper because the site doesn't want us to use their Wi-Fi” . Or the clinical sites block student access to Wi-Fi, “the hospital can block out your phone so you don’t actually have access to it” (P10).

Some clinical sites prohibited students from accessing their digital/informatics tools, even though they are encouraged by faculty to access evidence-based information. P8 described her

experiences in these words: “We actually encourage our students to use their cell phones to access up to date information… and there have been nursing units that have banned cell phones but yet they don't have enough computers available for students”.

P5 found it frustrating that students could not use their digital/informatics tools to access information in the clinical environment:

> We were advocating for students to use on-line tools to access basic information during clinical... I don't know whether it was an official policy or the norm that students should not be looking at their phones on the unit…they [students] had the medication prep cart in the hallway, it was challenging …They actually had to leave their medications to go look something up in a private room, and then come out again. The lesson for us was that even though there was the way our students could use technology, that use had not been incorporated into the policies and into the ways management were doing things in that clinical setting.

Steep Learning Curve. Participants’ learning curves were identified as another challenge to integrating digital/informatics tools into their teaching practice. Many described their opportunities to learn as ‘too fast’, ‘too complex’, or ‘having had received too much information over too short a time period.’ In addition to the steep learning curve, faculty needed to negotiate their time and workload. Participants identified challenges related to faculty development. P5, described her learning during the interview, stating “although I use a lot of technology, I can't say that I’m savvy… Knowing how to use it! That's a learning curve... and how you can use it and integrate it in a way that is useful for students”.

Many participants commented on the amount of time necessary to learn how to integrate the tools. “I think it’s the learning curve and the time required” (P8). Similarly, the following

participant described her experiences in wanting to learn, but feeling that competing demands from other curricular content restricted her ability to integrate them: “I had lots of issues with plagiarism, and it was recommended that I use it [Turnitin]…but there is a learning curve and time to learn something new” (P1). P19 also echoed similar thoughts, stating “there are these really interesting and innovative [tools] that I really wanted to do in my classroom, but I just didn't have the time to go and learn about the tools, the equipment, or the features. It takes time, and I do not have that luxury”. P21, meanwhile, reported that her workload was restricting her learning how to use digital/informatics tools: “it is the workload…I have written two simulations to enhance students’ learning, but I have to try to balance my workload…I thought I would have time to do things, but finding the time is really difficult”.

Participants also spoke about the time needed to actively engage with digital/informatics tools to figure out how they work, and whether they are appropriate for their teaching practice. “It’s about how you will engage with technology. It is like anything... you get out what you put into it” (P11). Furthermore, participants expressed that digital/informatics tools are changing at a rapid pace, particularly in the clinical environments. This makes teaching more difficult.

> “…it is ridiculous the amount of change. We [clinical environment] have a new IV pump, or we have a decision tree for such and such. Oh, this is something different we are doing right now. The pace of change as instructors is ridiculous, so then helping students to learn the functionality of the tools...and then how do you help them as something new comes on. “I think in general, the information and the technologies are constantly changing (P17).”

This challenge was also supported by another participant’s comments in regard to the difficulty of keeping up with technological advancements, and getting the time to become more familiar

with the tools. She highlighted, “Familiarity is a challenge. I only have so much time in the day. I can't keep up” (P26).

Participants reported that a lack of faculty development was another challenge to learning how to integrate digital/informatics tools. In particular, the types of supports available to them. P16 expressed her frustrations about learning how to use tools, such as the LMS. She pointed out that she did not receive the right support from the teaching and learning center, and that it seemed that the one-size-fits all learning session was not effective for her:

> “I did attend [faculty development] but the challenge for somebody like me, who is still a neophyte, is that it was done too quickly. I did not retain a lot even though I took note. What concerns me, as somebody who doesn't come to it naturally, is that the same educational principles we would use for any other field of learning endeavour don't seem to apply to computer technology (P16).

Some faculty found that learning sessions were not offered at a convenient time for them:

> The Teaching and Learning Centre put on these routine teaching sessions and training opportunities to work on [LMS]. They are very interesting, timely and relevant topics, but with everything that is going on I simply do not have the time to attend. It is not just making those opportunities available, but also making them available in a way that actually works for people (P19).

Technologies. Participants expressed technical difficulties in applying digital/informatics tools. Annoyances were related to interoperability, functionality, and cost. A participant noted that in the clinical environment students are exposed to many different information systems, and that this makes it challenging to teach students:

> There are apples and oranges with every health authority. They have different systems, making it a challenge around interoperability and using the same classification of things. How do you teach students in the real world, when we have this dog's breakfast out there? (P20).

Participants also noted that the digital/informatics tools that they relied upon to help support their teaching practice did not always work. For example, "technology doesn't always work. It cuts in and out. I couldn't get my Kahoot! up last week. It took 10 times to reboot the computers to actually get everything to load properly. I find that really frustrating" (P10). P3 reported "there are times when it doesn't work and I have to call the helpdesk number. It is inevitable that there will be a glitch somewhere, and the more people that use it, the more chance there is for glitches". Similarly, P4 stated "technology equipment breaks down. The Link breaks, or the wireless goes down. There are always going to be challenges with technology. Furthermore, P11 reported "there are always the technical glitches. Things don't work or the internet is too slow. You're trying to do a Kahoot! with 100 students and the bandwidth isn't sufficient, so it doesn't work in class."

When digital/informatics tools don't work, it creates stress for the participants and students. The following participant explained how it was stressful for her and her students during an online examination in a computer lab when technical difficulties ensued: "sometimes there are issues, the computers will automatically log out the students and they get super stressed, or suddenly your screen locks and you get disconnected, or your question isn't recorded" (P5).

Effects of Tech. The effect of tech was another sub-theme of the challenges faculty faced in integrating digital/informatics tools. The sub-theme examines participants' concerns of how digital/informatics tools influenced students' ability to develop relationships with others, perhaps

patients. Student's dependency on digital tools and concerns about how tools may negatively impact students' learning as well as student's privacy arose. In addition, some participants expressed concerns about not being able to view student's non-verbal behaviours, which will be further explored under the theme pandemic.

When I asked the participants about the challenges of using digital/informatics tools in the clinical environment, the following participants shared their concerns about technology interfering with the nurse-patient relationship:

> With technology, there are so many opportunities to get more data. Students are focused on collecting the data instead of dealing with the patients. I try hard to keep technology to a minimum in the clinical area for the students. My biggest concern with technology is that it takes away from true face-to-face communication with people. They don't know how to talk to each other (P10).

> It is a worry for me. I think sometimes it supersedes [technology] the nurse-patient relationship. I find students caught up in what is online, and they spend hours and hours researching their patient and I tell them to look at the patient that is sitting there. Speak to them. Talk to them. Assess them. You can look all this up later (P15).

Participants also spoke about the loss of interaction amongst students. For example, one participant spoke about her experience with students doing online collaborative work, and expressed her concerns about developing students' abilities to engage in discussions:

> It is very disruptive… I will have four students sitting in a row, each of them on a Google Doc typing, and nobody is talking. That's their groupwork… I actually see on the Google Doc everybody's typing. Then I tried to tell them, you actually need to talk to people.

> You learn to voice your ideas out loud, right or wrong. This is how new ideas are formulated. This is called discussion (P5).

In the lab, P8 shared her story about a simulation experience with students who were more focused on the computer monitors than on the patient. Consequently, she was re-evaluating how she was going to manage digital/informatics tools in the future, “I'm going to start shutting off the monitor because I was finding that the monitors were distracting students. They were looking for changes on the wall, as opposed to looking for changes in the patient”.

Another participant spoke about the importance that nursing faculty help students develop critical thinking, instead of relying on technology to help students make their own decisions. P10 described her concerns:

> The key difference between a nurse and anybody else not in a healthcare profession is their critical thinking. Their ability to take the information in front of them and then make some decisions. For example, if a patient collapses in the bathroom, you need to deal with what's in front of you. You can't run to your cell phone! You can’t run to the nurses’ desk and look it up. You need to stay with your patient and that's what I mean about the detriment of technology.

Some participants voiced that students just need to learn about “good old fashioned nursing care” and “striking a balance” between spending time getting to know the patients and using digital/informatic tools. For example, P10 firmly expressed:

> They need to get past the technology. Things don’t always turn out the way they should. They need to be able to adapt on the fly, and sometimes that's not technology. Sometimes that's just good old fashion human caring. It's great that they have all this technology, but

> it's not the end all and be all, and that's the piece that's really hard to teach to the young students.

Faculty members also raised concerns about the impact of technologies on students' learning and behaviours. For example, the following participant voiced her concerns that faculty members are not evaluating the impact that the tools are having on students' learning:

> There is always a risk of using technology because it is new versus it being used in a way that is conducive to learning. Being able to evaluate the technology. Most of what we teach is not evaluated rigorously. We're not doing a lot of measuring and understanding the impact it has on our students' learning and whether it's truly effective. That's a big question mark (P5).

Concerns from the participants existed with regards to the effects of technology on the ability of students to learn and retain information. A participant described how she prefers students to look up medication information in a book, as it forces them to read about it as opposed to getting the smartphone to do the work for the student.

> They can look it up in a book like everybody else. It's actually harder for them and they learn more in the long run when they have to do the work, as opposed to instant gratification. When they look it up in an actual medication book and figure out, it's a trade name with a generic name as opposed to just punching it into their iPhones and it pops up with all the information. Because they actually don't read it through, they're not building on their ability to retain the information (P10).

The same participant also expressed her concerns that students always have access to and are continuously being exposed to these tools in and out of the clinical environment, "people

seldom turn off their phones. When you're in the clinical area, you are on technology. Then when you're not in the clinical area, you are on your phone. I think that's unhealthy" (P10). While another was concerned about the risk of addiction to digital/informatics tools, "the risk of addiction and never turning it off, and how students moderate that information explosion" (P13). P1 described how she developed an assignment where students are encouraged to develop strategies to monitor and limit their use of their devices "I have them do a mini quality improvement assignment on themselves and their own tech use. We talk about what controls can you put on your phone to limit your ability to do certain things" (P1).

The same participant raised concerns related to security and student's data privacy when faculty members ask students to use their personal devices for classroom work, such as student's response systems, "privacy legislation, the Patriot Act…products hosted by a US company and on US soil can be a barrier. Our approach has been to fully disclose to our students that this is a US product. It's hosted on US soil" (P1). Interestingly, I interviewed P12 from the same undergraduate program a few months later. I reviewed her course syllabus, and there was a statement about students' data being stored on servers outside of Canada.

Faculty Attributes. This sub-theme explored faculty feelings about their ability to learn about digital/informatics tools. Faculty reported feelings of anxiety, fear, and of not feeling comfortable with digital/informatics tools.

During the interview, some participants reported that it was difficult to learn about digital/informatics tools. They explained, "I am willing to learn, I just find that it's not the strength in my brain" (P16), "I am just not natural for it. I don't have a mechanical mind. I don't have a computer mind, but I try… I can't use technology if I don't understand it" (P26), and P18

shared: “I feel that it's not intuitive, but I know it will benefit my students so that's why I am doing the modules.”

P7 explained how she feels anxious when she thinks about the future and technology, “it makes me a little anxious because I am not tech savvy. That's probably the way the future will be, and that we are moving towards that”. While, P13 shared her feeling of working with digital/informatics tools, “we are a little bit hesitant to use technology. We fear what we do not totally understand. We fear being looked at as a fool if in front of others, or of looking like we don't know anything”. Other faculty members reported not being comfortable with using technology. When asked about the use of current and innovative technology for nursing, one participant responded,

> I would just rather write on a piece of paper with a pen. I bring pens and flipchart paper [in the classroom]. It is pretty low tech. I don't know whether that is my comfort. I am a paper person. I cannot read online because I like to make notes in the margins. I highlight textbooks. It is probably part of my beingness (P18).

In summary, participants perceived several challenges to integrating digital/informatics tools. These challenges included: the clinical environment, a steep learning curve, technologies, the effects of tech, and faculty attributes. The next theme that arose from participants’ interview transcripts was developing students’ nursing informatics competencies.

Theme: Developing Student’s Nursing Informatics Competencies

The second part of the interview focused on how participants perceived that they were helping students to develop their nursing informatics competencies. The participants and I reviewed the CASN NI Entry-to-Practice competencies, and then I asked them how digital/informatics tools contributed to the integration of NI competencies in the nursing

curriculum. Upon examination of the data, three sub-themes emerged: preparing for practice, not doing enough, and strategies.

Preparing for Practice. Participants perceived digital/informatics tools as essential to preparing students for practice, even perhaps an expectation, to be able to work in an evolving technological healthcare environment. In general, participants perceived these tools as necessary, integral, and foundational to the integration of NI competencies in nursing education.

> I think it's required. It's essential… They will not develop information technology expertise if they don't work with it [digital/informatics tools]. It's foundational to the ability to learn how to use those technologies…. If they don't, they won't be able to access practice guidelines. They won't know how to access the library. (P3).

Participants also perceived the use of these tools to be important to nursing, "I think it is key [to use digital/informatics tools]. It is important for better patient outcomes, improved nursing education, and for nursing practice in general" (P22).

The following participants described the importance of students being exposed to these tools during their education, to ensure that they will more likely embrace the technological changes once they enter the clinical environment. P19 voiced, "I think it's important, especially with what is happening in the healthcare contexts. We are using technology every day. New things are being introduced in the healthcare system and we need to familiarize our students with them". Similarly, P11 expressed,

> it's essential, with the advent of different technologies that we see emerging. We can't stop the progress and the evolution of technologies, so the more prepared nurses are to be adaptive and receptive to new technologies, the better they're going to perform in the workforce, as well as leaders and educators.

The following participants spoke to the importance of developing students' abilities to use these tools to access evidence-based information and to communicate effectively, as well as of teaching them how to gather patient data and make sense of it. For example, P12 explained,

> students need to learn how to access the information and how they can communicate with each other appropriately. They need to learn how to gather data from their patients and what to do with that data once they get it.

Along the same thought, P3 expressed, "they have been accessing the library through their computers. It's all about using databases to access articles as a part of their nursing practice, and to support their learning". In addition, teaching students how to use digital/informatics tools to access information is thought to lead to better patient outcomes. An example of this was when one participant stated, "I think it should relate. We certainly teach our students evidence-based practice, and it all comes from information that has led us to change how we deliver care…[and] results in better patient outcomes" (P8). Finally, an important part of developing students NI competencies is for students to get hand-on experiences in using digital/informatics tools. One participant underscored this point by indicating, "when you are trying to teach informatics, it's hands-on. You have to learn how to use technology" (P20).

Not Doing a Good Job: In this sub-theme, participants described that although they believed it was important to integrate digital/informatics tools into their teaching, some felt that they were not preparing the students well enough for the technologically-orientated healthcare environment. P13 expressed, "it is absolutely necessary…we are not doing as good a job in integrating…in Canada, we have competency and components of it [nursing informatics]. I think we are all struggling a little bit with how we are integrating it". P5 promptly shared:

> I think it is a part of life now! Electronic health records and decision-making tools are going to be a big part of the future…it doesn't matter whether I think they're useful or not. This is the future! It needs to be integrated into our teaching and learning, into our student competencies… I don't think we've been doing a good job.

P11, meanwhile, reported that nursing education is not being responsive enough to the technological changes in the clinical environment:

> As long as our nursing education system is able to keep up with the industry, we're going to be in a good place. I think at the moment, we lag behind the industry for using technology. We run the risk of graduating nurses who are not prepared to work in a contemporary healthcare setting.

Finally, a participant expressed, apprehensively, that she was not sure how to integrate NI into her teaching practice but perceived that it was important, "I think we need to teach them, but I don't think I am really clear on all of it and how to teach" (P18).

Strategies Used. While reviewing the specific NI indicators within the CASN Entry-to-Practice NI competencies, I asked the participants to describe the strategies they used to support students' development of these competencies through the use of digital/informatics tools. The following sub-themes arose from the data, and include: working with digital tools, digging a little deeper and weeding through it, allies, and creating awareness.

***Working with Digital Tools*.** This sub-theme informs on how participants encouraged students to work with digital tools to help develop their NI competencies in the classroom, lab and clinical practice. Participants used a variety of digital tools (Appendix L) to assist students in developing certain aspects of nursing informatics competencies, such as computer literacy. For example, some students used computer applications, such as PowerPoint presentation, for

classroom assignments, accessed online learning management systems or developed questions using online games such as Kahoot! and polling platforms related to class content. Specifically, P5 described how she works with her students on how to use PowerPoint effectively for a classroom presentation:

> I asked them to give a PowerPoint presentation. The first thing I do is a 10-minute lecture with resources on how to use the PowerPoint, what is a good PowerPoint, what do we use PowerPoint for and what are the downfalls of PowerPoint, versus just saying… present with PowerPoint.

Another participant reported how her students were provided with a self-directed learning activity, and were then guided by faculty through a digital clinical experience (digital simulation) where they were able to practice documenting and accessing electronic health records. This experience provided students with an opportunity to work with digital tools that simulate the clinical environment prior to entering it:

> I think again it's a combination of giving the students the basic background information, and the opportunity to practice. Again, that's something they can do on their own virtually, if you have the right tools. Some of the commercial packages can be helpful. We use one in our program to practice documentation and use of electronic health records. It is not the same as what is used in our Health Authority, but it gives them an opportunity to practice documenting and accessing data and thus develop their informatics competencies (P20).

Similarly, other participants implemented learning activities that encouraged students to apply what they learned in the classroom and their computer literacy skills through various social platforms. Through these platforms, students can learn how to facilitate communication by

engaging and sharing information with others, and how social platforms could be useful for nursing practice. For example, students developed their own Podcast, webpage, Facebook page and even an online game. A participant articulated how her students worked with digital tools to develop a Facebook page about Florence Nightingale, who is considered a pioneer of nursing informatics, as she gathered data and analyzed information to improve patient outcomes. P17 stated, “we did do an activity one time in one of my classes where students had to create a full Facebook page for Florence Nightingale”. In one of my memos, I wondered if the participant was aware that Florence Nightingale was viewed as the pioneer of NI.

Participants also encouraged their students to explore innovative ways to deliver care to patients while working with digital tools. P15 shared her enthusiasm of how students utilized their computer literacy skills to develop an online game for pediatric patients, educating them about the physiological and psychological aspects of having an ostomy:

> I think it helps them master the content, but also helps them develop their competency by using online games. I had one of the most beautiful projects [enthusiastic; as noted in interview transcripts]. They developed an ostomy land for young adolescent patients with ostomies, a whole gaming world based around signs and symptoms and the stigma of having Crohn's disease with an ostomy. It was just phenomenal [enthusiastic; as noted in interview transcripts] …These boys who normally wouldn't have an interest in ostomies and the psychological care for a teenager had to think about all this. It took hours to develop a game. It was a kind of osmosis, how they learn the content in a fun way because they really want to use this technology.

P11 discussed the importance of teaching students how to work with digital tools to gather data. Based on past experiences, the participant could readily share with the students how

working with data and digital tools could potentially change nursing practice and enhance patient care:

> Because of my previous experiences in working with CIHI [Canadian Institute for Health Information], InterRAI, MDS [minimum data set] data, I tend to draw on those quality improvement datasets in my teaching. I will use them as examples of how nurses might use data to make changes to program planning or strategic work. Also, I will give examples of how technology has changed over the years. For example, when we moved to electronic health records and had some challenges with physician and staff engagement. Having had those experiences enhanced my ability to teach about these things. Because I am involved with the current roll out of the [electronic] health records, I am able to draw on concrete examples from my own experiences to point out similarities and differences between approaches to using health informatics in different circumstances.

Working with digital tools also helped students develop in other aspects, such as professionalism, knowledge of legal requirements, and professional judgment. A participant encouraged students to use an online networking platform for professionals by guiding them to create an electronic portfolio, "I get them to sign up a portfolio [online networking platform] to help them learn how to best present themselves professionally. I think as faculty we have a responsibility to help them create electronic portfolios" (P13).

In some settings, students also developed their NI competencies by the fact that they had to complete the Health Authorities' online learning modules about patient confidentiality, privacy and protection of health information. Completing these modules was a legal requirement

to enter the clinical settings as a learner. The words of the following participant describe how what students learned in the class was reinforced by the modules offered by the health sector:

> There is a confidential agreement as part of the practice course that they [students] have to read and sign, stating that they are not going to take pictures of the hospital ground at all. They are not allowed to have any identifying data in their patient's chart research, nor any names if they are going to give it to their teacher. They are only to access the chart of the patient that they are caring for. We also have a confidentiality module that everybody has to do for the hospital that states, again, that you can only access the chart for a legitimate reason to provide nursing care and that there is no photocopying [patients charts]. We make that very clear for students, because students get overwhelmed about doing the patient's chart research that some of them will photocopy labs and that's a 'no' (P17).

Some participants commented on the importance of showing students how to report errors, adverse events, or hazards occurring in clinical practice by working with an online reporting system. One participant explained how she teaches students how reporting through a patient safety system improves the patient safety processes and systems:

> We talk about the provincial risk management system, learning about how to use it effectively, and the non-punitive approach to errors. It's not an incident report, it's a safety learning opportunity, where at any time it [a safety concern] arises in practice, if we see something or an error occurred. The students have the opportunity to complete a [report in the patient safety and learning systems]. It's a really good learning (P1).

Also, in clinical practice, students work with a variety of digital tools (Appendix L) to deliver care to their patients, such as electronic vital sign machines, electronic pulse oximeters,

glucometers, IV pumps, etc. While working with these digital tools, students must learn not only how to effectively use them in the context of patient care, but also learn how to use their professional judgment. For example, P12 shares:

> Technologies such as vital signs machines or blood glucose meters, whatever that happens to be. We always do talk about making sure that you are confident that you are getting a reliable result. For example, with the Vital Signs machines, when you get an elevated blood pressure, we talk about what you should do. Should you check it on the other arm or maybe get a different machine. Students have to learn to understand the context of what they are seeing with the patient.

Another example from clinical practice was provided by P15 when asked about developing student's professional judgment when working with digital tools in clinical practice. The participant described that students learn to use the digital tools in the context of patient care, and further added:

> I think that's really important [placing emphasis; as noted in the interview transcript]. We keep saying to them that if the technology is telling you one thing but your common sense is telling you something else, then you need to ask someone. You just don't follow a guideline, because someone may have written it incorrectly. You always have to use your critical judgment and thinking, even though you have really good technology, because half the time you know the blood pressure might not be accurate or the temperature on a baby is really low but the baby is pink and warm and looks great. Well, check the thermometer!

Also, in clinical practice, many participants articulated the importance of role-modeling their use of digital/informatics tools to support student's development of their NI competencies. The

example provided below demonstrates how a participant role-modeled working with digital tools by accessing electronic health records and electronic medications records, as well as by using a smartphone to provide safe patient care:

> Whether it is looking up their allergies on EHR [electronic health record] or EMR [electronic medication record]. I will look up something on my phone, such as typical side effects [of a medication]. I am modeling [the use of] technology when I am teaching in clinical (P24).

Another participant further described the importance of role-modeling while working with digital tools for the purpose of teaching. The participant articulated how he used a social media platform and gaming to engage his students. By doing this, the participant modeled how to use these platforms in a professional way:

> In every class that I teach, this is just one example, but I have a [professional] Twitter account that I share with all my students. I hashtag relevant tweets that I think are useful to the class. I encourage them to sign up to Twitter and to search or hashtag for our class, so that they can find interesting related social media articles that relate to the class. I do e-polls using Kahoot! and those types of things to model the integration of technology into teaching and learning (P11).

P12 described how students discovered the benefits of and challenges to working with digital tools in the clinical environment in the context of patient care,

> By using them [digital tools], it provides opportunities for students to see both the positives and the negatives. They can actually critique which tools would be useful when they are in the clinical setting, supporting their clinical decision-making and seeing how they can contribute to patient care. Also, recognizing when there are problems and being

> able to work through those problems and errors. This builds their confidence in their own abilities to troubleshoot…By seeing different tools and websites, they learn about all of the different resources that are out there, how to find them, and how to use them. You can learn about it theoretically and what is out there, but unless you actually use the tools, see how they actually work and gain some experience, that's where they really gain an appreciation and understanding of informatics.

Finally, a further benefit to working with digital/informatics is that students gain a familiarity with the tools. A participant remarked that by working with digital tools in the clinical environment, students become less resistant to adapting new digital tools in their future nursing practice.

> It's just getting used to trying out different things, being more computer literate, information and electronically-literate ... right, like we talk about these electronic health records…I just think being more comfortable with technology makes you more …it is not such a big deal when somebody changes something and now everything is electronic. I think the more we introduce technology and stuff to them, and then when they go into practice as nurses, then oh it's just more technology. Like, what is the big deal? (P24)

Digging Deeper and Weeding Through it. The second sub-theme, "digging deeper and weeding through it," is related to helping students develop NI competencies by performing searches and critically appraising the literature. The following quotes from participants demonstrated how faculty encouraged students to access and search databases for literature, "dig deep" into the literature, then critically appraise it by "weeding through it," and then identifying which sources support evidence-based nursing care. For example, in the classroom, a participant

commented on how she used an online gaming resource to encourage students to learn how to access credible websites and where to find specific information for nursing practice:

> I used one [digital tools] a couple of times, it is called Goosechase [online gaming resource]. It's a scavenger hunt to teach [students] about professional organizations. They [students] have to go take a screenshot of the professional website and show where they have found the information. Instead of just saying how many nursing specialties are with the CNA, or who offers information about legal responsibilities, they have to physically go and find that information (P1).

This participant was my first interviewee. I reviewed my reflective notes and my journal that I wrote after the interview, and noted that I was captured by the practicality of how she used the tools. I reminded myself that I need to remain open and to focus on the interview questions guiding my research.

At the beginning of each clinical rotation, participants alluded to assisting students in developing their NI competencies by teaching them how to access digital tools used by nurses. Students were prompted to look for information on procedures from the hospital intranet site, and patient information in a patient electronic health record. For example, P8 encouraged her students to work with their digital tools to access information from smartphone applications, such as drug guides, lab values and health assessment tools, before students were able to administer a medication or complete a procedure on a patient:

> [I have a] learning activity, where students have to get into the hospital intranet and find different places where they might have a resource that will benefit them. For example, they have to find a policy about how to put in a nasogastric tube. They have to get into the patient's electronic chart to look at blood work, recent blood work, using digital tools.

> A lot of students have their drug guides on their phones and they need to look up information before they can deliver medications safely.

Again, in clinical practice, another participant talked about how students access online resources for researching medications, best practice guidelines, and decision support tools for patient care:

> I think the most common reason [for accessing digital tools] is for research, looking up medications or diagnoses, and accessing what is best practice. Last week in practice, I had students access a bilirubin tool that charts the bilirubin for babies, and an online [metric tool] converting a baby's weight from grams to lbs, as the parents wanted to know [baby's weight] in lbs (P1).

Another faculty member discussed the importance of students becoming more familiar with how to access resources for patients that are available in the clinical environment:

> I think getting the students familiar with the resources that are typically available to nurses. If students go to work for the [Provincial Health Authority], they are already going to be familiar with some of the resources that they will use as a registered nurse to support clinical decision making (P12).

P8 articulated the importance of developing skills to access and retrieve evidence-based practice information, stating:

> I have a learning activity where they have to learn about autonomous scopes of practice, medications, and particular drug schedules that they might give within their autonomous scope if they meet the competencies. It's just a way to get more familiar with [provincial nursing regulatory body] and what our regulators say about different things. I don't expect them to have it all memorized, but my hope is that when they graduate, they might be able to say to themselves in certain situations, 'oh, I bet you there's something

> [provincial regulatory body] has to say about this. I'll go find it rather than just rely on your buddy and say hey are we allowed to do such and such (P8).

P1 described that she encouraged students to dig deeper and weed through the literature. She also role-modeled how to access electronic databases. Furthermore, she remarked that it is essential to continue to reinforce the importance of locating evidence-based information to support their practice, and not just Googling information:

> We try to support them [students] through the whole program. With one group of 4th years, I asked them how they were finding sources for their final paper. Several said that "we learn something about the databases in 1st year but really we just Google it". So, I have actually embedded some pieces in my assignment, where I don't just say show me the articles you found in your references, but also, 'I want you to describe your literature search process and tell me which databases, terms and keywords you used' to try to refresh and remind them. It's the practice that teachers are showing students, and demonstrating those tools (P1).

Another participant further exemplified how she helped students access other databases and develop their ability to search for information that may be more complex or more obscure.

> I will say in my first class, "you know, tell me how comfortable you are with the databases and accessing literature" Oh… of course, everybody is fine. "Can I show you a couple of things"? I start to go in and show them a little bit outside of the regular sort of CINAHL and access some of the other databases, because sometimes in mental health you will come up against the wall in CINAHL. Then you need to go to the other databases. I am very happy, excited even, to sit with them and help them do their research

> and help them understand how to navigate the database systems to make it work for them (P21).

Nurses have a primary role in patient education. When I asked participants how students assist patients and families access information, a participant described a learning activity in which students evaluated the quality of information patients were retrieving online, and then the students helped their patients access more credible online information for their health:

> We actually have an assignment where we do patient teaching with the patient. We assess their health literacy, where they are getting their information from, and then depending on where they are getting their information from, we might direct them towards more credible websites (P24).

P15 further described how she role-models student's ability to access information, gather the data, and weed through the information. She demonstrated how to use this information to educate families:

> Students come to me with different issues, such as informed consent procedures, where a patient might be nervous to accept vitamin K for their child. The student will look up a document pertaining to the risk factors around vitamin K, and together we will go back to the patient, explain the risk factors, and let the patient have some time to make an informed choice as to whether or not they're going to accept the vitamin K for their baby.

Once students access information from multiple digital sources, students must learn to develop skills to search evidence-based resources and to evaluate the information. Consequently, they are developing student's information literacy competency. For example, a participant described this process:

> They decided on a nursing focused topic and wrote a research question, a PICO question, that would enable them to search the literature. They were then expected to go into CINAHL and Medline databases, find nursing articles, or an article related to their topic that helped them to answer the question. Then they were expected to critique and synthesize the information from those articles in a report (P3).

P8 described the process of locating and retrieving the information and then critically appraising the literature by digging deeper into the sources:

> In my experience, I'll ask a question and I'll get three different answers. Then, we'll dig a little deeper and start to look at the websites for quality information as opposed to popular websites that may be opinion as opposed to fact. I think that piece is really important.

Another participant described the process of weeding through the literature during her research class and how it could impact patient care:

> You cannot just pick anything if you are going to rely on it at the bedside. It has to be worth relying on. I often do that at the bedside … if I am laying there you better have good research to inform your practice (P21).

In this last example of digging deeper and weeding through it, P26 explained how she helps students make connections between information from literature and professional practice.

In one assignment, they [students] critically appraised online resources then they have answered this question "would it be something you would use in your practice, and why or why not?" The other thing we do in that course is that we connect the responsibility of the Registered Nurse to be research literate and information literate as part of their professional responsibility.

An outlier was noted when reviewing participants' transcripts in regards to information literacy. When I asked a participant about developing students' abilities to critically appraise online literature, P19 responded with the following comment:

> For the undergraduate students not really, I mean, our nursing students do not really do any literature searches as far as I know. They do critical appraisal of scholarly research at the graduates' level program… although now that you raise that, there is that aspect of the informatics modules. It briefly covers that when you go to this website, trustworthy website, you would have these characteristics…They get a little bit of that but in terms of evaluating research articles, they do not do that.

It is interesting to note that she perceived that students were not developing their information literacy skills in the undergraduate program. This was reflected in my research journal.

Allies. The third sub-theme relates to allyships. Allies refer to colleagues who have assisted in the development of students' informatics competencies. Participants built key relationships with others to help support student's development of NI competencies. These allies, such as librarians and nurses, played an important role in assisting students to work with digital/informatics tools, getting them to dig deeper and weed through the information, and to provide safe, high quality patient care. It seemed that all participants had access to library resources based on the information provided on the research sites' websites.

The following participant described how a Health Science librarian met with students and assisted them to access databases, then helped them to locate and retrieve literature.

> All of our student undergrad and grad first classes of any term in the program, meets with a specified librarian for Health Science. She walks them through [databases], they sit at the computers and they are physically learning how to do it (P13).

Additionally, one participant booked an orientation session with the librarian from the clinical environment. The librarian orientated students to their resources, and reviewed what type of data or information students are allowed or not to access:

> We make sure that all the year 2 students get an orientation from the librarians at their hospital. The librarians also talk about security with the systems to make sure that the students follow the health authority guidelines for that (P12).

As for the role of nurses in being in ally, nurses in the clinical environment are often well-informed about the current digital tools, and have more access to patients' charts than students or instructors. For example, P1 verbalized how difficult it is to keep abreast with the current technologies used in clinical practice, and that faculty have consequently become reliant on nurses to support students:

> As an instructor, I try to keep current with some of those new things [digital/informatics tools] that I have not had the opportunity to be trained on myself, so I am often reliant on the nurses on the floor who have had that education and training to support the students.

The same participant relied on another nurse for electronic documentation of patient care, as the students did not have access to the patients' chart. She explains how students would sit alongside the nurse to document care. Although the students did not directly access some parts of the chart, they did get some exposure:

> They [students] are blocked from that part of the chart in the system, in the Meditech system. They will often sit down with the primary nurse and work on it together. They're not doing it alone or independently because of the access limitations that have been set, but they are definitely engaging in it (P1).

Creating Awareness. The fourth sub-theme, creating awareness, relates to faculty creating an opportunity for students to gain an understanding of NI through presentations and discussions. Although students are not using digital tools while discussing NI, faculty talked about NI as a theory component in the classroom and then facilitated discussions about specific topics relating to NI. For example, P11 answers the questions "could you tell me a little bit more about how you integrate this document [CASN NI Entry-to-Practice competencies for Registered Nurses] into your class?"

> I do one lecture on health informatics, which is really just introducing the idea. I brush on competencies in about three slides, and then we get the students to look at different types of nursing informatics and how they would be applied to their practices as an entry-to practice nurses. There's a bit of discussion about that… I ask them "what do you see in nursing informatics?" We try to build on the idea of how information and technology influence and can be applied in the nursing setting.

Additionally, another participant created awareness of one of the CASN indicator 'advocate for current and innovative information and communication technologies' by applying a change theory and using a case study:

> that one is challenging [talking about the above indicator]; we talk about how slow health records implementation has been. In my 4th year class, we do some learning about change theory and responses to change. For example, EMR [electronic medication record] implementation and staff nurses' responses to it. I think there is an opportunity, maybe not advocate, but for students to be aware of the changes that are coming. I always tell them to go and be a superuser, and how they can respond and facilitate some of that if that makes sense (P1).

Finally, P24 described how they have integrated NI into their nursing undergraduate curriculum:

> I designed two classes on informatics using the CASN Competencies and their modules. I think it is something that students just need to learn. We use a concept-based approach, and nursing informatics is one of the concepts. We leveled nursing informatics, to a certain degree, depending on the context of where the students are practicing, whether it is in long term care, hospital, or the community. I also think just getting students used to using technology in nursing and why. It is such a gigantic term.

In the following quote, the participant explained that students learn about informatics from an interprofessional module which nursing students complete with students from other healthcare disciplines, such as medicine and pharmacy. The module was developed by a faculty member with expertise in NI. This was confirmed by reviewing an artifact from the participant, a course outline describing the learning activities for the interprofessional informatics module (Appendix I).

> We have an informatics module in our undergraduate program. We are also trying to do an interprofessional educational module on informatics that focuses on the use of electronic health records and medication reconciliation… A faculty member created a game where students look for information, kind of a fact finding. When you teach informatics, it is hands-on. You have to learn how to use technology. The more we play games, the hands-on learning opportunities, I think the better it is for students (P20).

Another outlier was noted during the interview. A participant shared that nursing students seemed to be intimidated by the concept of NI, when I asked how NI is related to nursing education:

> A contributing factor to students' intimidation of informatics is probably around all the acronyms frequently being used in nursing informatics, which I purposefully try to avoid in my teaching. The other thing is, I think overall, students including myself are a bit intimidated by technology. I mean everything is changing related to technology. It is so fast paced. I mean even my iPhone is changing (P19).

Finally, once we reviewed the CASN NI Entry-to-Practice competencies, participants reflected that they were developing students' NI competencies. P15 shared her thoughts,

> I honestly think we use it in every capacity. I did not know about it, but then it made a lot of sense. When I read through the competencies and the specific indicators, I thought, that's great. We use this in a lot of different ways.

In summary, the theme, developing students' NI competencies included three sub-themes: preparing for practice, not doing a good job, and strategies used. The next theme, building connections will be reviewed.

Theme: Building Connections

This theme relates to participants helping students build connections between the use of educational digital tools for teaching and learning, and developing their informatics competencies. Examples of tools used by participants in their teaching practice included: learning management systems, student response systems, accessing research databases through online library resources, and websites.

Participants were asked the following question during the interview "how do you perceive the use of technology for teaching and learning purposes can help enhance students' informatics competencies?" Some participants were challenged in answering this question, as noted from the interview transcript. For example, a participant stated,

> Um [pause] no [pause] maybe [pause] no [pause] yeah [pause] I'm not sure [pause] depends which competencies you are looking at. If are you teaching critical thinking [pause] accessing, evaluating information, then yes, I think we're doing that in class [pause] I don't know [pause] that's a hard question [pause] you got me [pause] it's a hard question [pause] I don't know (P5).

I pondered as to why the participant had difficulty answering this question, which I reflected on in my research journal. Was it because they themselves did not think that using digital tools could help develop student's informatics competencies?

Participants helped to build connections by encouraging students to access information in class, and then applying the information in patient care contexts. As one participant indicated, "I think just getting them to go online and looking things up is the best part of their class. Learning and then applying it to their clinical area so they can see the connections" (P10). Other participants voiced that they helped build connections through role modeling. Demonstrating to students how to access information through databases and websites was one way they perceived that they were developing students' NI competencies. For example, P13 voiced, "in the classroom, I role-model. I walk them through how to access databases". In addition, participants perceived that hands-on experience in working with the digital/informatics tools also helped students build connections between what is learned in the classroom and applying the knowledge in the clinical environment. It also enabled them to troubleshoot and help build their self-confidence in the use of digital/informatics tools:

> They learn a variety of different resources in clinical practice, such as showing students how to use UptoDate [subscribed website providing current evidence-based medical information for healthcare professionals]. They began to get a sense of what kind of

> resources are available, where they might be able to find and then how to use them. Using those various tools provides them with the opportunities to see the pros and the cons. They can critique which tools would be useful in the clinical setting to support their decision-making. Also, recognizing when there are problems and being able to work through those problems builds confidence in their own ability to troubleshoot ... It's kind of like nursing practice. You learn about the theory in the classroom, then in practice that's where you learn how to do patient care. I think it's the same for informatics and technology. You learn about it theoretically, but unless you actually use the tools and see how they actually work and gain some experience, that's where they really gain an appreciation and understanding of informatics (P12).

Other responses from participants focused on the use of education technologies to build students' computer competency by creating their own online quizzes, indicating "we get students to develop their own Kahoot! games. They write their own questions. I think it helps them master the content and develop their competencies by using some of these online games" (P15). Also, a participant perceived that building students' practical knowledge by using different types of tools was important to develop their competencies as well as of making the connections to practice. P24 voiced:

> Being more computer, information and electronic literate, getting them to try different things, and being more comfortable with technology. Then it is not a big deal when technology changes. I think the more we introduce technology to them, then when they are practicing as nurses, technology won't be a big deal.

Other participants believed educational technologies do not help develop students' NI competencies. For example:

> They can use a computer, navigate through a learning management system and figure out what they need to learn and do. To me that is very different from recognizing that the electronic health records is a source of data about your patient. There is a certain level of technological savviness to working on a learning management system, but that is less than understanding the usefulness of informatics in your workplace (P17).

I probed one participant and asked if accessing databases could help students develop their NI competencies. She hoped they would in their future practice but stated it was unlikely:

> My hope is that they can actually go onto Provincial Health Services websites to access databases. Except, I have not met any nurses that have the time, interest, or energy to do so. Nurses sometimes talk about not having done that since they were students. The regulator makes it clear to us that we need to keep ourselves up-to-date, but I do not know if nurses do that on their days off because nurses are usually very busy. I don't know (P21).

Finally, when participants were asked to describe how they used educational technologies, participants recognised that they do not notice that they are working with digital/informatics tools, as they have become integrated into their daily life. For example, P8 stated, “You use technology without realizing. It’s just a part of every day”. While P10 stated, “I think I do use a lot of technology actually. I don't think about it, you use so many things every day that you don't even think about it anymore”. Lastly, P1 expressed, “It depends on what you mean as technology. IV pumps and glucometers are technologies. There are some skills that go along with using all of those that we are facilitating their use all the time without really consciously thinking.”

In summary, this theme, building connections, characterized how faculty have utilized digital/informatics tools for teaching, learning, and developing student's informatics competencies. The next theme that arose from data analysis was teaching approaches.

Theme: Teaching Approaches

The last research question addressed participants' theoretical perspectives about teaching and learning, and how their perspectives supported their decision to integrate digital/informatics tools in their teaching practice. The findings that follow were grouped into two sub-themes: engaging the learner, and a critical perspective.

When I asked participants if they thought their teaching perspective influenced how they used digital/informatics tools, most participants paused and reflected on this question. Most participants believed their views of teaching and learning did influence why they used digital/informatics tools, and were able to provide examples. One participant could not make the direct link, stating "I can't say that I have made a direct link between my teaching philosophy and how I use technology" (P17).

Engaging the Learner. It seemed from the participants' responses regarding their teaching perspectives that they drew upon multiple perspectives to support their teaching and learning practice. Most of the participants perspectives seemed to be congruent with the constructivist approach, which includes elements of experiential and adult learning. Participants emphasized active inquiry, self-directed, and student-centered learning. For example, P3 explained her role as facilitating, supporting and engaging students in their learning. She viewed the role of the learner as an independent active member and a team collaborator:

> My approach to teaching relates to engaging the student, facilitating and helping them achieve the learning goals they have set for themselves. I see myself as an educator, and

> as a facilitator of their learning. They are the active learners. I am the person who is beside them asking questions. I'm guiding them in their learning. It is up to them to seek out the answers. They are self directed learners and work collaboratively in groups, giving the students ownership over their learning.

She further shared her experiences about teaching with digital/informatics tools, quoting "the medium is the message", which was the title of the first chapter of the seminal book *Understanding the Media the Extensions of Man,* that was published by Marshal McLuhan in 1964. She explained that we need to consider the purpose of using technology, and match the technology to what the students are learning:

> To quote Marshall McLuhan, a philosopher, who proposed that the medium is the message. They students] are using the medium. They are using the various technologies, and in so doing, the message is clear to them that it is essential for nursing practice to be competent in using these technologies. Therefore, when we are working with students, we're expecting them to complete their assignments by using technology. The fact that they are using technology to complete their assignments means that the message itself is that the technology is key for nursing practice (P3).

P1 shared similar views of teaching and learning. She described how, from the constructivist perspectives, she guided her teaching and how she purposefully integrated digital/informatics tools:

> My classroom is an active learning environment and I as a faculty have a constructivist perspective on teaching and learning. I think about the learner building their own knowledge based on previous experiences. When I am looking at using tech, I am thinking about how the students are using it to engage in their thinking and learning, as

> well as to construct their knowledge. I will help them make those larger connections, such as to the course learning objectives or the day-by-day learning objective.

P26 taught from a variety of lenses, including the constructivist view, experiential learning and relational practices. She also spoke about the importance of role modeling:

> My teaching philosophy is that of experiential learning theory, constructivists learning theory, and based on the understanding of the world around us. Students come to a learning experience with different knowledge, experiences and values. My job as a teacher is to facilitate and guide that learning, intentionally, and to provide them with feedback. I also believe that they learn more from who we are and how we are as teachers.

When asked if her teaching philosophy influenced the way she integrated digital/informatics tools for teaching and learning, the same participant responded with the following: "I press myself to use technology and role model good use of technology. It motivates me to try and use new technology" (P26). Participants also shared that students are responsible for their learning, moving ownership of the learning process to the students:

> we talk learner-centred education and constructivist stance where you are sharing the learning… I also like transformative learning, because it makes students think about it and not memorize the content. They think about why and how this new idea might change how they think about themselves. This idea of heightened responsibility for learning. For example, how can we set up the Learning Management System for students to find their way themselves. Also, the idea of not always being the authority in the classroom, or the "Lecture Queen," who is the "Sage on the Stage". I think if you really want to increase students' taking responsibility for their learning, you have to back off a

> little bit and be a guide, asking critical questions and getting students to work through (P17).

When P13 shared her perspectives, she explained how Bandura's social learning theory, in particular, influenced her modeling of teaching practice. For example:

> I mentioned the Montessori, the non-competitive component, definitely student-centred learning, relational practice and experiential learning. Adult learning rather than pedagogy components. One other piece that has shaped my teaching is Bandura. I am a social cognitive theorist at heart. …Simulation allows the opportunity to provide that feedback, using prompts as students are in the simulation. Then debrief where you can unpack... They still need the mentoring, the role modeling and the professional development with a human being or patient interaction. Simulation is a way that we can enhance their confidence and their self efficacy.

Interestingly [as noted in the interview transcript], the following participant explained her teaching and learning perspective to a "light bright analogy", with an emphasis on a student-centered approach. Her role as a teacher was to facilitate students' learning by helping them make connections:

> My light bright philosophy. We have all these colors of pegs. We have all these concepts. My job is to help students link those concepts. The pink pegs, the yellow pegs, the greens and the blues are all different concepts. We are going to connect all these pegs together and start to build this picture of a patient (P7).

With enthusiasm [as noted in the interview transcript], she shared how 'Kahoot!,' an online student's response system, helped her make those connections:

> I want to connect the dots. That's [playing Kahoot!] my opportunity to connect the dots and to really look. Let's say I have 14 students, 13 get it right and one doesn't. I say OK I can see why the students chose that answer, but they need to know there's another perspective. I say there's always different ways to think, there are different ways of doing things. I think that helps, there're many ways Kahoot! can help (P7).

Critical perspective.

In the second sub-theme, that of critical perspective, participants again drew from multiple perspectives but with a focus on critical theories. P5 explained:

> The post-colonial perspective informs my research and my teaching. In addition, certain aspects of the feminist perspective that directly relate to teaching are the idea of empowerment, relational practice, or relational teaching. The idea of equity and how to empower influences the relationship between the learner and the person facilitating learning. Those are the core perspectives that influence how I teach and thus when I integrate or utilize any sort of learning strategy that really is at the forefront.

When I explored further and asked if her view influenced her choice of technology to incorporate in her teaching practice, at first, she was unsure, but after some thought she expressed:

> it probably does without me consciously thinking about it that way. When I think of technology, there are a few things I always think about. What would be useful not just for this class, but for life? So, something like a web page, well that came from the idea maybe that would be a useful life skill to have. Some of the worries around technology do come from the equity lens. I see some of the strengths of technology but I also see a barrier. A good example would be my choice to not have a lot of PowerPoint slides, from their perspective, they are at a disadvantage if I do not use a Power Point (P5).

P11 had beliefs about teaching and learning that drew again from critical perspectives, specifically the critical feminist lens and critical pedagogy perspectives:

> I have a critical feminist approach to my teaching style. I encourage students to be active or engage in questioning the underlying premises of the knowledge that I am sharing, and also to question the overt and sometimes oppressive forces that influence their learning. It's always interesting when I am saying you know who is being excluded from this? Who benefits from you having this knowledge? What is the application in the broader social sense of these? My teaching philosophy has been heavily influenced by Paulo Freire and Kimberlé Crenshaw (P11).

He then elaborated on how his perspectives influenced how he uses digital/informatics tools. He explained:

> I mentioned the use of surveys and the Quizlets to engage students whose voices may not otherwise be heard. For example, by doing an anonymous poll, it gives the introverts in the classroom a voice. It levels the playing fields. If I'm asking their opinion on something, it gives them an opportunity to voice an opinion that might not be popular, that may undermine what has been said on the PowerPoint slide, or at least may challenge the dominant paradigm being presented. I find that can be really successful in sparking conversations that may not have occurred in that more traditional pedagogical sense (P11).

In summary, under the theme teaching approaches, participants viewed the teaching perspective as either engaging the learner, or as a critical perspective. The next theme discussed is the learner.

Theme: The Learner

Participants spoke about the diversity in the student population that is typical in nursing programs. Participants described the students as being either the tech savvy, or the not so tech savvy. P1 spoke to the differences in the students she noticed when students were using digital/informatics tools:

> Sometimes our mature students take a little bit more time using them, like me. It is not as intuitive, or they don't have as much experience with it. Our younger students are really comfortable and confident [with digital/informatics tools].

Participants described how some of their students are comfortable with digital/informatics tools. Faculty perceived students as being able to adapt to the changing tools, or up it quickly, having access to the tools, and being tech savvy. "They're so tech savvy" (P4); "They're pretty tech savvy" (P8). "They are very computer savvy. We require a laptop and a webcam for our program, and they do not struggle with it. You might have one or two students that struggle with it, but it is very rare" (P24). P11 noted students were also tech savvy in the clinical environment:

> I do a lot of work with students in the clinical setting, helping them get orientated to technology. What I'm finding is that most of our undergraduates are very tech savvy. They pick up the electronic health system pieces very quickly… they're not afraid of technology.

Other characteristics noted by the participants are that they are more aware of the consequences of posting information online, "I think students are actually more respectful as they progress in the program because they are exposed to social media. They are more cognizant of "oh I can't post a picture" (P4). Participants perceived them as more adaptable to using the tools:

> Students have used many different devices in their lives. They have a real adaptability to them... They spend so much time on computers and devices that they seem to navigate through it with younger, more flexible brains. I am relatively tech savvy in the work, but there is almost a learning curve, and for whatever reason the students seem to navigate that learning, especially the young students, so quickly (P1).

It also seemed that students were comfortable with online communication, but uncomfortable with face-to-face interactions as stated by P11:

> I definitely find, particularly in the students fresh out of high school, that they are more comfortable with electronic communication than the face-to-face. There's a lot of work that has to go into that direct social interaction piece.

Some participants expressed that students are tech-savvy or digital natives, while others are not.

> In our undergrad, a lot of students are mature students and they might be…not as tech savvy. "They might not necessarily be the young hip, technology generation, which would be your 18–19-year-olds; that's not everybody who enters into nursing… they also come with a different set of backgrounds and exposures to technology (P5).

Similarly, P13 voiced, "some of our students, many of them are digital immigrants. They were not forced to work with technology. She further explained what are the digital immigrant students and digital native students, and how they have impacted her teaching practice:

> Digital immigrants are my generation. I would say the 40 and above. Those who haven't grown up with a mouse in their hand and an iPhone in their hand, and had to adjust to using technology. I think students learn differently. They certainly learn differently than I did. I tend to write notes. They do not tend to do that. I will sit and do a three-hour

> lecture, and students will not take one note. Some may be on their computers, but I don't know if they are playing bridge or Facebooking. I am having to think much more creatively about that.

While other participants believed students understood the functionality of digital/informatics tools in their social environment, they believed that students were unaware of how to utilize them for learning or for nursing practice, "what I have noticed about students, they are digital natives if you are referring to their use of phones and their social media. They have not learned how to use a learning management system" (P17). Similarly, P13 expressed:

> We sometimes assume students come in with a large digital knowledge. They are savvy from a social perspective. As faculty, we have a responsibility to help them understand nursing informatics, eHealth, and how to best present themselves professionally.

P18 explained why she perceived students as not being digitally native,

> I have made a couple of comments [to students] "you know you guys are so technical!" and I had a student come up to me and said "every teacher says that but we are not, like I am not". They use their phones but they do not use all of the functions in the phone. They use Google, but they do not have the skills or the knowledge to assess the rigor or veracity of where they are getting that information. Many students barely know how to format a word document. They need a lot of guidance on formatting a paper… I think working from that premise [students are digital natives] is a big mistake, and it actually compromises the ability of the learner…our expectations are not in line with their ability and we set them up to fail.

Theme: The Pandemic

While I was conducting interviews in March 2020, the World Health Organization declare the COVID-19 outbreak a global pandemic. In response to the pandemic, in person classes were cancelled and faculty members transitioned to working and teaching remotely. As stated in Chapter Four, twelve participants were interviewed during this time, offering their insights into the unique opportunities and challenges in integrating digital/informatics tools into their teaching practice. Some interesting findings surfaced from these interviews, about faculty use of digital/informatics tools. These findings are categorized into three sub-themes: adaptability, seeing the benefits, and missing face- to-face interactions.

Adaptability

Within a short period of time, Friday to a Monday, faculty members were required to transition to an online environment. Consequently, they adapted their courses and teaching methods to be able to teach remotely. Participants spoke about rising to the challenge, taking opportunities to learn how to use digital/informatics tools in an online environment, trying out new tools, as well as being open, flexible and adaptable. For example, P24 voiced, "you just have to be flexible, adjust to what is happening in the world, and always try to do the best that you can so that students can learn. While others stated:

> When we went to online learning in March with the pandemic, we had to watch the person who teaches our students in the lab setting. They were trying new things, and had an open mind and willingness to engage. It was enabling, because then you go OK… I can maybe learn that tool (P26).

> We literally had to switch within 72 hours. It was a really steep learning curve and some of us really panicked, but I think that generally we've risen to the occasion. I've been forced into it. I don't think I would have been embracing it in this way (P15).

Participants were also keen on learning how to use digital/informatics tools and took advantage of learning opportunities to enable to integrate the tools into their teaching practice:

> We have to do some online teaching with the pandemic. I am going to learn about voice over PowerPoint, a video introduction where I can videotape myself, and it can be embedded into the learning management system. I think it's very helpful (P17).
>
> I am going to be taking an instructional design workshop offered through the University, now that we have the situation with the pandemic, because I want to take advantage of learning more about instructional technology for education (P20).

Seeing the Benefits

Some participants noted benefits while transitioning from face-to-face to remote teaching, using different pedagogical approaches. A participant explained that students were able to participate in a webinar, and ask questions to experts regarding current events related to healthcare.

> For my leadership class, I've assigned them to a website. They can access webinars where experts provide information on COVID. It's just better than any textbook, or even reading peer reviewed papers. They listened for 30 minutes, then the advantage of some of these webinars is that they also had a question-and-answer period (P20).

Students were able to access information remotely, “since we have gone remote, the library has moved a ton of those [resources] online” (P13). In addition, faculty members noted some benefits of working with LMS to post current information. For example, P4 was able to quickly

disseminate COVID-19 updates to the students, as information about the pandemic was changing day-to-day:

> You can do quick updates even in the environment we are in right now. For example, with COVID-19, I get up in the morning, look at it, and put out an update into our LMS that day, and the students can access it.

Participants also noted benefits to students. Students accessed courses remotely, therefore they did not need to travel, spend money on child care, or books. P15 elaborated, "students are not spending money on travelling nor on childcare, and the same cost on the environment you can do a lot of things from home". Similarly, "when you have virtual class, you are facilitating the time and space. Students do not have to travel" (P13).

Missing Face-to-Face Interactions

Missing face-to-face interaction centers on responses associated with how participants felt when connecting with students in an online environment. The COVID-19 pandemic prompted faculty members to abruptly adopt remote teaching, replacing the face-to-face interactions with students. Participants revealed how they missed the social interactions with students and the spontaneity of engaging in discussion:

> We all had to go online. The big limitation was that you do not have a community of students. You do not have the face-to-face time and the spontaneous questions. I think students miss out on the face-to-face time with the teacher and with each other (P17).

P23 reflected, "I love that chatting and supporting people. I really miss having the students telling me about what they observed in the clinical setting. I do find there is some of that learning that they are missing". I also reflected in my research journal why faculty missed the face-to-face interaction, could it be because of our nature as nurses? Participants described how it was

difficult to catch students' non-verbal cues. Authentic cues of feelings, concerns, questions and emotions remained hidden in the digital classroom. As well as getting a sense of the students' understanding, the content was difficult to recognize. For example, P20 voiced, "you can't always see people's nonverbal cues, as to whether they're getting it or not". Likewise, P13 spoke about her experience of teaching an online class:

> The challenge or barrier is you can't see your students. I am big on nonverbal interaction and reading people and getting that vibe…in the classroom we cannot keep check with 100 and plus faces but those who are comfortable, questions often will arise and an arm will shoot up or they will sink into their seat and you can pick up on that so that is a barrier [to technology].

Similarly, P15 commented that she could not get the sense of how students were feeling when discussing a sensitive topic that may have needed exploring:

> I think you can really kill the joy of learning and you can't get the pulse in the room. I was teaching about suicide risk assessment and dealing with patients with schizophrenia. It can be very triggering for people, and you can't really see them or how they are reacting to the content. When we talk about nursing in palliative care and death and dying, some of these principles are upsetting. I think it's really hard to deliver some of that content electronically.

I noted in the reflective notes written after the interview that I was surprised that digital tools could kill the joy of learning. I reflected and asked myself why I felt surprised by this participant's statement. Was it because I had the belief that digital could only benefit teaching?

Other concerns noted by participants were lack of privacy, and lack of access to digital/informatics tools during the COVID-19 pandemic. A participant was concerned about

sharing confidential information while video-conferencing as students may not have had a secure location. P22 explains, “they are at home, they have family members, such as mom, walk in. Or the dad walks in. I always say to them to wear ear pieces or headphones so nobody can hear what we are discussing”. One participant was also concerned about students’ lack of access to digital/informatics tools when students returned home:

> When they shut down with COVID, we discovered there were issues with some of our students who lived out of the city, or stayed with family in rural areas where they had limited internet access or had to share [the computer] with other family members (P23).

Relating to privacy, this was also commented by P15:

> There are some considerations around students not having access [online classes], or they just have access on a phone rather than on a laptop. Some of the technologies don't work as well for them, and then finding a quiet space can be tricky if you're talking about sensitive subject matter.

In summary, the theme pandemic included three sub-themes: adaptability, seeing the benefits and missing face-to-face interactions. ‘Adaptability’ captured how participants reacted to the transition of teaching online. ‘Seeing the benefits’ addressed the benefits of teaching with digital/informatics tools. The last sub-theme, ‘missing face-to-face interactions’, encompassed how faculty felt interacting with students in an online environment. Next, I turn my attention to the examination of related documents and artifacts.

Examination of Related Documents and Artifacts

As part of the data analysis process, I reviewed documents and artifacts to establish another level of verification of the themes identified throughout the data analysis process. These documents included course syllabi and outlines of learning activities (Appendix I). I visited the

universities and colleges' websites for things such as IT services or Teaching and Learning Centers (Appendix J). I also reviewed the nursing undergraduate programs' websites for the following information if available: mission and vision statement, strategic plan, course descriptions, faculty teaching and research biographies. All sites had online resources and workshops available to faculty from IT services, as well as Teaching and Learning Centers. It is important to note that I reviewed these websites prior to the COVID-19 pandemic, therefore more resources may have been available to participants afterwards. In regards to the nursing programs' strategic plans, only one site had their plan available on their website. Their plan included the integration of digital/informatics tools to support student learning. Two sites had a few faculty members whose area of research was NI or the use of digital/informatics tools to support nursing practice, or teaching and learning. Only one program had policies available on their websites, including policies on appropriate use of digital tools. As for the course outlines that were provided by the participants, it confirmed that students were required to use learning management systems to access course material. Students were able to communicate with participants through email. Furthermore, some course outlines made references to some components of NI.

Summary

In Chapter Four, participants' response to the research question, "What are the experiences of nursing faculty in integrating digital/informatics tools to support undergraduate students' learning and the development of informatics competencies?" revealed ten themes: meaning of the term nursing informatics, faculty perceived NI competence, perceived usefulness of digital informatics tools, facilitators, challenges, developing students NI competence, building connections, teaching approaches, the learner, and the pandemic. While challenges were evident,

participants described a variety of strategies being used to help develop students' NI competencies. Chapter Five provides a discussion of these themes, implications of the study findings, limitations, as well recommendations for future research.

Chapter 5: Discussion

Several national and international nursing organizations have and continue to call upon nursing faculty to facilitate students' informatics education for graduates to be adequately prepared to use digital/informatics tools once joining the healthcare environment (AACN, 2018; CNA, 2006; CNA & CNIA, 2017; ICN, 2015). A review of the literature revealed that researchers in several countries have identified concerns about nursing faculty engagement in preparing the next generation of nurses in informatics (Bove, 2020; Harerimana et al., 2020; Hunter et al., 2013; McNeil et al., 2006; Peltonen et al., 2019; Pobocik, 2015; Williamson, & Muckle, 2018). In Canada, although a few studies have examined informatics preparedness within schools of nursing (Kleib et al., 2013; Nagle & Clarke, 2004; Nagle, et al., 2014; Nagle et al., 2020a, b), there was limited research available regarding nursing faculty use of digital/informatics tools in Canadian undergraduate nursing programs. Hence the purpose of this focused ethnography study was to explore nursing faculty experiences in integrating digital/informatics tools to support undergraduate students' learning, and the development of students' informatics competencies. The research questions addressing the purpose of this study were:

1. How are nursing faculty currently integrating digital/informatics tools in teaching and learning?
2. What do nursing faculty perceive as enabling or hindering factors to integrating digital/informatics tools into teaching and learning?
3. How do nursing faculty perceive the usefulness of digital/informatics tools in nursing education?

4. How do nursing faculty perceive the use of digital/informatics tools can contribute to the integration of nursing informatics competencies in curriculum?
5. How do faculty perceive that the use of digital/informatics tools for learning and teaching purposes enhances students' nursing informatics competencies?
6. What are the theoretical perspectives that support nursing faculty's decision to integrate digital/informatics tools in teaching and learning?

Results from this focused ethnography revealed ten themes: 1) the meaning of the term nursing informatics from the perspective of educators, 2) faculty perceived NI competency, 3) perceived usefulness of digital informatics tools, 4) facilitators, 5) challenges, 6) developing students' NI competency, 7) building connections, 8) teaching approaches, 9) the learner, and 10) the pandemic. In this chapter, I have organized my discussion and interpretation of the findings according to the research questions. This is followed by recommendations for further research, limitations of the study, and how the findings will be disseminated. I start with a discussion of how faculty members understood informatics.

What did NI mean to nurse educators? In the literature, there are several definitions of nursing informatics. In Canada, the most widely used definition is the "science and practice [that] integrates nursing, its information and knowledge, with management of information and communication technologies to promote the health of people, families, and communities worldwide" (International Medical Informatics Association, 2009, para 2). Nursing informatics can also be discussed in the context of NI competency, which also has several definitions and meanings. Furthermore, there are variations in what constitutes NI competency. For example, in United States the core competencies include computer skills, information knowledge and

information skill; whereas in Australia, computer and information literacy as well as information management are their core competencies (Kleib et al., 2021). In Canada, NI competencies consist of slightly different aspects, including: information and knowledge management, professional and regulatory accountability, as well as the use of information and communication technologies in the delivery of patient/client care (CASN, 2012).

In this study, participants had various perspectives on the meaning of NI. Participants articulated NI as the use of digital/informatics tools for nursing practice, as well as the use of digital/informatics tools to collect data and information to inform nursing practice and improve patient outcomes. Participants recognized that digital/informatics tools, computers and information literacy were interrelated parts of NI, but managing data and information was not consistently apparent in their definitions. Once participants provided their definition of NI, I asked how they were developing students' NI competencies. There was some confusion, however, as to what exactly NI competencies encompassed. After probing the participants with more questions during the interview, it became evident that participants did not have a clear understanding of what constituted NI competencies. We consequently reviewed the CASN Entry-to-Practice competencies, at which point I asked the participants to provide examples of teaching activities involving digital/informatics tools, that they used to help students develop their NI competencies in accordance to the CASN document. Based on findings from a study by Nagle et al. (2020a), teaching activities were largely focused on the use of digital/informatics tools in the delivery of educational content, and not so much on the use of these tools to support patient care. Similar results were found when participants were interviewed in this study, but it seemed that faculty had limited awareness that they were even developing their students' NI competencies. This finding is echoed throughout the literature, in which faculty were reported to

have limited understanding of the concepts of informatics (Hebda & Calderone, 2010; McNeil, 2003, 2005). Furthermore, it seems that nursing faculty have difficulty distinguishing between digital/informatics tools to deliver classroom content vs. using the tools to guide, analyze and inform nursing practice (Nagle et al., 2020a; NLN, 2008).

As for participants' level of nursing informatics competencies, participants perceived themselves on a continuum from beginner to proficient, with most faculty identifying themselves as novice. Upon further exploration of participants' reasoning for identifying their NI proficiency as novice, most explained that they rated their proficiency based on their ability to use digital/informatics tools. Participants' limited view of what constitutes NI competency is consistent with the literature regarding faculty challenges with informatics (McNeil et al. 2005, 2006; Nguyen et al., 2011; Thompson & Skiba, 2008). This understanding of NI makes it difficult to know if participants' perceived competence in informatics is accurate or not. Nevertheless, it can be assumed that knowledge gaps about informatics continue to exist. Previous literature has also reported that nursing faculty perceived themselves as novice (McNeil et al., 2005; Thompson & Skiba, 2008). This is also congruent with Nagle's et al. (2020a) findings regarding educators' knowledge, confidence, and capacity to teach informatics. Specifically, Nagle et al. (2020a) found that 54% of faculty self-reported their digital/informatics proficiency at the beginner level, and only 48% felt confident in their ability to teach informatics content despite some faculty already teaching this content in their undergraduate program. Faculty levels of low proficiency in informatics has also been reported by students, suggesting that students are noticing that faculty may not be prepared to teach about NI (Fetter, 2009a; Edwards & O'Connor, 2011). These results are concerning, as faculty continue to teach informatics content to students despite their own perceived low levels of NI competence. Faculty

knowledge and expertise are critical to effectively teach about NI, including the skills required to use digital/informatics tools for clinical practice. All faculty must become proficient in NI, not only to adequately prepare students with the necessary knowledge, skills and abilities needed to work in the current healthcare context, but also to ensure the successful integration of informatics within the nursing curriculum. Nagle et al. (2020a) state that "all educators have a responsibility for teaching core digital-health related content and for contributing to informatics integration initiatives within their schools" (p 13). There is a need to increase faculty knowledge and understanding of informatics in order to achieve the necessary level of competency required to teach students how to apply digital/informatics to patient care and nursing practice. The findings from this study underscore faculty's need for professional development in informatics in order to acquire skills and become proficient users in informatics (Altmiller & Armstrong, 2017; Kinnunen et al., 2017; Nagle et al., 2020a; Nguyen et al., 2011; NLN 2015).

Research shows that several factors, such as age and type of teaching, may be associated with perceived lower levels of NI proficiency. In regards to age, it was noted from this study that the majority of participants (15 out of 21 participants; 71%) were in the 50 year and older age category, which is consistent with the profile of the current nursing academic workforce in Canada (CASN, 2019). Other studies have suggested that younger nurses perceived themselves as more proficient in NI when compared to older nurses (Brown et al., 2020; Hwang & Park, 2011; Kleib & Nagle, 2018b; Nguyen et al., 2011). For example, Kleib and Nagle (2018b), who studied factors associated with Canadian nurses' perceived level of informatics competencies, suggested that nurses 50 years and older had lower informatics competency scores as opposed to younger nurses. In this study, older groups of nursing faculty may have had less exposure to informatics within their own nursing education, or may have adopted digital/informatics tools

later in their lives. This may help to explain the lower perceived levels of NI competence in my study. As for types of teaching, only seven participants out of 21 (33%) taught in the clinical environment. Faculty who taught only in the classroom setting may have had less opportunity to use digital/informatics tools in the clinical environment. This may also account for low levels of faculty perceived NI competencies and a limited of understanding of faculty's role in teaching informatics in the current healthcare environment.

Question 1: How are Nursing Faculty Currently Integrating Digital/Informatics tools in Teaching and Learning?

The Canadian Nurses Association (CNA, 2006) posits that nurses must use digital/informatics tools to achieve better patient outcomes, while the Canadian Association of Schools of Nursing (CASN, 2012) asserts that it is imperative for nursing graduates to know how to interact with digital/informatics tools in order to ensure safe, high quality patient care. The use of digital/informatics tools in nursing curriculum has been identified as a key strategy for enhancing informatics competencies among future nurses (Borycki et al., 2014; Brown et al., 2020, Hebert, 1999; Kinnunen et al., 2017; Nagle & Clarke, 2004; Kleib, et al, 2013; NLN, 2015; Staggers et al., 2001; Staggers & Thompson, 2002). Hence, nursing faculty are called upon to infuse digital/informatics tools into their teaching practices to better prepare the next generation of professional nurses for their roles that will be highly reliant on technology (Fiedler et al., 2014; Smart et al., 2020). It is therefore important to know how faculty are integrating digital/informatics tools in teaching and learning at all undergraduate levels.

Findings from this present study suggest that nursing faculty were actively engaged in using a variety of educational technologies in the classroom, laboratory and clinical practice for

educational purposes. These tools were primarily used for course management, as an active learning strategy, to search for evidence-based information, to access point-of-care information, and for skill development. The use of digital/informatics tools for educational purposes helps students acquire foundational technological skills that should be further augmented so that these skills are transferable to different contexts like the clinical environment. Here, the faculty member role becomes instrumental in assisting students to learn how to use digital/informatics tools "to guide, document, analyse and inform nursing practice" (NLN, 2008 p.4), beyond technical use of technology.

All participants reported using learning management systems to facilitate course delivery, as their use was expected in their academic institutions. These systems have become an integral part of online content delivery, particularly in the context of the COVID-19 pandemic. In the classroom all participants used digital/informatics tools for pedagogical content delivery, and this is consistent with the findings from another study (Nagle et al., 2020a). The tools were also used to facilitate students' learning by actively engaging students with course content. In addition, social networking tools were used to disseminate information and communicate with others through Facebook, Twitter, blogs, etc. Participants also used electronic databases and health-related websites to perform literature searches, critically appraise the literature and then link these to patient care, which is consistent with current literature (Williamson & Muckle, 2018). A few participants reported using mobile devices to access reference materials, such as medications and laboratory tests, to help students make informed decisions about patient care in addition to facilitating communication between faculty and their students. Studies have also found similar benefits, in addition to promoting student's confidence (Doyle et al., 2016) and independence (Fetter, 2008; O'Connor & Andrews, 2018). Other studies have reported that students find

mobile devices useful for accessing information for immediate use (O'Connor & Andrews, 2018; Raman, 2015).

In the laboratory, digital/informatics tools were used in skill development and to assist in assessing and monitoring patients' data, such as vital signs and glucose testing. Faculty role-modeled their use through demonstration, while in clinical practice participants and their students used similar tools to assess and monitor patients. Participants also reported using electronic health records (EHRs), however there were significant barriers preventing effective use of these digital/informatics tools. Participants reported variations in the types of tools available for students to learn about, such as EHRs, as some clinical areas had very few tools compared with other areas.

During the COVID-19 pandemic restrictions, faculty had to become resourceful in replacing students' face-to-face clinical practicums. Some participants used clinical virtual simulations, as students were restricted from entering clinical practice. Clinical virtual simulations gave students the opportunity for "hands-on" experience in navigating EHR. Similarly, some studies have found that hands-on experiences with digital/informatics tools were an important factor in developing nurses NI competence (Borycki et al., 2009; Kowitlawkul et al., 2014; Miller et al., 2014). Digital/informatics tools allow students with opportunities to practice their informatics skills in a safe learning environment, while also allowing them to build familiarity in using these tools.

Faculty also described how they consciously role-modelled the use of digital/informatics tools in the classroom, laboratory and clinical environments by demonstrating their use while fostering positive attitudes towards the tools. Other research found that role-modeling

informatics skills was an important factor in helping students learn to use digital/informatics tools (Bani-issa & Rempusheski, 2014; Erdogan et al., 2013). There are, however, concerns that if faculty perceive their own NI competence as novice that they may not have the necessary skills to effectively role-model the integration of informatics in the context of patient care (Jack et al., 2017). Consequently, if the tools are not used competently, this could have a negative impact on patient care. Faculty must be able to demonstrate how digital/informatics tools are utilized in this context.

Question 2: What do Faculty Perceive as Enabling or Hindering Factors to Integrating Digital/Informatics Tools into Teaching and Learning?

In this study, participants articulated many facilitating and hindering factors to integrating digital/informatics tools into teaching and learning.

Facilitators Factors

Participants identified several facilitating factors to integrating digital/informatics tools. An important enabler highlighted by participants was the support offered by the academic institutions, librarians, staff nurses, and peers. Other enabling factors described in Chapter Four included faculty attributes, resources, as well as norms and expectations.

In regards to supports, participants accessed IT services and Teaching and Learning centres to help with instructional designs and best practices in how to use digital/informatics tools available to them in the context of teaching and learning. These supports tended to be orientated towards faculty use of the tools and not towards students. Librarians were reported as a source of support that assisted students in developing their informatics competencies. Librarians helped students develop skills in accessing, retrieving and critically analyzing

evidence-based information through online databases or health-related websites, facilitating the integration of a core competence of NI: information literacy. Similarly, other studies have also reported that librarians were important sources of support for developing students' informatics competencies (Thompson & Skiba, 2008; Sullo & Gomes, 2016; Theron et al., 2017). Librarians can therefore be seen as connectors, bridging the gap between the literature and the application of information literacy skills to patient care (Sullo & Gomes, 2016). It seems from the limited literature available that the role of the librarian in developing nursing student's informatics competencies and their application to nursing practice should be further explored.

The findings from this study revealed that interpersonal sources, such as peers and nurses, are highly relied upon. Participants recognized peers as supporting their integration of the tools by sharing their knowledge and resources, as well as by mentoring other faculty members. This is consistent with the current literature (Foster & Sethares, 2017). This supportive environment creates a climate in which attitudes and behaviours about the integration of the tools can be safely explored and where innovation can occur. It is an important consideration when integrating these tools (Gonen & Lev-Ari, 2016). The findings from this study indicate that having a faculty learning community may seem important for integrating digital/informatics tools into faculty's teaching practice (Curran, 2008). Peers also included nurses in the clinical environments who were familiar with the functionality of the digital/informatics tools. The rapid pace of change in the healthcare environment makes it difficult for faculty to keep pace when they are not consistently exposed to this environment. Participants in this study were reliant on nurses who were proficient in the use of digital/informatics tools found in the clinical environment. This may indicate that faculty may require more preparation to work in this environment to understand how these tools work.

Other studies have found that faculty's attributes, such as enthusiasm, willingness and motivation, have been identified as both facilitators and hindrances to integrating these tools into nursing curriculum (Fetter, 2008; Gonen & Lev-Ari, 2016; Mahon et al., 2010). Fostering a positive attitude among nurse educators towards the use of these tools could assist in their successful implementation. According to the findings in this study, faculty perceived that their past experiences, attitudes, curiosity, willingness and motivation made it easier for them to use digital/informatics tools. During the COVID-19 pandemic, participants from this study were flexible and responsive to integrating digital/informatics tools into their teaching practice, as these tools became an essential component to the delivery of course content because all faculty were forced to engage in the use of digital/informatics tools in their teaching practice. For example, participants reported having opportunities to explore and experiment with the use of digital/informatics tools for teaching and learning with other faculty members, perhaps creating a climate that was safe, supportive and accepting of faculty levels of computer proficiency. It is important to build on the momentum and maintain the openness to move and change teaching practices to enable the integration of NI in nursing education. These findings are contradictory to what has formerly been reported in the literature, whereby faculty members were reluctant to integrate digital/informatics tools into classrooms (McNeil et al., 2006; Thompson & Skiba, 2008). Nagle et al. (2020a), meanwhile, reported a lack of motivation for faculty to further develop their NI competencies; yet it is not clear if faculty members who participated in this study had similar attitudes towards technologies used in the clinical environment.

Regarding the resources that participants used to integrate digital/informatics tools into teaching and learning, these consisted of online modules that students completed prior to their practicum, such as e-module in electronic medication systems and glucometers. Faculty also

identified other resources, for instance workshops offered by their academic institutions, as helpful; but these activities were directed towards increased computer competence and developing faculty abilities to use the tools for teaching and learning purposes in response to the COVID-19 pandemic. Of note, also, is that only one participant commented on the use of CASN Teaching Toolkit to support students' learning of NI. Nagle et al. (2020a) also reported that only a few (21%) of the participants in their study used (moderately to expensively) the toolkit. Other Canadian resources which may prove helpful to help adopt NI in the curriculum; but, are also underutilized by educators include: *Consumer Health Solutions Resources: A Teaching and Learning Resource for Nursing Education* (2016) or the RNAO *Nurse Educator eHealth Resource* (2012). Stephens-Lee and Lu (2013) suggested compiling an inventory of resources on how to teach students informatics housed on a faculty Web-based portal such as a learning management system to which faculty could easily access. Furthermore, workshops could focus on how to use digital/informatics tools to help develop students' informatics competency by threading these into existing areas of curricular content (Frisch & Borycki, 2013).

Although, during data analysis, I perceived the 'norms and expectations' theme to encompass facilitators to the use of digital/informatics tools, I also recognized that this theme could also be perceived as a hindrance. Some participants perceived the use of digital/informatics tools as an expected part of one's teaching practice. For example, there is an expectation for faculty and students to use learning management systems in academic institutions. Furthermore, nursing faculty participants felt they needed to integrate digital/informatics tools into their teaching practice to meet students' expectations, which is supported by another study (Macquire et al., 2020). One participant reported that they felt there was an expectation to be competent in the use of digital/informatics tools, which was also noted by Smart et al. (2020). There is,

however, an increasing expectation to integrate digital/informatics tools into nursing faculty teaching practice from national nursing organizations (CNA 2006; CASN 2012; ICN 2015), as faculty shift to a more learner-centered approach (Benner et al., 2010). Finally, in light of the COVID-19 pandemic, online delivery may become the norm for teaching and learning, as the traditional delivery of education may not roll back (Maguire et al., 2020). There is little literature on how these norms and expectations influence faculty attitudes and behaviors in integrating the tools into their teaching practice. This may also be of interest for future studies.

Hindering Factors

The findings from the study revealed that faculty encountered many obstacles when integrating digital/informatics tools. The hindering factors are discussed from the following sub-themes reported in Chapter Four: the clinical environment, the steep learning curve, the effects of tech, missed face-to-face interactions, and the learner. Faculty's understanding and their perceived proficiency in NI was already reported as a hindering factor, as previously discussed.

The most significant hindering factor for integrating digital/informatics tools that participants identified in their teaching practice was the clinical environment. The majority of study participants teaching in the clinical environment explicitly stated that limited access to digital/informatics tools, such as EHR prevented students and faculty from using digital/informatics tools. This is consistent with findings from other researchers (Foster & Sethares, 2017; Lee et al., 2019; Nagle et al., 2020a). Faculty concerns about not being able to access patient information through EHR in a timely manner affected student learning and also patient care. Some nursing undergraduate programs rely on the clinical environment to provide students with the opportunity to use EHR to develop students' informatics competencies (Nagle et al., 2020a). Hands-on experiences with digital/informatics tools are an important factor in

developing nurses' NI competence (Borycki et al., 2009; Borycki et al., 2014; Brown et al., 2020; Theron et al., 2017). Hands-on experiences with EHR allow students to learn how to navigate EHR and apply / skills safely in the clinical environment with patients (Borycki et al., 2009; Curran 2008). Students perceived that they felt more prepared for practice when they were exposed to digital/informatics tools during their education (McDowell & Ma, 2007). Thus, helping students develop an understanding of informatics applications, as well as identifying both the benefits and hindrances of digital/informatics tools used in nursing practice are important (O'Connor & LaRue, 2021; Shin et al., 2018). Otherwise, future nurses run the risk of compromising patient care if these tools are used inappropriately (IOM, 2012; Kleib et al., 2013). Furthermore, EHR will eventually be the primary source to access patients records from which nurses will manage clinical data in the future (RNAO, 2012). The 2020 *National Survey of Canadian Nurses: Use of Digital Health Technology in Practice* reported that 86% of Canadian nurses who provide direct patient care are using digital/informatics tools. Specifically, 64% of nurses use electronic clinical decision support tools while 60% of nurses are using EHRs (CHI, 2020). There is an expectation for students to be practice-ready in using digital/informatics tools for patient care when they enter the workforce.

Given the above-mentioned challenges in the clinical environment and the importance of preparing the next generation of nurses, faculty cannot rely solely on the clinical agencies to develop students' NI competencies (Fetter, 2009c; Shin et al., 2018). Other researchers have recommended building partnerships and agreements with clinical agencies to create more conducive learning environments for students to acquire informatics competencies (NLN, 2015). Nevertheless, this should be a shared responsibility between faculty members, program leaders, academic institutions, (Kinnunen et al., 2017) as well as leaders in the clinical environments.

The use of mobile devices could provide nursing students immediate access to evidence-based information from anywhere and at any time; whether it is in the classroom, at the patient bedside, or in the community (Altmiller & Armstrong, 2017; Kenny et al., 2012; Kuiper, 2010; Johansson et al., 2014). Participants in this study, however, reported accessibility issues, a wide variety of institutional policies restricting students in their use of technology, and staff perceptions as hindrances to integrating digital/informatics tools. Furthermore, faculty themselves restricted students' use and access to evidence-based information at the patient bedsides to minimize any risk to patient care. The literature around mobile devices seems consistent with the findings from this study, also noting that policies in clinical environments were barriers to integrating mobile devices in clinical practice (Raman, 2015; O'Connor & Andrews, 2018). Perhaps faculty were not aware that mobile devices could enhance NI competencies, as students can retrieve, assess, manage, and evaluate evidence-based information, learn to incorporate the information into their nursing practice, and to problem solve directly in the healthcare and patient care settings. It is possible that faculty do not recognize the need to access evidence-based information at the bedside, or even students' future learning needs.

Another barrier that participants reported was that community sites and hospitals utilized clinical information systems that differed from one another. Hence, students' learning can be challenged if they are exposed to a myriad of different informatics systems. Furthermore, participants reported that students continued to work in paper chart and electronic records or hybrid environments, where they were required to access patient data from EHR in both paper and digital forms. This hybrid environment can lead to frustrations with the ability to access information, and patient care can be compromised. Faculty concerns about the effects of these challenges were consistent with the literature (Nagle et al. 2020a). Consequently, nursing faculty

need to consider the variabilities in clinical information systems and implement effective teaching strategies to develop students' informatics competencies, as exemplified by Nagle et al. (2020a) who stated: "this variability creates challenges for nurse educators to identify what should be taught to prepare students for their use" (p 12). Nevertheless, students' learning can be geared to understand the theoretical and conceptual aspects of clinical information systems, drawing on key aspects related to nurses' work with these systems such as documentation, legal and ethical aspects of EHR, while also engaging students to examine the implications of having a variety of systems and how they can be improved in the future.

The steep learning curve associated with learning NI tools was identified as a barrier by most participants, which was also noted prior to the pandemic. Faculty learning how to use these tools and applying them in their teaching practice takes time and requires opportunity to practice. The findings in the study align with the literature regarding the limited time faculty may have to learn about new digital/informatics tools (Fetter, 2008; Kowitlawakul et al., 2014; Lilly et al., 2015; Oermann, 2015; Webb et al., 2017). Faculty's heavy workload, usually consisting of teaching, service, scholarship and other responsibilities (Bittner & Bechtel., 2017; Boamah et al., 2021, in press) may limit their abilities to engage in learning opportunities about digital/informatics tools and restrict the develop their informatics competence.

Faculty also perceived technology as posing a threat to core nursing values, as participants reported that students spent more time focused on retrieving patient data from the digital/informatics tools instead of spending time with their patients and learning about "good old fashioned nursing care". The participants in this study were concerned about students' ability to develop the sense of caring, compassion, and empathy in the presence of digital/informatics tools. The perception that core values of nursing may be threatened in the midst of a

technological environment is a critical concern (Locsin & Purnell, 2015). Others have also indicated that digital/informatics tools may have an effect on the nurse-patient relationship and the ability to deliver compassionate care but there seems to be limited literature on the potential impacts of digital/informatics tools on compassionate care (RNAO & Associated Medical Services [AMS], 2020). Caring can be learned and reinforced by providing students with opportunities for dialogue and deliberate practice by supporting the intention of caring in their interaction with others (Nadelson et al., 2016; Strouse & Nickerson, 2016). A continued focus on these values and faculty role-modeling the interplay of the nurse-client relationship in the presence of digital/informatics tools could cultivate the sense of caring in students within a technologically rich healthcare environment (Buchanan et al., 2021). As nursing education progresses to meet the future technological demands, faculty should engage in discussions about the influences of technology on compassionate, patient-centered care, as it is likely that the nurse-patient-technology relationship, as well as nurse's role will become more blurred (Strudwick et al., 2020). Several studies posit that future nurses, as end users of digital/informatics tools, will be involved in the design of digital/informatics tools used for patient care to ensure the humanistic presence of the nurse (RNAO & AMS, 2020). Some undergraduate nursing programs are collaborating with engineering programs to help students' understanding of digital/informatics tools used in the clinical environment, and also working with them to help develop solutions that maintain patient-centered care (RNAO & AMS, 2020).

During the COVID-19 pandemic, all participants shifted to online delivery of teaching. Participants from this study noted several challenges that impeded how they taught online. They expressed that a lack of immediate real-time feedback from students, such as facial expressions and hand gestures, forced them to rely on different skills such as probing questions (Howe et al.,

2018). Some participants voiced how they missed the face-to-face interactions they had with students in the physical environment. These face-to-face interactions can provide faculty with rich feedback on students' learning. For example, faculty may not be able to discern if a student requires more support in an online environment, as this can only be disclosed by students and only if those students are actively engaged with the material. Results of the current study are consistent with previous research. One study indicated that faculty had concerns about their ability to build connections and rapport in the online environment, as well as maintaining students' engagement (Maguire et al., 2020). While Webb et al., (2017) questioned whether online teaching could lead to "a depersonalization of interactions which could results in role conflict" (p. 167). Furthermore, in a review study (Ingraham et al., 2018) the researchers suggested that the students-faculty relationship is key in determining students' academic success. Perhaps the participants in this study felt the authentic students-faculty relationship was lost in the wake of the COVID-19 pandemic, as they missed the in-person interactions between themselves and students, and may have had difficulty showing a caring presence in an online environment, or that there was a perception that they were what less accessible to students.

Another hindrance to the integration of digital/informatics tools included faculty's varied perceptions of student abilities to engage with these tools across the spectrum. This was revealed under the theme 'the learner'. In this study, some participants viewed students as lacking in computer literacy skills, whereas other participants perceived them as having higher computer literacy skills. Today's mix of nursing students consists of a broad range of educational backgrounds and experiences (Smart et al., 2020; Macquire et al., 2020). Consequently, students' knowledge, skills and abilities to work with these tools should not be taken for granted, nor as a marker of informatics competence. Jones and Donelle (2011) discussed the assumption that

Millennials should be able to adapt to the use of digital/informatics tools due to them being familiar with technologies, but others have found otherwise. Sandars (2012) explained that digital native students have lived with technology in all aspects of their lives, but that they were restricted to their ability in using these tools in social contexts. Students must also learn how to apply digital/informatics tools in the context of patient care (Gugerty & Delaney, 2009). Nagle et al. (2020a) posit that having the assumption that students have competence in using the tools may actually impede the integration of digital/informatics tools in nursing curriculum. To address these assumptions, it may be prudent to assess students' levels of NI competence to establish a baseline, and then directing teaching strategies to areas of weakness. There are a number of approaches to accomplish that, such as using self-assessment tools such as the Canadian Nurse Informatics Competency Assessment Scale (Kleib & Nagle, 2018a).

There is also an expectation that students are entering Canadian nursing undergraduate program with basic computer competence (CASN, 2012). As mentioned previously, students entering undergraduate nursing programs may not have basic computer competence. De Gagne et al. (2012) suggest that undergraduate programs could consider using the International Computer Driving License, an internationally recognized computer literacy certificate, as a prerequisite to enter undergraduate nursing programs. Students would then at least have acquired the foundational skills for informatics as expected by national nursing accreditation bodies, such as CASN in Canada (CASN, 2012). Students must have a solid foundation of computer literacy to continue to develop their informatics skills, as some researchers have found that computer proficiency was a strong predictor of informatics competence (Hwang & Park, 2011). Formalizing the completion of computer literacy will better equip students to integrate these skills in the healthcare environment. The views that faculty have of their students must be further

explored in nursing education. This is important, given that there is also a paucity of Canadian-based research that examines student nurses' perceived preparedness and competence in informatics.

Lastly, one participant expressed concerns about keeping student's information safe and private while using digital/informatics tools for teaching and learning purposes. In this study, participants used social media platforms, such as Twitter, Facebook and other educational tools, which may have collected student's personal information in order to grant access to these platforms. Exploitation of students' data can occur if security measures are not in place (Regan & Jesse, 2019). Faculty should consider the implications of using these platforms and safeguarding students' data (Smart et al., 2020). In the future, nursing faculty may need to be more proactive in protecting students' data and helping students to understand the implications of the collection, use, and sharing of their personal information.

The second research question addressed the enablers and challenges to curricular integration of NI content as perceived by nursing faculty. The enablers to integrating digital/informatics tools into nursing curriculum serve as a springboard for further discussion, and the hindrances provide an opportunity for talking points among nursing faculty about needed strategies to improve the successful integration of NI into nursing education.

Question 3: How do Faculty Perceive the Usefulness of Digital/Informatics Tools in Nursing Education?

Participants in my study perceived that digital/informatics tools were useful in engaging students with content, accessing information, and in facilitating student achievement of learning outcomes. According to previous literature, perceived usefulness of digital/information tools was found to be a significant determinant to the use of digital/informatics tools (Davis, 1989; Sharp,

2006). Participants in this study perceived digital/informatics tools as useful in their teaching practice. Specifically, faculty perceived these tools as student-centered, encouraging student's engagement and as a mean to liven-up the course content. These tools also increased social connectivity, thus making education more relevant, engaging, and authentic for students. Benner et al. (2010) recommended that nursing faculty restructure how nursing students are taught and to integrate of digital/informatics tools within student-centered, interactive, and innovative curricula. Most participants from this study responded to this recommendation. Participants also echoed that digital/informatics tools facilitate the learning process. More importantly, participants voiced that they carefully considered which tool was best suited for students' learning. Some participants recognized the importance of aligning specific digital/informatics tools with course content, students' learning outcomes and the method of instruction; realizing that these tools are an integral part in facilitating students' learning. It was also apparent from this study that faculty were concerned about helping students develop skills in information literacy such as assisting them in navigating databases, finding evidence-based information and critically evaluating information competently and thoroughly with the use of digital/informatics tools. Consequently, participants from this study were helping students develop a core component of NI competencies (Kleib et al., 2021).

In addition, participants perceived NI tools as a quick, convenient and easy way to access information in the classroom, laboratory and clinical environments. Specifically, participants articulated the usefulness of mobile devices in accessing critical information such as reference materials in the clinical environment to help students make informed decisions about patient care, which is consistent with the literature (Jensen et al., 2016; Raman, 2015). Specifically, Day-Black (2015) reported that using mobile devices in clinical enhances students' learning and

patient safety during medication administration by checking for drug dosages, contraindications, and side effects. Faculty assisting students to utilize these tools in the context of patient care are helping students in developing their own informatics competency (Frisch & Borycki, 2013). Furthermore, it is important that faculty perceive mobile devices as useful to help prepare students for the present clinical environment. Nurses' utilization of these tools is growing in Canada. In a Canadian national survey, nurses (59%) felt it essential to have access to mobile devices to provide and document patient care as well as to facilitate communication between other heath care professionals (61%) (CHI, 2020). Early use of these tools could help increase students' NI competencies in using the devices and their confidence (Raman, 2015).

Question 4: How do Faculty Perceive that Using Digital/informatics Tools can Contribute to the Integration of Nursing Informatics Competencies in Nursing Curriculum?

The integration of digital/informatics tools to help develop students' NI competencies has received support in the literature and in this study (Hwang & Park, 2011; Pilarski, 2010). In this study, a variety of digital/informatics tools were used by participants. Most participants in this study perceived the use of digital/informatics tools as an integral component of NI and supported its integration into nursing curriculum. As we went through the CASN NI Entry-to-Practice competencies, participants provided several examples of how they used digital/informatics tools to help develop students' NI competencies. Interestingly, after reviewing the document, participants stated that they did not realize they were helping students develop their informatics competencies, suggesting a lack of awareness and some participants even remarked that faculty were not doing enough to develop students' NI competencies. Similarly, Nagle et al. (2020a) reported that some "faculty expressed a sense of urgency in integrating informatics into nursing curriculum but their sentiments where not shared by other nursing faculty" (p 9). This may

suggest that NI is still not a priority in nursing education for some faculty and perhaps not a priority in certain programs (Nagle et al., 2020a).

This current study revealed that faculty are focused mostly on developing students' computer and information literacy skills versus broader NI competencies through the use of specific informatics/digital tools. For example, most participants from clinical environment used the informatics/digital tools that were required for assessing and monitoring patients, and a few participants encouraged students to use their mobile devices to access resources to make informed decisions about patient care. However, it seems that students are using mobile devices at the bedside for fact-checking. These findings are consistent with those of previous reviews on the topic (De Gagne et al., 2011; Kleib et al., 2013; Nagle et al., 2020a; Shin et al., 2018). Using digital/informatics tools is more than just knowing how to use the tools and retrieving evidence-based information. Faculty members' use of digital/informatics tools must include managing and using information for patient care, demonstrating transferability of this knowledge to the patient care context. For example, students using digital/informatics to gather different types of data from EHR and applications on their mobile devices while at the bedside. These students must then be able to interpret and use the data that is being accessed to come to an informed decision about patient care. Faculty can help students make the connections between these data points by asking clinical questions. This information can then be shared with the patient. Consequently, nursing faculty need to understand digital health and informatics so that they can demonstrate these linkages to their students. It is not clear if participants from this study integrated these core components of NI into their teaching practice, perhaps due to their limited understanding of NI. Researchers have reported that faculty do not incorporate informatics content into curricula when they have insufficient knowledge about informatics theory and practice (Bond & Proctor, 2009;

NLN, 2008a; Saba & McCormick, 2006; Thompson & Skiba, 2008). An important message that may need to be communicated is that faculty don't need to be experts in informatics, but rather have an awareness and understanding of how informatics informs the delivery of patient care.

Question 5: How do Faculty Perceive that the Use of Digital/Informatics Tools for Learning and Teaching Purposes Enhances Students' Nursing Informatics Competencies.

In this study, faculty expressed difficulty in drawing explicit linkages between the use of digital/informatics tools used for educational purposes and developing students' informatics competencies. Many participants reported using digital/informatics tools to perform searches and critical appraisal of online literature for classroom assignments. This aspect is only one indicator of a set of indicators pertinent to information and knowledge management within the entry-to-practice NI competencies for RNs in Canada. These findings are consistent with other studies (McNeil et al., 2003, 2005, 2006). Only a few participants encouraged the use of tools in assisting patients to manage their health. Perhaps this is related to the level of nursing education of the student. Students must also learn how to apply their informatics skills learned in the context of patient care specifically (Nagle et al., 2020a). As patients are encouraged to access health information online, patient education is directed towards helping them to access, review, and evaluate information to enable them to participate and manage their own care. It, therefore, becomes critical for nursing students to acquire these same skills.

As discussed earlier, faculty and their students had limited access to the specific EHRs used in the different clinical environments. In addition, it seems that simulated EHR are not being used in their nursing programs, as no examples were provided by participants about their use. This may suggest that simulated EHR are currently underutilized, not available for use in undergraduate programs of participants in this study or possibly unknown as this didn't come as

a focus in the interviews. Nevertheless, a Canadian study reported that 59% of nurses teaching in nursing education do not have access to a simulated EHR (CHI, 2020). Previous Canadian studies reported that the use of simulated EHR in nursing undergraduate programs to support the development of students' competencies is still limited (CHI, 2020; Nagle et al., 2020a). In the current study, some participants voiced that the use of simulated EHR were not warranted, as their clinical environments are still using pen and paper to document patient care in the clinical environment. Nevertheless, simulated EHR are valuable tools to help develop students' NI competencies (Kowitlawakul et al., 2014). More contextual information is needed to understand where EHRs can be utilized and where specific access and training may be feasible and applicable in some nursing educational settings.

Faculty participants in my study voiced that they were using digital/informatics tools such as learning management systems for course management, course content delivery, and to engage students in learning activities. This is consistent with reported literature (Essel et al., 2020). It could be argued that these tools could help develop students' informatics competencies as learning analytics are possibly embedded within these systems, and students can thereby track their own learning where possible. Some participants described students' learning about informatics from an interprofessional educational perspective, where students from different healthcare backgrounds learn about informatics together. Learning about informatics from this perspective would allow for exploration of perceptions about the variety of roles, identities, and teamwork in interprofessional learning (Hood et al., 2014; O'Connor & LaRue, 2021). O'Connor & LaRue, (2021) suggested this would also allow for sharing resources.

Based on findings from this study, faculty integration of digital/informatics tools in undergraduate nursing education is somehow limited and fragmented. Another study has also

reported that NI-related content was not sufficiently detailed to prepare students to work in the clinical environment (Shin et al., 2018). From this current study, it also seems that integration of NI in the nursing curriculum to help develop students' NI competencies was not purposefully done, nor it was intentional for nurse educators. This is also consistent with the literature (Nagle et al., 2020a).

Question 6: What are the Theoretical Perspectives that Support Nursing Faculty's Decision to Integrate Digital/Informatics Tools in Teaching and Learning?

According to Benner et al. (2010), the use of digital/informatics tools alone does not necessarily mean effective pedagogy. Learning theories can provide a foundation to inform the application of these tools for the purpose of learning. Awareness of one's underlying teaching philosophy is vital, as teaching and learning perspectives influence to what extent a particular digital/informatics tool is integrated into nursing curriculum. Consequently, faculty perceptions are quite important. Study participants articulated a variety of teaching perspectives to support their teaching practice, as summarized by the theme 'teaching approaches'. Findings from this study show that participants' views of teaching and learning include tenets of constructivism, adult learning, and critical social theory.

Most participants' teaching practice was supported by the constructivist approach, emphasizing a student-centered active learning and engagement, and was often aligned with adult learning theory using a variety of learning theories. Experiential learning was also highlighted, as participants created opportunities for experiences in group work and simulation. This approach was important in the clinical environment, where participants and students worked with digital/informatics tools within the context of authentic patient care. Findings from other research also found that participants using digital/informatics tools specifically aligned

themselves with the principles of constructivism (Kala et al., 2010; Parker & Myrick, 2009). Some participants' views were influenced by Bandura's social learning theory and included role modeling the use of digital/informatics tools. For example, participants voiced that they showed students how to access databases, retrieve, and critically appraise current literature. In the clinical environment, participants role modelled how to access patient information through EHRs.

Finally, a few participants' views were influenced by a critical social theory perspective. For example, the use of audience response systems, which empower students who are more introverted by encouraging them to share their views and voice their opinions anonymously. The findings from this study suggest that participants' use of digital/informatics tools was supported by their views of teaching and learning, although some participants may have only recognized this during the interview. Findings from another study reported that faculty lacked clarity and understanding of learning theories to inform the use of digital/informatics tools, citing a lack of guidelines, too many learning theories to choose from, or that they may not have realized the impact that these tools have on student learning (Bajpai et al., 2019). Interestingly, in this same review study, most studies identified a cognitivism theme, but participants in my study did not identify this learning theory to support their use of digital/informatics tools. Nevertheless, intentional use of the learning theories can perhaps foster a stronger integration of digital/informatics tools into nursing education. Parker and Myrick (2009) suggest faculty should consider using a blend of learning theories when integrating digital/informatics tools, depending on the learning objectives. Furthermore, it has been postulated that no learning theories have been established as the best approach to integrating digital/informatics tools (Bajpai et al., 2019), which is worth exploring in the future.

Summary

This study revealed that faculty are integrating digital/informatics tools, to some extent, into their teaching practice in a variety of ways in the classroom, lab and clinical settings but that this integration is still quite limited and somehow fragmented. In addition, participants summarized the usefulness of, as well as the enablers and hindrances to integrating digital/informatics tools in their teaching. This study indicates that faculty do employ digital/informatics tools to some extent in their teaching practice to facilitate active learning and to increase student engagement.

Regarding the use of digital/informatics tools in developing students' informatics competencies, this study reinforced previous research findings (Nagle et al., 2020a) that more needs to be done to integrate informatics into the nursing curricula. There is still a large focus on developing students' computer and information literacy skills using digital/informatics tools in the classroom, but it is not known if these aspects of integration help in transferring the knowledge, skills, and abilities to the clinical environment. Core NI competencies are not being fully addressed, which is a huge limitation to the development of students' nursing informatics competencies. Based on the findings in this study, faculty could enhance their use of digital/informatics tools to foster student-centered learning and to intentionally build connections to core NI competencies.

Both facilitating and hindering factors are important points for discussion. Faculty were keen on embedding digital/informatics tools into their teaching practice with the support from their academic institutions in terms of technological and pedagogical support, as well as with the support from their peers. While in the clinical environment students are integrating tools to assess and monitor the patient; their abilities to use these tools to help make clinical decisions

becomes restricted due to limited accessibility to these tools. This lack of access to EHRs in clinical settings as well as simulated EHRs in undergraduate nursing programs adversely affects faculty's teaching and students' abilities to embrace informatics, as well as creates learning gaps. Furthermore, it is unclear whether students are being evaluated on their use of digital/informatics tools for patient care. Finally, results also revealed that limited professional development and resources were used by faculty to assist them in implementing of informatics competencies in nursing undergraduate programs.

This study shed light on educators' experiences with informatics integration in undergraduate nursing. Findings from this study can help faculty engage in positive dialogue about integrating digital/informatics tools to develop students' informatics competencies. The knowledge gained from this study can increase the effectiveness of informatics integration in nursing undergraduate programs and potentially lead to nursing graduates who are better prepared for competent and safe nursing practice in modern day digitally enabled healthcare environment.

Future Recommendations

Based on the information obtained from of this study, I make the following recommendations for practice and research to provide direction for nursing faculty, schools of nursing, nursing organizations and nursing informatics scholars. I elaborate on each below.

Recommendations for Nursing Faculty

1- Encourage self-assessment of NI competencies:

Faculty can take a proactive approach to determine their NI competencies using an NI competency scale, such as the Canadian Nurse Informatics Competency Assessment Scale (Kleib

& Nagle, 2018a). This helps identify areas of strength and opportunities for learning and professional development. Advancing faculty competency along the continuum from novice to proficient is therefore warranted.

2- Foster professional development of self and peers through an informatics community of practice:

Study participants identified their peers as facilitators to integrating digital/informatics tools into their teaching practice. Peers could establish an informatics community of practice group, possibly with the support of CASN, such as the Digital Health Nursing Faculty Peer Leaders Network, to encourage professional development in informatics. This peer group within their school of nursing could provide professional development opportunities with the support of program leaders. Collaboration may create a climate which helps empower and support peers to integrate informatics into their teaching practice while encouraging learning and innovation. Faculty could also connect with other peers through the CASN Digital Health interest group where members can share information and exchange ideas while promoting informatics in nursing education.

Recommendations for Schools of Nursing or Nursing Programs

1- Encourage student and faculty use of mobiles devices in the clinical environment:

Students' use of mobile devices facilitates the access to resources such as clinical decision support tools and reference materials. Nursing faculty could work with staff and managers to explore their perceptions of NI in the clinical environment. Program leaders need to work with the managers in the clinical environments to re-examine policies which limit the use of mobile devices by students (Raman 2015).

2- Encourage and support faculty professional development in NI:

Nurse leaders play an instrumental role in role modeling and advocating for resources to support the professional development of their faculty in relation to NI. Suggested resources include but are not limited to workshops, educational programs, etc. Foundational NI topics should be delivered to all faculty members, and then targeted topics could be delivered to a core group of faculty members who teach specific NI topics. Encouraging faculty to complete the computer literacy certificate, such as the International Computer Driving License, might be an initial start. Learning opportunities could be delivered using a variety of modalities, such as in person, online or one-on-one or by using experiential learning facilitated by a nursing informatician. Program leaders may also refer to the CASN Digital Health Nursing Faculty Peer Leaders Network for resources that faculty can access and utilize. The CASN network group offers support and mentorship for faculty wanting to increase their informatics knowledge and increase their teaching strategies to help students develop their own NI competencies.

3- Assess students' NI competencies at the entry of program and upon exiting the nursing programs:

Today's unique mix of nursing students has varying levels of educational backgrounds and experiences. Assessing students' NI competencies using tools such as the Canadian Nurse Informatics Competency Assessment Scale (Kleib & Nagle, 2018a) at the entry of an undergraduate program would provide a baseline self-assessment to better identify specific knowledge and skills gaps in students. Subsequently, the assessment would help identify what priorities are needed to better address students' learning needs. In addition, assessing students' competencies upon entry-to-practice will help evaluate the effectiveness of the educational strategies and identify any gaps in the curriculum.

4- Collaborate with clinical sites to ensure there are opportunities for students to have hands-on experiences with clinical information systems.

There needs to be a partnership between nursing programs and the clinical environments to help students develop NI competencies. This would provide students with dedicated time to learn clinical information systems. Faculty access to the authentic systems will also help them to teach the links from the data that is gathered to use of the data and information when providing patient care. Hands-on experiences with clinical information systems would also allow students to familiarize themselves with these digital/informatics tools in the clinical environment. Engaging with the clinical sites to create sustainable solutions for accessibility to clinical information systems is an important aspect of ensuring that both faculty and students increase their NI competency level.

5- Intentionally incorporate CASN NI Entry-to- Practice competencies (2012) into nursing curriculum.

The findings of this study highlight the importance that NI be explicitly incorporated into nursing curriculum. Program leaders play an integral role in supporting and adopting CASN NI Entry-to- Practice competencies which should be in integrated into nursing curriculum to foster a culture that embraces informatics. CASN NI Entry-to-Practice competencies can serve as a guidepost for planning curricula and providing a comprehensive foundation for embedding NI into curriculum. Nursing programs should conduct a gap analysis of the current state on informatics using the sample template for mapping out curricula content provided by the RNAO *Nurse Educator eHealth Resource* (2012), and then address any gaps that have been identified in the curricula through an implementation plan. This could then be included in the nursing program's strategic plan to ensure accountability. When developing learning activities, faculty

could use the CASN/Infoway NI *Teaching Toolkit: Supporting the Integration of CASN Nursing Informatics Competencies into Nursing Curricula* (CASN & CHI, 2013), the *Consumer Health Solutions Resources: A Teaching and Learning Resource for Nursing Education* (2016) and *Digital Health eResources* (CASN & CHI, 2019) which offer learning modules to assist faculty in incorporating NI competencies into curriculum. Integrating specific NI competencies and toolkits will take time to implement and recognizing faculty work should be an important part of this process. Nursing curricula are not static and must evolve with the changing landscape occurring in healthcare environments. Consequently, the full integration of informatics into nursing curriculum must occur. There needs to be a deliberate action plan to examine nursing curriculum which considers current trends and makes informatics a more explicit requirement in nurses' education. Curriculum mapping may help assist faculty in determining the scope of informatics being taught, and where gaps exist. In addition, it may encourage faculty to integrate informatics into their nursing curriculum in a more systematic way. For example, Frisch and Borycki (2013) developed a framework of how to structure informatics content for nursing undergraduate programs, which faculty and programs can use as a guide.

6- Formalize a collaboration with librarians in academia and the clinical environments to assist in development of students' skills in informatics.

Collaborating with librarians could assist with the integration of informatics in nursing curricula by helping students develop basic information literacy and data management skills. Academic librarians could assist students in locating and critically evaluating online literature and websites, while librarians in the clinical sites could assist students in retrieving data and information from EHR. Furthermore, they could help students find reliable consumer health information through the use of digital/informatics tools (Ma et al., 2017). Formalizing this

collaboration would intentionally ensure a continued partnership between librarians and faculty. It is recognized however, that costs may affect the extent to which this is possible.

7- Develop an academic informatics infrastructure:

Nursing programs could adopt an open-source EHR, which could be adapted to the needs of the curricula and used by students to complete informatics learning activities. Learning activities could focus on the functionality of EHR as well as developing students' knowledge about the principles underlying the use of EHR, such as documentation, legal and ethical aspects. One participant recommended populating the EHR database with clinical data from a virtual patient. Virtual clinical experiences are another option that faculty could use to explore the functionalities of an EHR. This would also require professional development and release time for faculty to integrate these programs.

Recommendation for Nursing Organizations

1- Specify the inclusion of NI in nursing education.

Nursing accrediting and approving bodies are instrumental in directing nursing curricula and holding nursing schools accountable for meeting educational standards. Agencies such as CASN and provincial regulators should consider re-examining their accreditation and approval standards to reflect the integration of NI into nursing curricula. These agencies should also consider maintaining clear and updated NI competencies which nursing programs should adopt for consistency.

Recommendation for Nursing Informatics Researchers

1- Establish minimal informatics competencies levels for nursing faculty.

Broad informatics competencies for nurse educators have been identified (Grobe, 1988), however they do not reflect the current and future NI competencies needed for nursing faculty (Forman et al., 2020). Perhaps it is time to revisit these competencies, as the development of students' competencies is influenced by faculty competence. In the interim, researchers may examine Canadian nursing faculty perceived NI competency using the Canadian Nurse Informatics Competency Assessment Scale (C-NICAS), because this scale is based on NI competency indicators for RNs. It is also a validated scale, meaning it could be applied among a larger group of nurse educators and could yield more reliable results. This would also be a springboard for engaging faculty in self-assessment of NI competency, and consequently professional development to enhance their competency.

Areas for Further Research

It is important to continue research in the area of NI in the ongoing attempts to understand NI, its representation in the undergraduate nursing programs and its role in the provision of safe patient care. There were many areas for future research that were identified in the discussion. The following four areas would provide opportunities to further understand the integration of NI in Canadian undergraduate nursing education:

1. In this research, several significant barriers were perceived by faculty. Further research on how to best address barriers to integrating informatics in Canadian undergraduate nursing programs would be helpful to their future application.

2. This research did not explore faculty attitudes towards the integration of digital/informatics tools or nursing informatics. There is little literature on how norms and expectations influence faculty attitudes and behaviors in integrating the tools into their teaching practice. Furthermore,

the COVID-19 pandemic forced faculty to use digital/informatics tools, and little is known if this will have an effect on students' NI competencies.

3. This study explored the perspectives of a group of nursing faculty from six Canadian universities related to integrating digital/informatics tools using focused ethnography approach. Further research is needed using other research methods and across all Canadian Schools of Nursing. Furthermore, a study following students' informatics competencies from when they enter the program to when they enter practice is also needed. This may help identify which NI competencies are not being addressed by faculty and nursing curriculum.

4. In light of the increasing technological world, faculty must contemplate future trends in digital health, such as models of care delivery, which are supported by digital/informatics tools such as telehealth, mHealth and virtual health. In addition, emerging technologies such as artificial intelligence and robotics will likely influence care and professional practice roles as well as how faculty teach. During the COVID pandemic, faculty went from face-to-face to complete online instruction. These trends suggest that faculty's roles may be changing and therefore it may be important to research how these trends are affecting faculty and how they view their future roles. It is also another supporting factor for defining specific NI competency expectations for nursing faculty.

Limitations of the Study

There were several limitations to this study. The interviews were conducted during two different time periods. Nine interviews were conducted before the COVID-19 pandemic, and twelve interviews were conducted after the onset of the pandemic. During the pandemic, participants were required to use digital/informatics tools for the delivery of their course content, which may have influenced their perceptions about the use of these tools. While the intent of

this study was to conduct several site visits and in person face-to-face interviews, the COVID-19 pandemic restricted my ability to conduct these activities. Consequently, I used video-conferencing applications, such as Zoom and Skype, however there were some connectivity issues during some interviews in which I could not hear clearly what some of the participants were saying. I had to occasionally ask them to repeat their responses and this may have led them to forget what they had initially stated.

My limited experience in conducting qualitative interviews may have restricted my ability to ask the necessary questions to obtain fruitful data from the participants, or may have prompted me to ask questions that did not result in disclosure of relevant information. I would have liked to explore more on faculty understanding of how they perceive their own NI competency. In addition, I reviewed the CASN NI Entry-to-Practice competencies and asked the participants to provide examples of how they were meeting these competencies during the interview. This may have prompted faculty to answer the questions differently than they would have otherwise.

There were limitations related to the participants' demographic makeup. The sample lacked variety regarding gender and age, which may limit the transferability of the results. The demographic composition of the study did, however, does reflect the current faculty population in Canadian undergraduate programs (CASN, 2019). The sample included one male faculty member. Males and younger participants may also offer different perspectives and experiences in the integration of digital/informatics tools in nursing education.

Dissemination of Research Findings

The value of this research is that it provided a deeper understating of faculty members' experiences with digital/informatics tools, their approaches for integrating these tools in nursing

education and their perceptions of the influence of these tools on the development of students' NI competence. In addition, this research study helped to better understand the development of nursing students' informatics competencies from a faculty perspective. Although I have submitted a traditional format for this thesis, my intention is to publish the study findings in highly accessed, peer-reviewed journals (Appendix M). I also intend to present the findings of this research to nursing faculty members at national and international conferences, such as the Canadian Nursing Informatics Association and the Western-Northwest Region Canadian Association of School of Nursing conference and at other local conferences targeting audiences from nursing faculty and nursing students.

Conclusion

It has long been recognized that faculty need to incorporate NI into their curriculum, and that undergraduate nursing programs are not integrating informatics adequately to meet the demands of the current healthcare environment (Hunter et al., 2013). The application of digital/informatics tools through purposeful implementation could facilitate this process (Borycki et al., 2015; CASN, 2012; CNA & CNIA, 2017; IOM, 2000, 2001; Kleib & Nagle, 2018b; Kupferschmid et al., 2020; Nagle et al., 2020a, 2020b; Repsha et al., 2020). The literature review identified in part that little is known about nursing faculty's current utilization of digital/informatics tools to help support the development of students' informatics competencies.

This focused ethnography has uncovered the complex and interactive experiences that faculty faced in using digital/informatics tools to help students develop their NI competencies. Looking at the data from multiple perspectives, this research was able to uncover facilitators and challenges that nursing faculty experience. The findings of this study illustrate that some aspects of informatics are integrated into undergraduate nursing education, but that gaps continue to

exist. To improve informatics visibility in the nursing curriculum, faculty must become more knowledgeable about NI in order to plan and effectively implement strategies to build on the facilitators and to limit the barriers. Faculty are aware that the use of digital/informatics tools will continue to grow in the healthcare environment, and must prepare future nurses to work competently in this environment. More supports and resources, however, are needed to realize this goal. If these limitations persist, students are at risk of gaining minimal understanding of informatics concepts and their applicability in the context of patient care.

References

Abdrbo, A. A. (2015). Nursing informatics competencies among nursing students and their relationship to patient safety competencies: Knowledge, attitude, and skills. *CIN: Computers, Informatics, Nursing, 33*(11), 509-514. https://doi.org/10.1097/CIN.0000000000000197

Agar, M. (1980). *The professional stranger*. Academic Press.

Ally, M. (2013). Mobile learning: From research to practice to impact education. *Learning and Teaching in Higher Education: Gulf Perspectives*, *10*(2), 1–10. http://lthe.zu.ac.ae/index.php/lthehome/article/viewFile/140/62

Altmann, T. K., & Brady, D. (2005). PDAs bring information competence to the point-of-care. *International Journal of Nursing Education Scholarship, 2*, 1. https://doi.org/10.2202/1548-923X.1127

Altmiller, G., & Armstrong, G. (2017). 2017 National quality and safety education for nurses faculty survey results. *Nurse Educator*, *42*(5S), S3-S7. https://doi.org/10.1097/NNE.0000000000000408

Altuna, J., & Lareki, A. (2015). Analysis of the use of digital technologies in schools that implement different learning theories. *Journal of Educational Computing Research, 53*(2), 205-227. https://doi.org/10.1177/0735633115597869

American Association of Colleges of Nursing (2021). *The Essentials: Core Competencies of for Professional Nursing Education.* https://www.aacnnursing.org/Portals/42/AcademicNursing/pdf/Essentials-2021.pdf

American Library Association (1989). *Presidential Committee on Information Literacy. Final Report.* American Library Association.

https://libguides.ala.org/InformationEvaluation/Infolit

American Nurses Association. (2008). Nursing informatics: Scope and standards of practice (2nd ed.). American Nurses Association.

Amuno, A. (2017). Computer History: Classification of Computer Generations. https://turbofuture.com/computers/Classification-of-Computers-by-Generation

Arnold, W. W. (2018). Digital pedagogy the millennials' way: E-book as a course project. *Journal of Instructional Pedagogies, 18.*

Aronson, J. (1995). A pragmatic view of thematic analysis. *The Qualitative Report, 2*(1), 1-3. https://doi.org/10.46743/2160-3715/1995.2069

Arrigo, M., Kukulska-Hulme, A., Arnedillo-Sánchez, I., & Kismihok, G. (2013). Meta-analyses from a collaborative project in mobile lifelong learning. *British Educational Research Journal, 39*(2), 222-247.

Austin, S. I. (1999). Baccalaureate nursing faculty performance of nursing computer literacy skills and curriculum integration of these skills through teaching practice. *Journal of Nursing Education, 38*(6), 260-266. https://doi.org/10.3928/0148-4834-19990901-06

Australian College of Nursing. (2018). *Nursing Informatics Position Statement*. joint-position-statement-nursing-informatics-hisa-nia.pdf (acn.edu.au)

Australian Nursing and Midwifery Federation. (2015). *ANMF National informatics standards for nurses and midwives*. ANMF Federal Office. http://anmf.org.au/documents/National_Informatics_Standards_For_Nurses_And_Midwives.pdf

Bajpai, S., Semwal, M., Bajpai, R., Car, J., & Ho, A. H. Y. (2019). Health professions' digital education: Review of learning theories in randomized controlled trials by the Digital

Health Education Collaboration. *Journal of Medical Internet Research, 21*(3), e12912. https://doi.org/10.2196/12912

Baker, J. D., & Brusco, J. M. (2011). Nursing education gets a second life. *Association of Perioperative Registered Nurses Journal, 94*(6), 599-605. https://doi.org/10.1016/j.aorn.2011.09.004

Bakken, S., Cook, S. S., Curtis, L., Desjardins, K., Hyun, S., Jenkins, M., ... & Soupios, M. (2004). Promoting patient safety through informatics-based nursing education. International *Journal of Medical Informatics, 73*(7-8), 581-589. https://doi.org/10.1016/j.ijmedinf.2004.04.008

Ball, M. J., Douglas, J. V., Walker, P. H., DuLong, D., Gugerty, B., Hannah, K. J., ... & Troseth, M. R. (2011). *Nursing informatics: Where technology and caring meet*. Springer Science & Business Media. https://doi.org/10.1007/978-1-84996-278-0

Bandura, A. (1977). Self-efficacy: toward a unifying theory of behavioral change. *Psychological review, 84*(2), 191. https://doi.org/10.1037/0033-295X.84.2.191

Bani-issa, W., & Rempusheski, V. F. (2014). Congruency between educators' teaching beliefs and an electronic health record teaching strategy. *Nurse Education Today, 34*(6), 906-911. https://doi.org/10.1016/j.nedt.2014.01.006

Barrett, J. R. (2007). The researcher as instrument: Learning to conduct qualitative research through analyzing and interpreting a choral rehearsal. *Music Education Research, 9*(3), 417-433. https://doi.org/10.1080/14613800701587795

Bastable, S. B., Harvey, A., Parker, K. E., & Alt, M. F. (2014). *Nurse as educator: principles of teaching and learning for nursing practice* (4th ed). Jones & Bartlett Learning.

Beck, C. T. (1993). Qualitative research: The evaluation of its credibility, fittingness, and auditability. *Western Journal of Nursing Research, 15*(2), 263-266. https://doi.org/10.1177/019394599301500212

Becker, S.A., Brown, M., Dahlstrom, E., Davis, A., DePaul, K., Diaz, V., & Pomerantz. J. (2018). *NMC Horizon Report: 2018 Higher Education Edition*. EDUCAUSE. https://library.educause.edu/~/media/files/library/2018/8/2018horizonreport.pdf

Benner, P., Sutphen, M., Leonard, V., & Day, L. (2010). Educating nurses. *A Call for Radical Transformation*. Jossey-Bass

Billings, D. M., Connors, H. R., & Skiba, D. J. (2001). Benchmarking best practices in web-based nursing courses. *Advances in Nursing Science, 23*(3), 41-52.

Billups, F. (2014). The quest for rigor in qualitative studies: Strategies for institutional researchers. *The NERA Researcher*, *52*(1), 1-5.

Bittner, N. P., & Bechtel, C. F. (2017). Identifying and describing nurse faculty workload issues: A looming faculty shortage. *Nursing Education Perspectives*, *38*(4), 171-176. https://doi.org/10.1097/01.NEP.0000000000000178

Bitzer, M. D., & Boudreaux, M. C. (1969). Using a computer to teach nursing. *Nursing Forum 8*(3), 3.

Black, A. D., Car, J., Pagliari, C., Anandan, C., Cresswell, K., Bokun, T., ... & Sheikh, A. (2011). The impact of eHealth on the quality and safety of healthcare: a systematic overview. *PLoS medicine, 8*(1), e1000387. https://doi.org/10.1371/journal.pmed.1000387

Black, C. D., & Watties-Daniels, A. D. (2006). Cutting edge technology to enhance nursing classroom instruction at Coppin State University. *ABNF Journal*, *17*(3), 103.

Blake, H. (2009). Staff perceptions of e-learning for teaching delivery in healthcare. *Learning in*

Health and Social Care, *8*(3), 223-234. https://doi.org/10.1111/j.1473-6861.2009.00213.x

Boddy, C. R. (2016). Sample size for qualitative research. *Qualitative Market Research: An International Journal,19* (4), 426-432. https://doi.org/10.1108/QMR-06-2016-0053

Booth, R., Strudwick, G., McMurray, J., Chan, R., Cotton, K., Cooke, S. (2021). The future of nursing informatics in a digitally-enabled world. In K. J. Hannah, P., Hussey, M. A. Kennedy, & M. Ball (Eds.), *Introduction to nursing informatics.* (5th ed., pp. 392-412). Springer. https://doi.org/10.1007/978-3-030-58740-6_16

Bond, C. S., & Procter, P. M. (2009). Prescription for nursing informatics in pre-registration nurse education. *Health Informatics Journal, 15*(1), 55-64. https://doi.org/10.1177/1460458208099868

Boamah, S. A., Callen, M., & Cruz, E. (2021; in press). Nursing faculty shortage in Canada: A scoping review of contributing factors. *Nursing Outlook*. https://doi.org/10.1016/j.outlook.2021.01.018

Borycki, E. M., Frisch, N., Moreau, J., & Kushniruk, A. (2015). Integration of electronic health records into nursing education: Issues, challenges and limitations. *Studies in Health Technology and Informatics. 208,* 88-92.

Borycki, E.M., Griffith, J., Reid, P., Kuo, M-H., & Kushniruk, A.W. (2014). Do electronic health records help undergraduate students develop health informatics competencies? *Studies in Health Technology and Informatics, 205*, 838-842.

Borycki, E. M., Kushniruk, A. W., Joe, R., Armstrong, B., Otto, T., Ho, K., ... & Frisch, N. (2009). The University of Victoria Interdisciplinary Electronic Health Record Educational Portal. *Advances in Information Technology and Communication in Health*, 143, 49-*54*.

Bove, L. A. (2020). Integration of informatics content in baccalaureate and graduate nursing education: An updated status report. *Nurse Educator*, *45*(4), 206-209. https://doi.org/10.1097/NNE.0000000000000734

Braun, V. & Clarke, V. (2006) Using thematic analysis in psychology. *Qualitative Research in Psychology, 3*(2), 77-101. https://doi.org/10.1191/1478088706qp063oa

Braungart, M.M., & Braungrat, G.R. (2008). Applying learning theories to healthcare practice. In Bastable, S. B. (2008). *Nurse as Educator*. Jones & Bartlett Publishers.

British Columbia College of Nurses and Midwives. (2021). *Entry-Level Competencies for Registered Nurse Practice in British Columbia*. https://www.bccnm.ca/Documents/competencies_requisite_skills/RN_entry_level_competencies_375.pdf

Brooks, D. C., & Pomerantz, J. (2017). *ECAR Study of Undergraduate Students and Information Technology*. ECAR.

Brown, J. S. (2000). Growing up: Digital: How the web changes work, education, and the ways people learn. *Change: The Magazine of Higher Learning, 32*(2), 11-20. https://doi.org/10.1080/00091380009601719

Brown, J., Morgan, A., Mason, J., Pope, N., & Bosco, A. M. (2020). Student nurses' digital literacy levels: Lessons for curricula. *CIN: Computers, Informatics, Nursing*, *38*(9), 451-458. https://doi.org/10.1097/CIN.0000000000000615

Buchanan, C., Howitt, M. L., Wilson, R., Booth, R. G., Risling, T., & Bamford, M. (2021). Predicted Influences of Artificial Intelligence on Nursing Education: Scoping Review. *Journal of Medical Internet Research Nursing, 4*(1), e23933. https://doi.org/10.2196/23933

Button, D., Harrington, A., & Belan, I. (2014). E-learning & information communication technology (ICT) in nursing education: A review of the literature. *Nurse Education Today, 34*(10), 1311-1323. https://doi.org/10.1016/j.nedt.2013.05.002

Cambridge International. (2014). *Digital technologies in the classroom.* https://www.cambridgeinternational.org/Images/271191-digital-technologies-in-the-classroom.pdf

Canadian Association of Schools of Nursing. (2012). *Nursing informatics entry-to-practice competencies for Registered Nurses.* Nursing-Informatics-Entry-to-Practice-Competencies-for-RNs_updated-June-4-2015.pdf (casn.ca)

Canadian Association of Schools of Nursing & Canada Health Infoway. (2013). *Nursing informatics teaching toolkit: Supporting the integration of the CASN nursing informatics competencies into nursing curricula*. http://digitalhealth.casn.ca/wp-content/uploads/2019/03/FINAL-EN_Nursing-Informatics-Teaching-Toolkit.pdf

Canadian Association of Schools of Nursing. (2015). *National nursing education framework. final report*. https://www.casn.ca/wp-content/uploads/2014/12/Framwork- FINAL-SB-Nov-30-20151.pdf

Canadian Association of Schools of Nursing. (2016). *Consumer health solutions: a teaching and learning resource for nursing education*. https://www.casn.ca/wp-content/uploads/2016/04/Consumer-Health-Solutions-A-teaching-and-learning-resource-for-nursing-education-EN.pdf

Canadian Association of Schools of Nursing. (2017). *Registered nurses' education in Canada statistics, 2015-2016 — registered nurse workforce, Canadian production:*

potential new supply. https://www.casn.ca/2017/12/2015-2016-nursing-education-statistics-report/

Canadian Association of Schools of Nursing & Canada Health Infoway (2019). *Digital health eModule*. https://digitalhealth.casn.ca/modules/

Canada Health Infoway. (n.d.). *Understanding EHRs, EMRs and PHRs*. https://infoway-inforoute.ca/en/solutions/digital-health-foundation/understanding-ehrs-emrs-and-phrs

Canada Health Infoway. (2018). Connected Health Information in Canada: A Benefits Evaluation Study. https://www.infoway-inforoute.ca/en/component/edocman/3510-connected-health-information-in-canada-a-benefits-evaluation-study-document/view-document?Itemid=101

Canada Health Infoway. (2009). *EHR vision 2015: Advancing Canada's next generation of healthcare*. https://www.infoway-inforoute.ca/en/component/edocman/16-2015-canada-s-next-generation-of-health-care-full/view-document?Itemid=0

Canada Health Infoway. (2020). 2020 *National survey of Canadian nurses: Use of digital health technology in practice.* https://cnia.ca/resources/Documents/National%20Survey%20of%20Canadian%20Nurses%20Use%20of%20Digital%20Health%20Technology%20Report.pdf

Canada Health Infoway & Canadian Nurses Association & Canadian Nursing Informatics Association. (2017). *2017 National survey of Canadian nurses use of digital health technology in practice. https://www.infoway-inforoute.ca/en/component/edocman/3320-2017-national-survey-of-canadian-nurses-use-of-digital-health-technology-in-practice/view-document?Itemid=0*

Canadian Institute for Health Information. (2017). *Regulated Nurses, 2017: Canada and jurisdiction highlights*. https://www.cihi.ca/sites/default/files/document/regulated-nurses-2017-pt-highlights-en-web.pdf

Canadian Institutes of Health Research. (2014). *Tri-council policy statement: Ethical conduct for research involving humans*. Interagency Secretariat on Research Ethics. https://www.toronto.ca/wp-content/uploads/2018/03/97a8-tri-council-policy-statement-2014.pdf

Canadian Nurses Association. (2001). *What is nursing informatics and why is it so important?* https://www.nursing-informatics.com/kwantlen/NursingInformaticsSept_2001_e.pdf

Canadian Nurses Association. (2006). *E-nursing strategy for Canada.* https://www.cna-aiic.ca/~/media/cna/page-content/pdf-en/e-nursing-strategy-for-canada.pdf?la=en

Canadian Nurses Association. (2011). *Canadian Registered Nurse examination competencies: June 2010 – May 2015*. https://www.cna-aiic.ca/~/media/cna/page-content/pdf-en/framework-for-the-pracice-of-registered-nurses-in-canada.pdf

Canadian Nurses Association. (2017). *Code of ethics for registered nurses*. https://cna-aiic.ca/html/en/Code-of-Ethics-2017-Edition/files/assets/basic-html/page-1.html

Canadian Nurses Association & Canadian Nursing Informatic Association. (2017). *Nursing information joint position statement*. https://www.cna-aiic.ca/-/media/cna/page-content/pdf-en/nursing-informatics-joint-position-statement.pdf?la=en&hash=C89A6A32F5FD5489DE31E5F6594DE48936AFDAE1

Cardoso A, & Souza P. (2015) *Nursing informatics core competencies for Portugal*. HIMSS. http://s3.amazonaws.com/rdcms-himss/files/production/public/FileDownloads/TIGER_HIMSS15_VLE_PortugalCaseStudy_11182015.pdf

Carty, R. & Ong, I. (2015). The nursing curriculum in the information age. In K. McCormick, V. Saba, & K. McCormick (Eds.), *Essentials of nursing informatics* (pp. 517-532). McGraw-Hill Education.

Carty, R, & Rosenfeld P. (1998). From computer technology to information technology: Findings from a national study of nursing education. *Computers in Nursing, 16*(5), 259–265.

Chang P., Kuo M.C.J., & Lu, S.J. (2015) Case Study 4: Mobile nursing in health information systems. In: K. J. Hannah, P. Hussey, M. A. Kennedy, & M. Ball (Eds.), *Introduction to nursing informatics* (pp. 122-132). Springer. https://doi.org/10.1007/978-1-4471-2999-8_18

Chang, J., Poynton, M. R., Gassert, C. A., & Staggers, N. (2011). Nursing informatics competencies required of nurses in Taiwan. *International Journal of Medical Informatics*, *80*(5), 332-340. https://doi.org/10.1016/j.ijmedinf.2011.01.011

Chauvette, A. (2018). *Technology and theoretical perspective in nursing education* [Unpublished manuscript]. Faculty of Nursing, University of Alberta.

Cho, S., & Lee, E. (2016). Distraction by smartphone use during clinical practice and opinions about smartphone restriction policies: A cross-sectional descriptive study of nursing students. *Nurse Education Today, 40*, 128-133. https://doi.org/10.1016/j.nedt.2016.02.021

Choi, J., & De Martinis, J. E. (2013). Nursing informatics competencies: Assessment of undergraduate and graduate nursing students. *Journal of Clinical Nursing*, *22*(13-14), 1970-1976. https://doi.org/10.1111/jocn.12188

Chioh, M.S., Yan, C.C. Tang, K.L. Mustaffa S.M., Koh M.G., Sim T.W., & Chan,Y.H. (2013). The use of the personal digital assistant by nursing students in the classroom and clinical practice: a questionnaire survey. *Singapore Nursing Journal, 40*(20),8-44.

Chung, J., & Cho, I. (2017). The need for academic electronic health record systems in nurse education. *Nurse Education Today*, *54*, 83-88. https://doi.org/10.1016/j.nedt.2017.04.018

Cibulka, N. J. & Crane-Wider, L. (2011). Introducing personal digital assistants to enhance nursing education in undergraduate and graduate nursing programs. *Journal of Nursing Education, 50*(2), 115-118. https://doi.org/10.3928/01484834-20101230-07

Cobcroft, R., Towers, S., Smith, J., & Bruns, A. (2006). Mobile learning in review: Opportunities and challenges for learners, teachers and institutions. In Brown, A (Ed.) *Learning on the move: Proceedings of the online learning and teaching conference 2006* (pp. 21-30). Queensland University of Technology.

College and Association of Registered Nurses of Alberta (2019). *Entry-level competencies for the practice of Registered Nurses*. https://www.nurses.ab.ca/docs/default-source/document-library/standards/entry-to-practice-competencies-for-the-registered-nurses-profession.pdf?sfvrsn=15c1005a_12

College of Nurses of Ontario. (2019). *Entry-to-practice competencies for Registered Nurse*. https://www.cno.org/globalassets/docs/reg/41042_entrypracrpn-2020.pdf

Collins, S., Yen, P. Y., Phillips, A., & Kennedy, M. K. (2017). Nursing informatics competency

assessment for the nurse leader: The Delphi study. *Journal of Nursing Administration*, *47*(4), 212-218. https://doi.org/10.1097/NNA.0000000000000467

Cooney, A. (2011). Rigour and grounded theory. *Nurse Researcher, 18*(4), 17–22. https://doi.org/10.7748/nr2011.07.18.4.17.c8631

Creswell, J. (2013). *Qualitative inquiry and research design: Choosing among five approaches* (3rd ed.). Sage.

Creswell, J. W., & Miller, D. L. (2000). Determining validity in qualitative inquiry. *Theory into Practice, 39*(3), 124-130. https://doi.org/10.1207/s15430421tip3903_2

Cruz, E. V., & Higginbottom, G. (2013). The use of focused ethnography in nursing research. *Nurse Researcher, 20*(4), 36. https://doi.org/10.7748/nr2013.03.20.4.36.e305

Curran, C. R. (2003). Informatics competencies for nurse practitioners. *AACN Advanced Critical Care*, *14*(3), 320-330. https://doi.org/10.1097/00044067-200308000-00007

Curran, C. R. (2008). Faculty development initiatives for the integration of informatics competencies and point-of-care technologies in undergraduate nursing education. *Nursing Clinics of North America*, *43*(4), 523-533. https://doi.org/10.1016/j.cnur.2008.06.001

Day-Black, C. (2015). Using Mobile Devices in Nursing Education. *ABNF Journal*, *26*(4), 78–84

Day-Black, C., Merrill, E. B., Konzelman, L., Williams, T. T., & Hart, N. (2015). Gamification: An innovative teaching-learning strategy for the digital nursing students in a community health nursing course. *Journal of the Association of Black Nursing Faculty in Higher Education, 26*(4), 90–94.

Darvish, A., Bahramnezhad, F., Keyhanian, S., & Navidhamidi, M. (2014). The role of nursing informatics on promoting quality of healthcare and the need for appropriate

education. *Global Journal of Health Science, 6*(6), 11-18. https://doi.org/10.5539/gjhs.v6n6p11

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *Management Information Systems Quarterly*, 319-340. https://doi.org/10.2307/249008

De Gagne, J. C., Bisanar, W. A., Makowski, J. T., & Neumann, J. L. (2012). Integrating informatics into the BSN curriculum: A review of the literature. *Nurse Education Today, 32*(6), 675-682. https://doi.org/10.1016/j.nedt.2011.09.003

De Groote, S. L., & Doranski, M. (2004). The use of personal digital assistants in the health sciences: Results of a survey. *Journal of the Medical Library Association, 92*(3), 341.

Delaney, C., & Gugerty, B. (2010). *Competencies: Nuts and Bolts*. In M. J. Ball, (Ed.), *Nursing informatics: Where technology and caring meet* (pp. 81-93). Springer. https://doi.org/10.1007/978-1-84996-278-0_6

Denzin, N. K., & Lincoln, Y. S. (2005). *Introduction: The discipline and practice of qualitative research* (3rd ed). Sage.

Desjardins, K. S., Cook, S. S., Jenkins, M., & Bakken, S. (2005). Effect of an informatics for evidence-based practice curriculum on nursing informatics competencies. *International Journal of Medical Informatics*, *74*(11-12), 1012-1020. https://doi.org/10.1016/j.ijmedinf.2005.07.001

Diaz, D. P., & Bontenbal, K. F. (2000). Pedagogy-based technology training. In H. Fujita, & P. Johannesson, (Eds), *Teaching and learning in a network world*, (pp. 50-57). IOS Press/Ohmsha.

Dingley, C., Daugherty, K., Derieg, M. K., & Persing, R. (2008). Improving patient safety

through provider communication strategy enhancements. In K. Henriksen, J. B. Battles, M. A. Keyes, & M. L Grady (Eds.), *Advances in patient safety: New directions and alternative approaches, vol. 3: Performance and tools* (pp. 1-27). Agency for Healthcare Research and Quality.

Doyle, G. J., Furlong, K. E., & Secco, L. (2016). Information literacy in a digital era: Understanding the impact of mobile information for undergraduate nursing students. In W, Sermeus, P.M. Procter, & P. Webe (Eds.), *Nursing informatics* (pp. 297-301). IOS Press.

Dutile, C., Wright, N., & Beauchesne, M. (2011). Virtual clinical education: Going the full distance in nursing education. *Newborn and Infant Nursing Reviews, 11*(1), 43-48. https://doi.org/10.1053/j.nainr.2010.12.008

Edwards, J., & O'Connor, P. A. (2011). Improving technological competency in nursing students: The Passport Project. *Journal of Educators Online, 8*(2), n2. https://doi.org/10.9743/JEO.2011.2.2

Elder, B. L., & Koehn, M. L. (2009). Assessment tool for nursing student computer competencies. *Nursing Education Perspectives, 30*(3), 148-152.

Eley, R., Fallon, T., Soar, J., Buikstra, E., & Hegney, D. (2008). The status of training and education in information and computer technology of Australian nurses: A national survey. *Journal of Clinical Nursing, 17*(20), 2758-2767. https://doi.org/10.1111/j.1365-2702.2008.02285.x

Ertmer, P. A., & Newby, T. J. (2013). Behaviorism, cognitivism, constructivism: comparing critical features from an instructional design perspective. *Performance Improvement Quarterly, 26*(2), 43-71. https://doi.org/10.1002/piq.21143

Esewe, R. E., & Adejumo, O. (2014). Challenges in ICT experienced by nurse educators in tertiary institutions in Edo State, Nigeria: Teaching and learning. *African Journal for Physical Health Education, Recreation and Dance*, 20(Supplement 1), 50-60.

Essel, H. B., Awuni, T., & Mohammed, S. (2020). Digital technologies in nursing and midwifery education in Ghana: Educators perspective, practice and barriers. *Library Philosophy and Practice*, 1-16.

Fetter, M. S. (2008). Enhancing baccalaureate nursing information technology outcomes: Faculty perspectives. *International Journal of Nursing Education Scholarship, 5*(1), 1-14. https://doi.org/10.2202/1548-923X.1440

Fetter, M. S. (2009a). Graduating nurses' self-evaluation of information technology competencies. *Journal of Nursing Education, 48*(2), 86-90. https://doi.org/10.3928/01484834-20090201-05

Fetter, M. S. (2009b). Baccalaureate nursing students' information technology competence—Agency perspectives. *Journal of Professional Nursing, 25*(1), 42-49. https://doi.org/10.1016/j.profnurs.2007.12.005

Fetter, M. S. (2009c). Curriculum strategies to improve baccalaureate nursing information technology outcomes. *Journal of Nursing Education*, *48*(2), 78-85. https://doi.org/10.3928/01484834-20090201-06

Fetterman, D. M. (1998). *Ethnography.* Sage Publications, Inc.

Fiedler, R., Giddens, J., & North, S. (2014). Faculty experience of a technological innovation in nursing education. *Nursing Education Perspectives, 35*(6), 387-391. https://doi.org/10.5480/13-1188

First Ministers of Canada (2003). *First Ministers' Accord on Healthcare Renewal*. Canada.

http://www.scics.gc.ca/CMFiles/800039004_e1GTC-352011-6102.pdf

Fisher, K., & Koren, A. (2007). Palm perspectives: The use of personal digital assistants in nursing clinical education. A qualitative study. *Online Journal of Nursing Informatics, 11*(2), 12.

Forman, T. M., Armor, D. A., & Miller, A. S. (2020). A review of clinical informatics competencies in nursing to inform best practices in education and nurse faculty development. *Nursing Education Perspectives, 41*(1), E3-E7. https://doi.org/10.1097/01.NEP.0000000000000588

Foster, J., & Bryce, J. (2009). Connecting health and humans. *Australian nursing informatics competency project, proceedings of NI.*

Foster, M. & Sethares, K. (2017). Current strategies to implement informatics into the nursing curriculum: An Integrative Review. *Online Journal of Nursing*, *21*(3)

Fourman, M. (2002). *Informatics.* University of Edinburg. www.inf.ed.ac.uk/publications/online/0139.pdf

Frisch, N., & Borycki, E. M. (2013). A framework for leveling informatics content a cross four years of a Bachelor of Science in Nursing (BSN) curriculum. *Studies in Health Technology and Informatics*, *183*, 356-366.

Fulton, C. R., Meek, J. A., & Walker, P. H. (2014). Faculty and organizational characteristics associated with informatics/health information technology adoption in DNP programs. *Journal of Professional Nursing*, *30*(4), 292-299. https://doi.org/10.1016/j.profnurs.2014.01.004

Fyke K.J. (2001). *Caring for Medicare: Sustaining a Quality System*. http://www.health.gov.sk.ca/mc_dp_commission_on_medicare-bw.pdf>.

Galanek, J. D., Gierdowski, D. C., & Brooks D. C. (2018). *ECAR Study of Undergraduate Students and Information Technology, Research report*. ECAR.

Glen, S. (2005). E-learning in nursing education: Lessons learnt? *Nurse Education Today, 25*(6), 415–417. https://doi.org/10.1016/j.nedt.2005.07.001

Gonen, A., & Lev-Ari, L. (2016). The relationship between work climate and nurse educators' use of information technology. *Nurse Education Today, 39,* 1-6. https://doi.org/10.1016/j.nedt.2016.01.018

Graves, J. R., & Corcoran, S. (1989). The study of nursing informatics. *Image: The Journal of Nursing Scholarship*, *21*(4), 227-231. https://doi.org/10.1111/j.1547-5069.1989.tb00148.x

Greenberger, D., S. (2014). The Nature of inquiry. In A. DiVincenzo (Ed.). *Find your purpose: The Path to a successful doctoral experience*. http://lc.gcumedia.com/res811/find-your-purpose-the-path-to-a-successful-doctoral-experience/v1.1/.

Greenfield, S. (2007). Medication error reduction and the use of PDA technology. *Journal of Nursing Education, 46*(3), 127-1310. https://doi.org/10.3928/01484834-20070301-07

Greer, H. (2012). *Nursing informatics competencies: Implications for safe and effective Practice* [Unpublished these]. https://scholarworks.wmich.edu/honors_theses/1775

Greiner, A., & Knebel, E. (2003). *Health professions education: A bridge to quality*. The National Academies Press. https://www.nap.edu/read/10681/chapter/1

Grobe, S. J. (1988). Nursing informatics competencies for nurse educators and researchers. *NLN Publications*, (14-2234), 25.

Grove, S. K, Burns, N., & Gray, J. (2013). *The practice of nursing research: Appraisal,*

synthesis, and generation of evidence (7th ed.). Elsevier/Saunders

Guba, E. G., & Lincoln, Y. S. (1994). Competing paradigms in qualitative research. In N. K. Denzin & Y.S. Lincoln (Eds.), *Handbook of qualitative research* (pp. 105-117). Sage.

Gugerty, B., Delaney, C. (2009). *Collaborating to integrate evidence and informatics into nursing practice and education: TIGER executive summary report.* https://tigercompetencies.pbworks.com/f/TICC_Final.pdf

Hall, H., Griffiths, D., & McKenna, L. (2013). From Darwin to constructivism: The evolution of grounded theory. *Nurse Researcher, 20*(3), 17-21. https://doi.org/10.7748/nr2013.01.20.3.17.c9492

Hallowell, R. (2014). *Teaching and learning with digital media: Learning ecologies and digital Pedagogies* [Unpublished doctoral dissertation], University of Southern California.

Hammersley, M., & Atkinson, P. (2007). *Ethnography: Principles in practice*. Routledge. https://doi.org/10.4324/9780203944769

Hannah, K. J. (2007). The state of nursing informatics in Canada. *The Canadian Nurse, 103*(5), 18.

Hannah, K.J., Ball, M.J., & Edwards, M.J.A. (1994). *Introduction to Nursing Informatics*. Springer-Verlag. https://doi.org/10.1007/978-1-4757-2246-8

Hannah, K. J., White, P.A., Nagle, L.M., & Pringle, D.M. (2009). Standardizing nursing information in Canada for inclusion in electronic health records: C-HOBIC, *Journal of the American Medical Informatics Association, 16*(4) 524–530, https://doi.org/10.1197/jamia.M2974

Harerimana, A., Wicking, K., Biedermann, N., & Yates, K. (2020). Integrating nursing informatics into undergraduate nursing education in Africa: A scoping review. *International Nursing Review*, 00, 1-14 https://doi.org/10.1111/inr.12618

Hart, C. (2012). Technology and nursing education: An online toolkit for educators. *The Journal of Continuing Education in Nursing, 43*(9), 393-394. https://doi.org/10.3928/00220124-20120822-04

Hart, M. D. (2010). A Delphi study to determine baseline informatics competencies for nurse managers. *CIN: Computers, Informatics, Nursing*, *28*(6), 364-370. https://doi.org/10.1097/NCN.0b013e3181f69d89

Havens, D. S., Vasey, J., Gittell, J. H., & Lin, W. T. (2010). Relational coordination among nurses and other providers: Impact on the quality of patient care. *Journal of Nursing Management, 18*(8), 926-937. https://doi.org/10.1111/j.1365-2834.2010.01138.x

Hebda, T. L., & Calderone, T. L. (2012). Informatics competencies for healthcare professionals: the Technology Informatics Guiding Education Reform (TIGER) Initiative model. *Drug Metabolism and Drug Interactions, 27*(3), 145–149. https://doi.org/10.1515/dmdi-2012-0013

Hebert, M. (1999). *National Nursing Informatics Project: Discussion Paper*. http://www.nursing-informatics.com/kwantlen/National_NI_Project_Discussion_paperDRAFT.pdf

Hebert, V.M. & Connors, H. (2016). Integrating an academic electronic health record: Challenges and success strategies. *CIN: Computers, Informatics, Nursing, 34*(8), 376. https://doi.org/10.1097/01.NCN.0000492410.13476.c9

Hendler, J., Berners-Lee, T., 7 Miller, E. (2002). Integrating applications on the Semantic Web.

Journal of the Institute of Electrical Engineers of Japan, 122(10), 676-680. https://doi.org/10.1541/ieejjournal.122.676

Hern, M. J., Key, M., Goss, L. K., & Owens, H. (2015). Facilitating adoption of informatics and meaningful use of electronic health records with nursing faculty. *Journal of Nursing Education and Practice, 5*(3), 118. https://doi.org/10.5430/jnep.v5n3p118

Higginbottom, G. (2004). Sampling issues in qualitative research. *Nurse Researcher, 12*(1), 7-19. https://doi.org/10.7748/nr2004.07.12.1.7.c5927

History.com. (2009). *Invention of the PC.* https://www.history.com/topics/inventions/invention-of-the-pc#section_1

Honey, M., Collins, E., & Britnell, S. (2020). Education into policy: Embedding health informatics to prepare future nurses—New Zealand case study. *Journal of Medical Internet Research Nursing*, *3*(1), e16186. https://doi.org/10.2196/16186

Hood, K., Cant, R., Leech, M., Baulch, J., & Gilbee, A. (2014). Trying on the professional self: nursing students' perceptions of learning about roles, identity and teamwork in an interprofessional clinical placement. *Applied Nursing Research*, *27*(2), 109-114. https://doi.org/10.1016/j.apnr.2013.07.003

Howe, D. L., Chen, H. C., Heitner, K. L., & Morgan, S. A. (2018). Differences in nursing faculty satisfaction teaching online: A comparative descriptive study. *Journal of Nursing Education*, *57*(9), 536-543. https://doi.org/10.3928/01484834-20180815-05

Hunter, K., McGonigle, D., & Hebda, T. (2013). The integration of informatics content in baccalaureate and graduate nursing education: a status report. *Nurse Educator, 38*(3), 110-113. https://doi.org/10.1097/NNE.0b013e31828dc292

Hunter, L., Rorabauch, D., Stommel, J., Wharton, R., & Whitson, R. (2012). Digital humanities

made me a better pedagogue: a crowdsourced article. *Hybrid Pedagogy.* http://hybridpedagogy.org/digital-humanities-made-me-a-better-pedagogue-a-crowdsourced-article/

Hussey, P., & Hannah, K. J. (2021). Nursing Informatics: A Core Competency for the Profession. In K.J. Hannah, P. Hussey, M.A. Kennedy, M. Ball (Eds.), *Introduction to nursing introduction to nursing informatics* (5th ed., pp. 55-85). Springer. https://doi.org/10.1007/978-3-030-58740-6

Hussey P., Kennedy M.A., & Spencer A. (2015). History of computing and technology. In K. J. Hannah, P. Hussey, M. A. Kennedy, M. Ball. (Eds.), *Introduction to nursing informatics. Health informatics.* (4th ed., pp. 33-45). Springer.

Hwang, J. I., & Park, H. A. (2011). Factors associated with nurses' informatics competency. *CIN: Computers, Informatics, Nursing, 29*(4), 256-262. https://doi.org/10.1097/NCN.0b013e3181fc3d24

Hybrid Pedagogy (n.d.). *What is digital pedagogy?* http://hybridpedagogy.org/digitalpedagogy/

Ingraham, K. C., Davidson, S. J., & Yonge, O. (2018). Student-faculty relationships and its impact on academic outcomes. *Nurse Education Today*, *71*, 17-21.

International Council of Nurses. (2015). *Position statement: Nursing and social media.* https://www.icn.ch/sites/default/files/inline-files/E10a_Nurses_Social_Media.pdf

Institute of Medicine. (2000). *To err is human*. National Academies Press. https://www.nap.edu/read/9728/chapter/1

Institute of Medicine. (2001). *Crossing the quality chasm: A new health system for the 21st century*. National Academies Press. https://www.nap.edu/read/10027/chapter/1

Institute of Medicine. (2003). *Health professional education: A bridge to quality*. National Academies Press. https://pubmed.ncbi.nlm.nih.gov/25057657/

International Medical Informatics Association. (2009). *The nursing informatics special interest group-definition*. https://imianews.wordpress.com/2009/08/24/imia-ni-definition-of-nursing-informatics-updated/

Jack, K., Hamshire, C., & Chambers, A. (2017). The influence of role models in undergraduate nurse education. *Journal of Clinical Nursing*, *26*(23-24), 4707-4715. https://doi.org/10.1111/jocn.13822

Jackson, E. (2013). Choosing a methodology: Philosophical underpinning. *Practitioner Research in Higher Education*, *7*(1), 49-62.

Jeon, E., Kim, J., Park, H. A., Lee, J. H., Kim, J., Jin, M., ... & Yim, S. (2016). Current status of nursing informatics education in Korea. *Healthcare Informatics Research*, *22*(2), 142. https://doi.org/10.4258/hir.2016.22.2.142

Jensen, R., Meyer, L., & Sternberger, C. (2009). Three technological enhancements in nursing education: Informatics instruction, personal response systems, and human patient simulation. *Nurse Education in Practice, 9*(2), 86-90. https://doi.org/10.1016/j.nepr.2008.10.005

Jensen, R., Guedes, E. D. S., & Leite, M. M. J. (2016). Informatics competencies essential to decision making in nursing management. *Revista da Escola de Enfermagem da USP*, *50*(1), 109-117. https://doi.org/10.1590/S0080-623420160000100015

Jetté, S., Tribble, D. S.-C., Gagnon, J., & Mathieu, L. (2010). Nursing students' perceptions of

their resources toward the development of competencies in nursing informatics. *Nurse Education Today, 30,* 742–746. https://doi.org/10.1016/j.nedt.2010.01.016

Johansson, P., Petersson, G., Saveman, B. I., & Nilsson, G. (2014). Using advanced mobile devices in nursing practice–the views of nurses and nursing students. *Health Informatics Journal, 20*(3), 220-231. https://doi.org/10.1177/1460458213491512

Johnson, D. M., & Bushey, T. I. (2011). Integrating the academic electronic health record into nursing curriculum: Preparing student nurses for practice. *CIN: Computers, Informatics, Nursing, 29*(3), 133-137. https://doi.org/10.1097/NCN.0b013e3182121ed8

Johnson, L., Smith, R., Willis, H., Levine, A., & Haywood, K., (2011). *The 2011 Horizon Report*. The New Media Consortium. ED515956.pdf

Jones, S., & Donelle, L. (2011). Assessment of electronic health record usability with undergraduate nursing students. *International Journal of Nursing Education Scholarship*, *8*(1), 1–18. https://doi.org/10.2202/1548-923X.2123

Kaakinen, J., & Arwood, E. (2009). Systematic review of nursing simulation literature for use of learning theory. *International Journal of Nursing Education Scholarship, 6*(1). https://doi.org/10.2202/1548-923X.1688

Kala, S., Isaramalai, S. A., & Pohthong, A. (2010). Electronic learning and constructivism: A model for nursing education. *Nurse Education Today, 30*(1), 61-66. https://doi.org/10.1016/j.nedt.2009.06.002

Kanuka, H. (2008). Understanding e-learning technologies-in-practice through philosophies-in-practice. https://ustpaul.ca/uploadfiles/DistanceEducation/UNDERSTANDING_E_learning.pdf

Kennedy, G. E., Judd, T. S., Churchward, A., Gray, K., & Krause, K. L. (2008). First year

students' experiences with technology: Are they really digital natives? *Australasian Journal of Educational Technology*, *24*(1). https://doi.org/10.14742/ajet.1233

Kenny, R. F., Van Neste-Kenny, J. M., Burton, P. A., Park, C. L., & Qayyum, A. (2012). Using self-efficacy to assess the readiness of nursing educators and students for mobile learning. *The International Review of Research in Open and Distributed Learning, 13*(3), 277-296. https://doi.org/10.19173/irrodl.v13i3.1221

Keskin, N. O., & Metcalf, D. (2011). The current perspectives, theories and practices of mobile learning. *The Turkish Online Journal of Educational Technology, 10*, 202-208

Kinnunen, U. M., Rajalahti, E., Cummings, E., & Borycki, E. M. (2017). Curricula challenges and informatics competencies for nurse educators. *Forecasting informatics competencies for nurses in the future of connected health*, *232*, 41-48.

Kirby, M. (2002). The Health of Canadians – The Federal Role: Final Report. Health Canada. https://sencanada.ca/content/sen/committee/372/soci/rep/repoct02vol6-e.htm

Kleib, M., Chauvette, A., Furlong, K., Nagle, L., Slater, L., & McCloskey, R. (2021). Approaches for defining and assessing nursing informatics competencies: A scoping review. *JBI Evidence Synthesis*. https://doi.org/10.11124/JBIES-20-00100

Kleib, M., & Nagle, L. (2018a). Psychometric properties of the Canadian nurse informatics competency assessment scale. *CIN: Computers, Informatics, Nursing*, *36*(7), 359-365. https://doi.org/10.1097/CIN.0000000000000437

Kleib, M., & Nagle, L. (2018b). Factors associated with Canadian nurses' informatics competency. *CIN: Computers, Informatics, Nursing, 36*(8), 406-415. https://doi.org/10.1097/CIN.0000000000000434

Kleib, M., Zimka, O., & Olson, K. (2013). Status of informatics integration in baccalaureate

nursing education: A systematic review. *Canadian Journal of Nursing Research*, *45*(1), 138-154

Knoblauch, H. (2005). Focused ethnography. *Forum Qualitative Sozialforschung/forum: qualitative social research, 6*(3). https://doi.org/10.1177/084456211304500111

Knowles, M. S, Holton, E. F., & Swanson, R. A. (2005). *The adult learner: the definitive classic in adult education and human resource development*. (6th ed). Elsevier.

Korstjens, A. & Moser, J. (2018) Series: Practical guidance to qualitative research. Part 4: Trustworthiness and publishing, *European Journal of General Practice, 24*(1), 120-124. https://doi.org/10.1080/13814788.2017.1375092

Kowitlawakul, Y., Chang, S. W. C., Wang, L., & Wang, W. (2014). Exploring faculty perceptions towards electronic health records for nursing education. *International Nursing Review, 61*(4), 499-506. https://doi.org/10.1111/inr.12141

Krefting, L. (1991). Rigor in qualitative research: The assessment of trustworthiness. American *Journal of Occupational Therapy, 45*(3), 214-222. https://doi.org/10.5014/ajot.45.3.214

Kuiper, R. (2010). Metacognitive factors that impact student nurse use of point of care technology in clinical settings. *International Journal of Nursing Education Scholarship*, 7(1). https://doi.org/10.2202/1548-923X.1866

Kupferschmid, B., Creech, C., Lesley, M., & Schoville, R. (2020). Informatics experience can help predict doctor of nursing practice student mastery of informatics competencies. *CIN: Computers, Informatics, Nursing*, *38*(11), 590-596. https://doi.org/10.1097/CIN.0000000000000656

Lavoie, P., Michaud, C., Belisle, M., Boyer, L., Gosselin, E., Grondin, M., ... & Pepin, J. (2018). Learning theories and tools for the assessment of core nursing competencies in

simulation: A theoretical review. *Journal of Advanced Nursing*, *74*(2), 239-250. https://doi.org/10.1111/jan.13416

Lee, J. J., Carson, M. N., Clarke, C. L., Yang, S. C., & Nam, S. J. (2019). Nursing students' learning dynamics with clinical information and communication technology: A constructive grounded theory approach. *Nurse Education Today*, *73*, 41-47. https://doi.org/10.1016/j.nedt.2018.11.007

Lincoln, Y. S, & Guba, E. G. (1985). *Naturalistic inquiry*. Beverly Hills, CA: Sage Publications. https://doi.org/10.1016/0147-1767(85)90062-8

Lilly, K., Fitzpatrick, J., & Madigan, E. (2015). Barriers to integrating information technology content in doctor of nursing practice curricula. *Journal of Professional Nursing, 31*(3), 187-199. https://doi.org/10.1016/j.profnurs.2014.10.005

LoBiondo-Wood, G., Haber, J., Cameron, C., & Singh, M. D. (2018). *Nursing research in Canada: Methods, critical appraisal, and utilization*. (4th Canadian ed). Elsevier Canada.

Locsin, R. C., & Purnell, M. (2015). Advancing the theory of technological competency as caring in nursing: The universal technological domain. *International Journal for Human Caring*, *19*(2), 50-54. https://doi.org/10.20467/1091-5710-19.2.50

Machi, L. A., & McEvoy, B. T. (2016). *The literature review: Six steps to success.* Corwin Press. https://doi.org/10.1093/obo/9780199756810-0169

MacKay, B., Anderson, J., & Harding, T. (2017). Clinical education: Mobile technology in clinical teaching. *Nurse Education in Practice*, 221-6. https://doi.org/10.1016/j.nepr.2016.11.001

Mackenzie, N., & Knipe, S. (2006). Research dilemmas: Paradigms, methods and methodology. *Issues in Educational Research, 16*(2), 193-205.

Mangold, K. (2007). Educating a new generation: Teaching baby boomer faculty about millennial students. *Nurse Educator, 32*(1), 21-23. https://doi.org/10.1097/00006223-200701000-00007

Mahon, P. Y., Nickitas, D. M., & Nokes, K. M. (2010). Faculty perceptions of student documentation skills during the transition from paper-based to electronic health records systems. *Journal of Nursing Education*, *49*(11), 615-621. https://doi.org/10.3928/01484834-20100524-06

Mazankowski, D. A (2001). Framework for reform: Report of the premier's advisory council on health. https://archive.org/details/frameworkforrefo01albe

Merriam, S. B. (2001). Andragogy and self-directed learning: Pillars of adult learning theory. *New Directions for Adult and Continuing Education*, (89), 3-13. https://doi.org/10.1002/ace.3

McCannon, M., & O'Neal, P.V. (2003). Results of a national survey indicating information technology skills needed by nurses at time of entry into the workforce. *Journal of Nursing Education, 42*(8), 337-340. https://doi.org/10.3928/0148-4834-20030801-04

McGonigle, D., & Mastrian, K. G. (2015). *Nursing informatics and the foundation of knowledge.* Jones & Bartlett Publishers.

McGraw-Hill Education. (2017). *2017 Digital Study Trends Survey.* https://www.mheducation.com/highered/explore/studytrends.html

Macquire, D., Dale., L., & Pauli, M. (2020). *Learning and teaching reimagined: a new dawn for higher education.* Jisc. https://repository.jisc.ac.uk/8150/1/learning-and-teaching-reimagined-a-new-dawn-for-higher-education.pdf

McDowell, D. E., & Ma, X. (2007). Computer literacy in baccalaureate nursing students during

the last 8 years. *CIN: Computers, Informatics, Nursing*, *25*(1), 30-36. https://doi.org/10.1097/00024665-200701000-00010

McKinney, H.E., DeSantis, S., Mastrian, K., & McGonigle, D. (2017). Nursing informatics and nursing education. In K. Mastrian (Eds.), *Nursing informatics and the foundation of knowledge* (4th ed., pp.76-100). Jones & Bartlett Learning.

McNally, G., Frey, R., & Crossan, M. (2017). Nurse manager and student nurse perceptions of the use of personal smartphones or tablets and the adjunct applications, as an educational tool in clinical settings. *Nurse Education in Practice*, *23*, 1-7. https://doi.org/10.1016/j.nepr.2016.12.004

McNamara, C. (2009). *General guidelines for conducting interviews*. https://managementhelp.org/businessresearch/interviews.htm

McNeil, B. J., Elfrink, V. L., Bickford, C. J., Pierce, S. T., Beyea, S. C., Averill, C., & Klappenbach, C. (2003). Nursing information technology knowledge, skills, and preparation of student nurses, nursing faculty, and clinicians: A US survey. *Journal of Nursing Education, 42*(8), 341-349. https://doi.org/10.3928/0148-4834-20030801-05

McNeil, B. J., Elfrink, V. L., Pierce, S. T., Beyea, S. C., Bickford, C. J., & Averill, C. (2005). Nursing informatics knowledge and competencies: A national survey of nursing education programs in the United States. *International Journal of Medical Informatics, 74*(11-12), 1021-1030. https://doi.org/10.1016/j.ijmedinf.2005.05.010

McNeil, B. J., Elfrink, V., Beyea, S. C., Pierce, S. T., & Bickford, C. J. (2006). Computer literacy study: Report of qualitative findings. *Journal of Professional Nursing, 22*(1), 52-59. https://doi.org/10.1016/j.profnurs.2005.12.006

Miller. J., Shaw-Kokot. M., Boggin., T.,Crowell., K. E., Allergri, F. & ... Berrier. S.B. (2005). A

study of personal digital assistants to enhance undergraduate clinical nursing education. *Journal of Nursing Education,* (1), 19. https://doi.org/10.3928/01484834-20050101-04

Miller, L., Stimely, M., Matheny, P., Pope, M., McAtee, R., & Miller, K. (2014). Novice nurse preparedness to effectively use electronic health records in acute care settings: Critical informatics knowledge and skill gaps. *Online Journal of Nursing Informatics*, *18*(2).

Mills, D., & Morton, M. (2013). Being, seeing, writing: The role of fieldnotes. *Research Methods in Education: Ethnography in education* (pp. 77-93). Sage Publications Ltd. https://doi.org/10.4135/9781446251201

Montenery, S. M., Walker, M., Sorensen, E., Thompson, R., Kirklin, D., White, R., & Ross, C. (2013). Millennial generation student nurses' perceptions of the impact of multiple technologies on learning. *Nursing Education Perspectives*, *34*(6), 405-409. https://doi.org/10.5480/10-451

Morris, S. (2014). *What Is Digital Pedagogy?* https://www.seanmichaelmorris.com/what-is-digital-pedagogy/

Morris, T. L., & Hancock, D. R. (2013). Institute of Medicine core competencies as a foundation for nursing program evaluation. *Nursing Education Research, 34*(1), 29-33. https://doi.org/10.1097/00024776-201301000-00007

Morse, J. M. (1994). Designing funded qualitative research. In N. K Denzin, & L.S. Lincoln (Eds.), *Handbook of qualitative research* (2nd ed., pp.220-35). Sage.

Morse, J.M. (2007) Does health research warrant the modification of qualitative methods? *Qualitative Health Research, 17*(7), 863-865. https://doi.org/10.1177/1049732307306186

Nadelson, S. G., Zigmond, T., Nadelson, L., Scadden, M., & Collins, C. (2016). Fostering caring in undergraduate nursing students: An integrative review. *Journal of Nursing Education and Practice*, *6*(11), 7-14. https://doi.org/10.5430/jnep.v6n11p7

Nagle, L. M., & Clarke, H. F. (2004, January). Assessing informatics in Canadian schools of nursing. In M. Fieschi et al. (Eds), *Medinfo* (pp. 912-915). IOS Press.

Nagle, L.M., Crosby, K.C., Frisch, N., Borycki, E., Donelle, L., Hannah, K. … Shaben, T. (2014). Developing entry-to-practice nursing informatics competencies for registered nurses. In K. Saranto, C.A. Weaver, & P. Chang (Eds.), *Studies in Health Technology and Informatics* (pp.356-363). IOS Press.

Nagle, L. M., Kleib, M., & Furlong, K. (2020a). Digital health in Canadian schools of nursing Part A: Nurse educators' perspectives. *Quality Advancement in Nursing Education-Avancées en formation infirmière*, *6*(1), 4. https://doi.org/10.17483/2368-6669.1229

Nagle, L. M., Kleib, M., & Furlong, K. (2020b). Digital health in Canadian schools of nursing—Part B: Academic nurse administrators' perspectives. *Quality Advancement in Nursing Education-Avancées en formation infirmière*, *6*(3), 8. https://doi.org/10.17483/2368-6669.1256

National League for Nursing. (2008). *Preparing the next generation of nurses to practice in a technology-rich environment: An informatics agenda.* https://www.nln.org/docs/default-source/professional-development-programs/preparing-the-next-generation-of-nurses.pdf?sfvrsn=6

National League for Nursing. (2015). *A vision for the changing faculty role: Preparing students for the technological world of healthcare*. a-vision-for-the-changing-faculty-role-preparing-students-for-the-technological-world-of-health-care.pdf (nln.org)

Nelson, R. (2018). Evolution of the nelson data, information, knowledge and wisdom model: Part 1. *The Online Journal of Issues in Nursing, 23*(3).

Nelson, R., & Staggers, N. (2016). *Health Informatics-E-Book: An Interprofessional Approach*. Elsevier Health Sciences.

Nguyen, D. N., Zierler, B., & Nguyen, H. Q. (2011). A survey of nursing faculty needs for training in use of new technologies for education and practice. *Journal of Nursing Education, 50*(4), 181-189. https://doi.org/10.3928/01484834-20101130-06

Nursing Council of New Zealand. (2007). *Competencies for registered nurses.* https://www.nursingcouncil.org.nz/Public/Nursing/Scopes_of_practice/Registered_Nurse/NCNZ/nursing-section/Registered_nurse.aspx

O'Connor, S., & Andrews, T. (2018). Smartphones and mobile applications (apps) in clinical nursing education: A student perspective. *Nurse Education Today*, *69*, 172-178. https://doi.org/10.1016/j.nedt.2018.07.013

O'Connor, S., & LaRue, E. (2021). Integrating informatics into undergraduate nursing education: A case study using a spiral learning approach. *Nurse Education in Practice*, *50*, 102934. https://doi.org/10.1016/j.nepr.2020.102934

Oermann, M. H. (2015). Technology and teaching innovations in nursing education: Engaging the student. *Nurse Educator, 40*(2), 55-56. https://doi.org/10.1097/NNE.0000000000000139

Ornes, L. L., & Gassert, C. (2007). Computer competencies in a BSN program. *Journal of Nursing Education, 46*(2), 75-78. https://doi.org/10.3928/01484834-20070201-07

Parker, B. C., & Myrick, F. (2009). A critical examination of high-fidelity human patient

simulation within the context of nursing pedagogy. *Nurse Education Today*, *29*(3), 322-329. https://doi.org/10.1016/j.nedt.2008.10.012

Patel, S. (2015). The research paradigm–methodology, epistemology and ontology–explained in simple language. *Healthcare, Technology, Participation, Research and a PhD*. http://salmapatel.co.uk/academia/the-research-paradigm-methodology-epistemology-and-ontology-explained-in-simple-language

Patton, M. Q. (2015). *Qualitative research & evaluation methods: integrating theory and practice* (4th ed.).SAGE Publications, Inc.

Peters, K. (2009). M-learning: positioning educators for mobile, connected future. In Ally, M. (Ed.). *Mobile learning: Transforming the delivery of education and training* (pp. 103-132). Athabasca University Press.

Peltonen, L. M., Pruinelli, L., Ronquillo, C., Nibber, R., Peresmitre, E. L., Block, L., ... & Topaz, M. (2019). The current state of Nursing Informatics–An international cross-sectional survey. *Finnish Journal of eHealth and eWelfare*, *11*(3), 220-231. https://doi.org/10.23996/fjhw.77584

Pettigrew, M. (2015). Learning and Students. In M. H. Oermann (Ed). *Teaching in nursing and role of the educator* (pp. 15-33). Springer.

Phillippi, J., & Lauderdale, J. (n.d). A guide to field notes for qualitative research: Context and Conversation. *Qualitative Health Research, 28*(3), 381-388. https://doi.org/10.1177/1049732317697102

Pilarski, T. (2010). Where is nursing informatics in undergraduate nursing education. *CJNI: Canadian Journal of Nursing Informatics*, *5*.

Pobocik, T. (2015). Using an educational electronic documentation system to help nursing

students accurately identify patient data. *International Journal of Nursing Knowledge*, *26*(1), 26-34. https://doi.org/10.1111/2047-3095.12032

Pottenger, W.M. & Hemmendinger, D. (2018). *Computer*. Encyclopedia Britannica, inc. https://www.britannica.com/technology/computer

Prensky, M. (2001). Digital natives, digital immigrants part 1. *On the Horizon*, *9*(5), 1-6. https://doi.org/10.1108/10748120110424816

Pringle, D. & Nagle, L. (2009). Leadership for the information age: The time for action is now. *Nursing Leadership*, *22*(1), 1-6. http://www.longwoods.com/product.php?productid=20849&cat=601&page=1

Raman, J. (2015). Review: Mobile technology in nursing education: Where do we go from here? A review of the literature. *Nurse Education Today, 35*, 663–672. https://doi.org/10.1016/j.nedt.2015.01.018

Regan, P. M., & Jesse, J. (2019). Ethical challenges of edtech, big data and personalized learning: Twenty-first century student sorting and tracking. *Ethics and Information Technology*, *21*(3), 167-179. https://doi.org/10.1007/s10676-018-9492-2

Registered Nurses' Association of Ontario. (2012). *RNAO nurse educator eHealth resource for the integration of eHealth into undergraduate nursing curricula.* https://rnao.ca/ehealth/educator_resource

Registered Nurses Association of Ontario. (2016). *Practice education in nursing.* https://rnao.ca/sites/rnao-ca/files/SHWE_Practice_Education_BPG_WEB_0.pdf

Registered Nurses Association of Ontario & Associated Medical Services. (2020). *Nursing and compassionate care in the age of artificial intelligence: Engaging in the emerging future.*

https://rnao.ca/sites/rnao-ca/files/RNAO-AMS_Report-Nursing_and_Compassionate_Care_in_the_Age_of_AI_Final_For_Media_Release_10.21.2020.pdf

Repique, R. J. R. (2007). Computers and information technologies in psychiatric nursing. *Perspectives in Psychiatric Care*, *43*(2), 77-83. https://doi.org/10.1111/j.1744-6163.2007.00083.x

Repsha, C., Morse, B., Lee, S. E., Katz, J., Burrows, E., & Teates, J. (2020). Use of a simulated electronic health record to support nursing student informatics knowledge and skills. *CIN: Computers, Informatics, Nursing*, 38(2), 55-59. https://doi.org/10.1097/CIN.0000000000000618

Remus, S., & Kennedy, M. A. (2012). Innovation in transformative nursing leadership: nursing informatics competencies and roles. *Nursing Leadership*, *25*(4), 14-26. https://doi.org/10.12927/cjnl.2012.23260

Risling, T. (2017). Educating the nurses of 2025: Technology trends of the next decade. *Nurse Education in Practice*, *22*, 89-92. https://doi.org/10.1016/j.nepr.2016.12.007

Roller, M. (2014). Reflections from the field: Questions to stimulate reflexivity among qualitative researchers. *Research Design Review.* http://www.rollerresearch.com/MRR%20WORKING%20PAPERS/Qualitative%20Research%20Design-2014.pdf

Romanow, R.J. (2002). *Commission on the future of healthcare in Canada. Building on values: The future of healthcare in Canada*. http://publications.gc.ca/site/eng/237274/publication.html

Roney, L. N., Westrick, S. J., Acri, M. C., Aronson, B. S., & Rebeschi, L. M. (2017).

Technology use and technological self-efficacy among undergraduate nursing faculty. *Nursing Education Perspectives*, *38*(3), 113-118. https://doi.org/10.1097/01.NEP.0000000000000141

Roper, J. M., & Shapira, J. (2000). *Ethnography in nursing research* (Vol. 1). Sage. https://doi.org/10.4135/9781483328294

Rossing, J. P., Miller, W. M., Cecil, A. K., & Stamper, S. E. (2012). iLearning: The future of higher education? Student perceptions on learning with mobile tablets. *Journal of the Scholarship of Teaching and Learning, 12*(2), 1-26.

Rourke, L., Schmidt, M. & Garga, N. (2010). Theory-based research of high fidelity simulation use in nursing education: A review of the literature. *International Journal of Nursing Education Scholarship, 7*(1), 1-14. https://doi.org/10.2202/1548-923X.1965

Saba, V. K., & McCormick, K. A., (2006). *Essentials of nursing informatics* (4th ed.). McGraw-Hill, Medical Publishing Division.

Saba, V. K., & Westra, B. L. (2011). Historical perspectives of nursing informatics. In V.K. Saba & K.A. McCormick, *Essentials of* nursing *informatics* (5th ed., pp. 45-57). McGraw-Hill Medical.

Sanches, L. M. P., Jensen, R., Monteiro, M. I., & Lopes, M. H. B. D. M. (2011). Informatics teaching in undergraduate nursing programs at Brazilian public institutions. *Revista latino-americana de enfermagem*, *19*(6), 1385-1390. https://doi.org/10.1590/S0104-11692011000600015

Sandars, J. (2012). Technology and the delivery of the curriculum of the future: Opportunities and challenges. *Medical Teacher*, *34*(7), 534-538. https://doi.org/10.3109/0142159X.2012.671560

Sandelowski, M. (1986). The problem of rigor in qualitative research. *Advances in Nursing Science, 3*, 27. https://doi.org/10.1097/00012272-198604000-00005

Sanko, J. S., & MckKy, M. (2017). Impact of simulation-enhanced pharmacology education in prelicensure nursing education. *Nurse Educator, 42*(5S), S32-S37. https://doi.org/10.1097/NNE.0000000000000409

Saranto, K., & Hovenga, E. J. (2004). Information literacy—what it is about?: Literature review of the concept and the context. *International Journal of Medical Informatics, 73*(6), 503-513. https://doi.org/10.1016/j.ijmedinf.2004.03.002

Saranto, K. & Tallberg, M. (1998). Nursing informatics in nursing education: A challenge to nurse teachers. *Nurse Education Today*, *18*, 79-87. https://doi.org/10.1016/S0260-6917(98)80038-5

Savage, J. (2006). Ethnographic evidence: The value of applied ethnography in healthcare. *Journal of Research in Nursing, 11*(5), 383-393. https://doi.org/10.1177/1744987106068297

Schensul, J. J., & LeCompte, M. D. (2012). *Essential ethnographic methods: A mixed methods approach*. AltaMira Press.

Scholes, M. & Barber, B. (1980). Towards nursing informatics. In DAD Lindberg. & S. Kaihara (Eds.), *MEDINFO 80*. (pp. 70-73).

Schunk, D. H. (2012). *Learning theories.* (6th ed.). Pearson.

Sharp, J. H. (2006). Development, extension, and application: a review of the technology acceptance model. *Director*, *7*.

Sharples, M., Taylor, J., & Vavoula, G. (2005). Towards a theory of mobile learning. *Proceedings of mLearn (1)*,1-9.

Shin, E. H., Cummings, E., & Ford, K. (2018). A qualitative study of new graduates' readiness to use nursing informatics in acute care settings: Clinical nurse educators' perspectives. *Contemporary Nurse*, *54*(1), 64-76. https://doi.org/10.1080/10376178.2017.1393317

Shin, H., Rim, D., Kim, H., Park, S., & Shon, S. (2019). Educational characteristics of virtual simulation in nursing: An integrative review. *Clinical Simulation in Nursing*, *37*, 18-28. https://doi.org/10.1016/j.ecns.2019.08.002

Simpson, R. L. (2002). The virtual reality revolution: Technology changes nursing education. *Nursing Management*, *9,* 14-15. https://doi.org/10.1097/00006247-200209000-00007

Sinacori, B. C. (2020). How nurse educators perceive the transition from the traditional classroom to the online environment: A qualitative inquiry. *Nursing Education Perspectives*, *41*(1), 16-19. https://doi.org/10.1097/01.NEP.0000000000000490

Skiba, D. J. (2005). The Millennials: Have they arrived at your school of nursing? *Nursing Education Perspectives, 26*(6), 370-371.

Smart, D., Ross, K., Carollo, S., & Williams-Gilbert, W. (2020). Contextualizing instructional technology to the demands of nursing education. *CIN: Computers, Informatics, Nursing*, *38*(1), 18-27. https://doi.org/10.1097/CIN.0000000000000565

Smith, T. (2013). Entering the conversation of qualitative research. In S. Tracy (Ed.), *Qualitative Research Methods: Collecting evidence, Crafting Analysis, Communicating Impact Account* (pp. 123-130). Blackwell Publishing.

Smith, E. L., Cronenwett, L., & Sherwood, G. (2007). Current assessments of quality and safety education in nursing. *Nursing Outlook, 55*(3), 132-137. https://doi.org/10.1016/j.outlook.2007.02.005

Staggers, N., Gassert, C. A., & Curran, C. (2001). Informatics competencies for nurses at four

levels of practice. *Journal of Nursing Education, 40*(7), 303-315. https://doi.org/10.3928/0148-4834-20011001-05

Staggers, N., Gassert, C. A., & Curran, C. (2002). A Delphi study to determine informatics competencies for nurses at four levels of practice. *Nursing Research, 51*(6), 383-390.

Staggers, N., & Thompson, C. B. (2002). The evolution of definitions for nursing informatics: A critical analysis and revised definition. *Journal of the American Medical Informatics Association : JAMIA, 9*(3), 255–261. http://doi.org/10.1197/jamia.M0946

Stephens-Lee, C., & Lu, D. F. (2013). Preparing students for an electronic workplace. *Online Journal of Nursing Informatics*, *17*(3).

Strawser, M. (2017). *New media and digital pedagogy: Enhancing the twenty-first-century classroom*. Lexington Books.

Strouse, S. M., & Nickerson, C. J. (2016). Professional culture brokers: Nursing faculty perceptions of nursing culture and their role in student formation. *Nurse Education in Practice*, *18*, 10-15. https://doi.org/10.1016/j.nepr.2016.02.008

Strudwick, G., Nagle, L. M., Morgan, A., Kennedy, M. A., Currie, L. M., Lo, B., & White, P. (2019). Adapting and validating informatics competencies for senior nurse leaders in the Canadian context: Results of a Delphi study. *International Journal of Medical Informatics*, *129*, 211-218. https://doi.org/10.1016/j.ijmedinf.2019.06.012

Strudwick, G., Wiljer, D., Inglis, F. (2020). *Nursing and compassionate care in a technological world: A discussion paper*. AMS healthcare. https://www.ams-inc.on.ca/wp-content/uploads/2020/02/Nursing-and-Compassionate-Care.pdf

Sullo, E., & Gomes, A. W. (n.d.). A profession without limits: The changing role of reference Librarians. *Medical Reference Services Quarterly*, *35*(2), 145–157. https://doi.org/10.1080/02763869.2016.1152141

Sword, T. S. (2012). The transition to online teaching as experienced by nurse educators. *Nursing Education Perspectives*, *33*(4), 269-271.https://doi.org/10.5480/1536-5026-33.4.269

Tacy, J. W., Northam, S. S., & Wieck, K. L. (2016). Understanding the effects of technology acceptance in nursing faculty: A hierarchical regression. *On-Line Journal of Nursing Informatics, 20*(2).

Taylor, B. & Kroth, M. (2009). Andragogy's transition into the future: Meta-analysis of andragogy and its search for a measurable instrument. *Journal of Adult Education, 38*(1).

TechTarget. (2018). Web 2.0. https://whatis.techtarget.com/definition/Web-20-or-Web-2

Thede, L. Q, & Sewell, J. P. (2010). *Informatics and nursing: Competencies & applications* (3rd ed). Wolters Kluwer Health/Lippincott Williams & Wilkins.

Thompson, B. W., & Skiba, D. J. (2008). Informatics in the nursing curriculum: A national survey of nursing informatics requirements in nursing curricula. *Nursing Education Perspectives, 29*(5), 312-317.

Theron, M., Redmond, A., & Borycki, E. M. (2017). Baccalaureate nursing students' abilities in critically identifying and evaluating the quality of online health information. *Studies in Health Technology and Informatics*, *234*, 321-327.

Tubaishat, A. (2014). An investigation into the attitudes of nursing students toward technology. *Journal of Nursing Research, 22*(2), 119-125. https://doi.org/10.1097/jnr.0000000000000029

Turley, J. P. (1996). Toward a model for nursing informatics. *IMAGE: The Journal of Nursing Scholarship*, *28*(4), 309-313. https://doi.org/10.1111/j.1547-5069.1996.tb00379.x

Turner III, D. W. (2010). Qualitative interview design: A practical guide for novice investigators. *The Qualitative Report, 15*(3), 754.

van Houwelingen, C. T., Moerman, A. H., Ettema, R. G., Kort, H. S., & ten Cate, O. (2016). Competencies required for nursing telehealth activities: A Delphi-study. *Nurse Education Today*, *39*, 50-62. https://doi.org/10.1016/j.nedt.2015.12.025

Vargo-Warran, J. (2016). *A quantitative study of nursing faculty's personal and professional use of technology* [Unpublished doctoral dissertation]. University of Phoenix.

Verma, M. P., & Gupta, S. (2019). Competency in informatics for nursing professional in India: Imbibing the tech-culture among nursing professionals. *Amarjeet Kaur Sandhu*, *11*(1), 67.

Wall, S. (2014). Focused ethnography: A methodological adaption for social research in emerging contexts. *Forum: Qualitative Social Research, 16*(1), 102–116.

Webb, L., Clough, J., O'Reilly, D., Wilmott, D., & Witham, G. (2017). The utility and impact of information communication technology (ICT) for pre-registration nurse education: A narrative synthesis systematic review. *Nurse Education Today*, *48*, 160-171. https://doi.org/10.1016/j.nedt.2016.10.007

Weiner, E. E., & Trangenstein, P. A. (2009). The emerging role of educational informatics. *Studies in Health Technology and Informatics*, *146*, 567–571.

Westra, B. L., & Delaney, C. W. (2008). Informatics competencies for nursing and healthcare leaders. *AMIA Annual Symposium Proceedings*. American Medical Informatics Association.

White, A., Allen, P., Goodwin, L., Breckinridge, D., Dowell, J., & Garvy, R. (2005). Infusing PDA technology into nursing education. *Nurse Educator, 30*(4), 150-154. https://doi.org/10.1097/00006223-200507000-00006

Williamson, K. M., & Muckle, J. (2018). Students' perception of technology use in nursing education. *CIN: Computers, Informatics, Nursing*, *36*(2), 70-76. https://doi.org/10.1097/CIN.0000000000000396

Willis, J. W. (2007). *Foundations of qualitative research: Interpretive and critical approaches.* Thousand Oaks, CA: Sage. https://doi.org/10.4135/9781452230108

Wingo, N. P., Peters, G. B., Ivankova, N. V., & Gurley, D. K. (2016). Benefits and challenges of teaching nursing online: Exploring perspectives of different stakeholders. *Journal of Nursing Education*, *55*(8), 433-440. https://doi.org/10.3928/01484834-20160715-03

Zimmermann, K. A. (2017). *History of computers: A brief timeline*. https://www.livescience.com/20718-computer-history.html

Appendix A

Letter of Request for Permission

To: Deans, and Associate Deans of Nursing Program(s)

RE: Requesting Permission to Conduct A Research Study: *A Focused Ethnography to Explore Nursing Faculty Experiences in Integrating Digital/Informatics Tools s to Support Undergraduate Students' Learning and the Development of Informatics Competencies.*

Hello,

I am a doctoral nursing student at the University of Alberta. I am writing to request your permission to communicate with your nursing faculty and invite each one to participate in this focused ethnography study, which aims to explore nursing faculty experiences in integrating digital/informatics tools and the development of informatics competencies in undergraduate nursing programs. Digital/informatics tools include but are not limited to learning management systems, e-books, classroom response systems, academic electronic health records, You Tube, mobile devices, electronic health records, etc.

I am looking to interview nursing faculty who teach in your undergraduate program. During the semi-structured one-on-one interview, I will ask faculty interested in participating questions about their experiences of integrating digital/informatics tools and the development of nursing informatics competencies. The interview will take about 60 minutes either by telephone or through Skype for Business™. I may need to follow-up with faculty again by telephone, or through Skype for Business™, which may take about 30 minutes. I will also ask faculty to share sections of their course syllabi, teaching plans and outlines of learning activities. This will allow me the opportunity to understand what types digital/informatics tools they use. Finally, I will ask faculty to read the interview transcripts to ensure the information is correct from their interview. A research ethics review board at the University of Alberta has reviewed and approved this study. (Please see attachment: University of Alberta Ethics Board Approval Letter).

The risk of participating in this study is no more than what is experienced in everyday life. Although, there is no payment or other reward for participation in this study, participation may contribute to nursing informatics knowledge and support change in nursing undergraduate education. Interested faculty members interested in participating in this research will be provided with an information letter and an informed consent prior to carrying out the interviews.

I would like to assure you that all data collected in this study including field notes, interview transcripts, and textual analysis of the course syllabi, teaching plans and outlines of learning activities will be treated with utmost confidence. Additionally, in the transcripts, field notes, and in future dissemination of the findings, the name of your institution and the names of

participating faculty will not be used publicly. I will not include any identifiable features of faculty, or institution in study reports.

Upon receiving your permission to conduct this study at your facility, I would like to contact you again to assist me in disseminating recruiting materials to your faculty members or suggest a designate person that I could coordinate recruitment activities with.
Recruitment will likely start in the month of _____.

I will provide two methods for recruiting faculty members: (1) a poster invitation and (2) an email invite as described below:
(1) Recruitment Poster: This document has research information. This poster could be displayed on faculty bulletin boards in the nursing building. (Please see attached).
(2) An Email Invite: The "Email Invitation Text" could either be copied/pasted into an email message to share with faculty members, or simply be shared as an attachment. A follow-up email to faculty members may be required two weeks after the initial email to participate in the study.

I look forward to hearing from you regarding your permission to conduct this study, and any specific permission conditions pertaining to the conduct of this research, if any. My email address is *chauvett@ualberta.ca*.

Thank you for your consideration of my request. I look forward to hearing from you.
Respectfully,
Amelia Chauvette PhD (candidate), RN

Appendix B

Email Invitation to Participate in Research Study to Faculty

Dear Nursing faculty,

My name is Amelia Chauvette, I am PhD student at the University of Alberta in the Faculty of Nursing. I invite you to participate in this research study because you are a faculty member. The purpose of this study is to explore nursing faculty experiences in integrating digital/informatics tools to support student's learning in undergraduate nursing program and the development of informatics competencies. Digital/informatic tools include but not limited to learning management systems, e-books, classroom response systems, academic electronic health records, You Tube, mobile devices, etc. You do not need to use digital/informatics tools to participate in this study. I have permission from your dean or associate dean (NAME will be inserted) to use your school of nursing as a research site.

This focused ethnography study consists of a one-on-one interview lasting about 60 minutes at a mutually agreed date and time. The interview can be through telephone or Skype for Business™. We will ask you several general questions about you. Then, we will ask you if and how you integrate digital/informatics tools in your teaching. There may a need for a follow up interview again by telephone, through Skype for Business ™. This will be a short interview. We will schedule one at your convenience. We will also ask that you read the interview transcripts. This review will give you an opportunity to verify what you said in the interview and to clarify or add information, if needed. In addition, we will ask you to share sections of your course outlines, teaching plans and outlines of learning activities.

Your input is greatly valued and will help contribute to the limited research available on this topic. If you have any questions, or wish to participate in this study, please do not hesitate to contact: Amelia Chauvette at 250-305-7893 or email me at chauvett@ualberta.ca. Or one of my thesis supervisors: Dr. Pauline Paul Tel: (780) 492-7479; email ppaul@ualberta.ca or Dr. Manal Kleib, Tel: (780) 248-1422; email kleib@ualberta.ca

Thank you for considering participation in this interview. This research has been reviewed and approved by Research Ethics Board from the University of Alberta. If you have any ethical concerns regarding how this study is being conducted, you may contact the University of Alberta's Research Ethics office at (780) 492-2615.

Sincerely,

Amelia Chauvette PhD (candidate), RN

Appendix C

Participant Communication—Initial Contact

Dear,_____

Thank you for your interest in my study, I look forward to our first meeting. During our first meeting, I will introduce myself. I will talk with you about the purpose of the study, and I will make sure you have the information you need to make an informed decision to participate in this study. In addition, I will ask you several general questions about you and your work as a faculty member.

I have included the informed consent in this email. Please read through the consent thoroughly. If you have questions about the consent, please contact me, and we can talk either by telephone, through Skype for Business™ or you can email me. Please let me know of if any accommodations are needed for you to provide informed consent. If you don't have any questions or points to clarify, please sign the consent form and send it back to me by email. Please provide me with your preferred contact information and I will contact you to set up our first meeting.

Thank you for your time. I look forward to hearing from you.

Amelia Chauvette PhD (candidate), RN

Appendix D

Email Reminder

Dear Nursing faculty members,

On (DATE will be inserted), you received an email to participate in a study regarding the use of digital/informatics tools and the development of informatics competencies in nursing education. We wanted to send you a quick reminder about this study.

Briefly, the study involves examining nursing faculty experiences in integrating digital/informatics tools and the development of informatics in undergraduate nursing program. Digital/informatics tools include learning management systems, e-books, interactive Whiteboards, classroom response systems, academic electronic health records, You Tube, etc. The study consists of a one-on-one interview lasting about 60 minutes at a mutually agreed location, date and time. The interview can be in person, by telephone or through Skype for Business™. We will ask you some general questions about you. Then, we will ask you if and how you integrate digital/informatics tools in your teaching. If there is, a need for a follow up interview we will schedule one at your convenience. This will be a short interview via telephone or through Skype for Business™. We will also ask that you read the interview transcripts. This review will give you an opportunity to verify what you said in the interview and to clarify or add information, if needed. In addition, we will ask you to share sections of your course outlines, teaching plans and outlines of learning activities. Finally, we will ask you to visit your office, and a typical classroom or lab. Your input is greatly valued and will help contribute to the limited research available on this topic. The deadline for participation is (DATE will be inserted).

If you are interested in participating in this research or if you have any questions regarding this research study, please contact me at 250-305-7893 email me at chauvett@ualberta.ca. Or one of my supervisors: Dr. Pauline Paul Tel: (780) 780-492-7479; email ppaul@ualberta.ca or Dr. Manal Kleib, Tel: (780) 248-1422; email kleib@ualberta.ca Thank you for your time. I look forward to hearing from you.

Amelia Chauvette PhD (candidate), RN

Appendix E

Recruitment Poster

You are invited to Participate in a Research Study Titled:

A Focused Ethnography to Explore Nursing Faculty Experiences in Integrating Digital/Informatics Tools to Support Undergraduate Students' Learning and the Development of Informatics Competencies

We interested in hearing about how and if you integrate digital/informatics tools in the classroom, lab or in clinical. Digital/informatics tools include not limited to learning management systems, e-books, classroom response systems, electronic health records, You Tube, mobile devices, etc. You do not need to have experience with these tools to participate in the study.

This study has been reviewed and approved by Research Ethics Board at the University of Alberta (study number Pro00091981). If you have any ethical concerns regarding how this study is being conducted, you may contact the University of Alberta's Research Ethics office at (780) 492-2615.

To find out more about this study, please contact Amelia Chauvette at 250-762-5445 (ext:3291) or e-mail chauvett@ualberta.ca

Amelia Chauvette chauvett@ualberta.ca
Amelia Chauvette chauvett@ualberta.ca
Amelia Chauvette chauvett@ualberta.ca
Amelia Chauvette chauvett@ualberta.ca
Amelia Chauvette chauvett@ualberta.ca
Amelia Chauvette chauvett@ualberta.ca

Appendix F

Interview Guide

I will use this interview guide to direct the interview process to ensure consistency for each interview. After reviewing the purpose of the study, risks/benefits associated with this research and permission to digitally tape the interview, I will begin the interview asking a few demographic and general questions. These include age, years of nursing experience, years of teaching experience, role/job title and position/rank, undergraduate teaching responsibilities, & best method for communication with the researcher. Lastly, the interview guide displays the alignment of interview questions to the research question.

Date:_____
Location:_____
Interviewee: anonymity
Interviewer:_____
Start time:_____End time:_____

Demographic questions:

1. Note participant gendre **M F**

2. Can you tell me what age group you belong to?
   - 20-25 years
   - 26-30 years
   - 31-35 years
   - 36-40 years
   - 41-45 years
   - 46-50 years
   - >50 years

3. How long have you been a nurse?

4. How long have you been teaching in an undergraduate nursing program?

5. What is your position within the faculty of nursing?
   - Full-time tenure track
   - Full-time contractual
   - Part-time contractual
   - Sessional

6. If tenure track, what is your rank?
   - Assistant professor
   - Associate professor
   - Professor
   - Lecturer
7. Most of your undergraduate teaching responsibilities are:
   - Classroom only (includes on-line)
   - Clinical only
   - Classroom & Clinical
   - Skills lab/ simulation

   Other: _____

8. What is the best way to communicate with you?
   - e-mail
   - text
   - phone
   - in person

Overarching question: "What are the experiences of nursing faculty in integrating digital/informatics tools to support undergraduate students' learning and the development of informatics competencies?"

1. Tell me about your experiences of integrating digital/informatics tools in nursing education.

   a. What is your understanding of digital/informatics tools for teaching and learning?
   b. How are you currently using digital/informatics tools in your teaching and learning?
      Probe: What are your thoughts on using digital/informatics tools in the classroom vs. using these tools in the clinical environment or in the lab?
      Probe: Could you give me details about how you do this? Learning activities/assignments/digital/informatics tools (academic electronic health records, simulation, computer assisted instruction)
   c. How do you perceive the usefulness of digital/informatics tools in nursing education?
   d. What do you perceive as enabling factors to integrating digital/informatics tools into your teaching?
      Probe: What are your thoughts on using digital/informatics tools in the classroom, in the clinical environment /or in the lab
      Probe: Which would you say was/is more beneficial to you? How so?

   e. What do you perceive as hindering factors to integrating digital/informatics tools into your teaching?
      Probe: What are your thoughts on using digital/informatics tools in the classroom, in the clinical environment, or in the lab

Probe: Which would you say was/is more challenging to you? How so?
Probe: What are the factors leading you to integrate or not integrate digital/informatics tools into teaching?

2. What theoretical perspectives about teaching and learning are appealing to you?
   Prompt: behaviourist, cognitive, constructivist or other perspectives.

   a. From your perspective, could you tell me more about how this teaching perspective supports your decision to integrate of digital/informatics tools in teaching and learning?

The next few questions relate to nursing informatics.

3. Are you familiar with Canadian Association of School of Nursing Entry-to-Practice Nursing Informatics Competencies?

4. What is your understanding of nursing informatics and its importance in nursing education?

5. How are you integrating nursing informatics into your courses?
   a. Probes: theory/clinical/lab
   b. Probe: Could you give me details about how you do this?
   c. Probe: Could you tell me more about (repeat what participant said)?

6. How do you perceive using digital/informatics tools to support the integration of nursing informatics competencies in nursing education?
   a. Probe: for students' acquisition of nursing informatics competencies?
   b. Probe Can you tell me more about…?

7. How do you perceive the use of digital/informatics tools for learning and teaching purposes enhance students' informatics competencies?
   Probe: Could you give me details about how you do this? Learning activities/assignments/ digital/informatics tools (academic electronic health records, simulation, computer assisted instruction)
   Probe: Could you tell me more about (repeat what participant said)?

8. If any, would you like to share any insight regarding integrating digital/informatics tools into your instruction?

9. Other questions or comments?

The following prompts may be used during the interviews:

- Could you describe for me what you did when you ...?

- Could you describe for me what that involved? or what was going on?
- Could you tell me more about (repeat what participant said)?
- You mentioned several things that you did [I will list/repeat them]
- You said that you would [repeat most recent thought that the participant described].

Notes/comments/memos during interview including non-verbal behaviour.

Appendix G

Information Letter and Consent Form

Study Title: *A Focused Ethnography to Explore Nursing Faculty Experiences in Integrating Digital/Informatics Tools to Support Undergraduate Students' Learning and the Development of Informatics Competencies*

Research Investigator: Amelia Chauvette PhD (candidate), RN
2402 Westwood drive
Penticton, BC
V2A 8Y8
Email: chauvett@ualberta.ca

Co-Supervisors:

Pauline Paul, PhD, RN
Professor
Faculty of Nursing
University of Alberta
3rd Floor Clinical Sciences Building
Edmonton, Alberta
T6G 2G3
Tel:(780) 492-7479
Email: ppaul@ualberta.ca

Manal Kleib, PhD, RN
Assistant Professor
Faculty of Nursing
University of Alberta
3rd Floor Clinical Sciences Building
Edmonton, Alberta
T6G 2G3
Tel: (780) 248-1422
Email: kleib@ualberta.ca

Dear _____

My name is Amelia Chauvette, I am PhD student at the University of Alberta in the Faculty of Nursing.

Background and Purpose:
We are inviting to participate in this research study because you are a faculty member teaching in an undergraduate nursing program. The purpose of this study is to explore nursing faculty experiences in integrating digital/informatics tools to support students' learning in undergraduate nursing program and the development of informatics competencies.

Study Procedures.
The study consists of a one-on-one interview lasting about 60 minutes. We will ask you several general questions about you. Then, we will ask you if and how you integrate digital/informatics tools in your teaching. The interview can be by telephone or through Skype for Business™.

We will record the interviews and will take notes. If there is a need for a follow up interview, we will

schedule one at your convenience. This will be a short interview via telephone and Skype for Business ™. We will also ask that you read the interview transcripts. This review will give you an opportunity to verify what you said in the interview and to clarify or add information, if needed. In addition, we will ask you to share sections of your course outlines, teaching plans and outlines of learning activities. Finally, we will ask you to visit your office, and a typical classroom or lab.

Benefits:
There are no direct benefits to you to take part in this study. One benefit of participating may be that you find our discussion about the use of digital/informatics tools and its competencies useful to you. The greatest benefits will be your contribution to future nursing informatics initiatives.

Risks:
There are no known risks to being in this study. If we learn of any risks that may affect your willingness to continue being in the study, we will inform you immediately.

Voluntary Participation
We would appreciate your participation in this study. However, you are under no obligation to participate. You are free to withdraw your consent at any time. You may decide not to answer any questions you do not wish to answer. The study is completely voluntary.

You can withdraw from the study at any time without giving me a reason. If you withdraw from this study, we will not use the information you have provided us will destroy the data immediately, as long as withdrawal occurs no later than two weeks after data transcription.

Confidentiality & Anonymity
We will keep the information you give us confidential. My co-supervisors and I will be the only people who will have access to your information. We will encrypt and password protect all research data. We will store the information we receive from you in a locked filing cabinet at Okanagan College-Penticton campus and on a computer that is password protected. We will keep all data for five years after the study is finished, and then will discard it in a way that will not identify you.

We will assign a unique identifier code to your responses. We will keep the list connecting your name to this code in an encrypted and password protected file. We will first report the result of this study in my thesis. We plan to present our finding at conferences and in professional journals.

If you are interested in receiving a copy of the research findings, email me at chauvett@ualberta.ca. There is a potential that the data collected for this study may be used for further research. If so, ethics approval will be first sought by a Research Ethics Board.

Further Information:
This study has been reviewed and received ethics clearance by Research Ethics Board at the University of Alberta. If you have any questions regarding your rights as a participant, or how this study is being conducted, you may contact the University of Alberta's Research Ethics Office at (780) 492-2615. This office has no affiliation with the study investigators.
Procedure for Obtaining Consent: Please review the consent form. If you do not have any questions about the study or consent, please signed the consent form, scan and return the consent form to Amelia Chauvette via email at chauvett@ualberta.ca. If you prefer to mail the consent form, please contact Amelia Chauvette via email.

If you have any questions about the study or consent process, please do not hesitate to contact: Amelia Chauvette, Tel: 250-305-7893 or email: chauvett@ualberta.ca. or one of my thesis supervisors: Dr. Pauline Paul, Tel: (780)-492-7479; email ppaul@ualberta.ca or Dr. Manal Kleib. Tel: (780) 248-1422; email kleib@ualberta.ca

Consent Statement
I have read this form and the research study has been explained to me. I had the opportunity to ask questions, and I received answers to my questions. I was told who to contact if I have additional questions. I agree to participate in the research study described above and will receive a copy of this consent form. I will receive a copy of this consent form after I sign it. Please keep a copy of this letter for reference.

_____ _____
Participant's Name (printed) and Signature Date

_____ _____
Name (printed) and Signature of Person Obtaining Consent Date

Appendix H

Thank you for Participating in Research Study Email.

Dear__ (NAME will be inserted),

Having recently completed an interview in the research entitled: *A Focused Ethnography to Explore Nursing Faculty Experiences in Integrating Digital/Informatics Tools to Support Undergraduate Students' Learning and the Development of Informatics Competencies,* we would like to take this opportunity to thank you. Your participation and the data that you contributed are valuable to this research. Specially, thank you for helping to understand how nursing faculty perceive and integrate digital/informatics tools and informatics competencies into nursing curriculum.

If you have any question, please contact Amelia Chauvette at 250-762-5445 (ext:3291) or e-mail chauvett@ualberta.ca

Your sincerely,

Amelia Chauvette PhD (candidate), RN

Appendix I

Documents

Document	Use of digital/informatics tools	Reference to Nursing Informatics competencies
Course syllabus P1	Email contact Learning Management System (LMS) Online exam Online learning module Students access websites for class Reference to IT support and library services	none
Course syllabus P5	Email contact LMS Students access websites for class Online learning activity Statement about digital use	Course objective #8: Demonstrate information literacy skills (for example, formulation of searchable clinical questions and conducting searches of relevant databases).
Course syllabus P8	Email contact LMS Online exams Students access websites for class	None
Course syllabus P10	Email contact LMS Online exams Students access websites for class	None
Learning activity P10	Photo-voice	
Course syllabus P12	Email contact LMS Online exam Online learning module Students access websites for class Reference to IT support and Library services Statement about data being stored outside of Canada	
Learning activity P13		Course objectives

		Define Information and Communication Technology (ICT) within the healthcare context Define and differentiate key terms and concepts and their use in different contexts of care Describe the overarching goals of ICT within the current healthcare context ü Describe how ICT supports safe, collaborative, person centred care to diverse populations across practice settings Describe the principles that guide effective ICT use in healthcare
Course syllabus P15	Email contact LMS Online exam Online Learning module Students access websites for class	Course objective: Evaluate the healthcare setting using Quality and Safety Education for Nurses (QSEN) competencies to advocate and negotiate safe care in the context of crisis and complexity
Course syllabus P16	Email contact LMS	None
Course syllabus P17	Email contact LMS	Learning outcomes Access, review, and appraise literature for evidence-informed practice at a beginning level Understand the potential influence of informatics and technology on nursing knowledge.
Course outline schedule P18	LMS	None
Course outline P19	Email contact LMS Online exam Online Learning module Students access websites for class Statement about personal sue of digital tools Link to appropriate use of technology	Course description this course will enable students to apply leadership, policy and informatics knowledge and skills to foster quality and equity in healthcare, and to address challenges in health and healthcare delivery locally, nationally, and globally. Effective leadership is a key component of innovation, from the workplace to broader social and political contexts. Policy and informatics are two contemporary leadership 'tools' for leading innovation at every health system level. Students will have opportunities to engage in interprofessional learning in health informatics.

Course outline P21	Email contact LMS	None
Course outline P23	Email contact LMS Students access websites for class	Learning outcomes Develop research mindedness and fundamental skills to critique and appraise research literature and examine appropriate application to nursing practice.

Note. Participants P3, P4, P7, P11, P20, P22, P24 and P26 did not provide course outlines or an outline of their learning activities.

Appendix J

Artifacts (example)

Site A

Website - Nursing	Yes	No	
Nursing informatics courses		x	
Nursing informatics competencies described in curriculum, which ones		x	
Policies	x		Appropriate use of digital tools Statement about data security in course outline
Research interest in Nursing informatics	x		Three faculty members
Others			Five-year strategic plan (20XX-202XX) Become a leader in teaching innovation and practice education scholarship: Incorporate active learning, up-to-date technology, and simulation to engage with students and accelerate learning.
Website - Teaching and Learning center			
Resources available	x		Many resources available for faculty
Website – IT services			
Resources available	x		

Appendix K

University of Alberta Ethics Approval Notification

Notification of Approval

Date:	August 16, 2019
Study ID:	Pro00091981
Principal Investigator:	Amelia Chauvette
Study Supervisor:	*Manal Kleib*
Study Title:	A Focused Ethnography to Explore Nursing Faculty Experiences in Integrating Informatics Tools to Support Undergraduate Students' Learning and the Development of Informatics Competencies.
Approval Expiry Date:	August 15, 2020
Sponsor/Funding Agency:	Canadian Nurses Foundation

Thank you for submitting the above study to the Research Ethics Board 1. Your application has been reviewed and approved on behalf of the committee.

Any proposed changes to the study must be submitted to the REB for approval prior to implementation. A renewal report must be submitted next year prior to the expiry of this approval if your study still requires ethics approval. If you do not renew on or before the renewal expiry date, you will have to re-submit an ethics application.

Approval by the Research Ethics Board does not encompass authorization to access the staff, students, facilities or resources of local institutions for the purposes of the research.

Sincerely,

Anne Malena, PhD
Chair, Research Ethics Board 1

Note: This correspondence includes an electronic signature (validation and approval via an online system).

Appendix L

A Summary of Digital/Informatics Tools Used in Nursing Education

Participants were asked which digital/informatic tools they integrated into their teaching practice (classroom, lab/simulation, clinical practice). The list below consolidates the answers from the participants' semi-structured interviews. The tools are listed according to the following categories: digital tools used in the classroom, lab and clinical practice, teaching tools used face-to-face, synchronous or asynchronous classes, and items used within a Learning Management System and Websites accessed by participants for teaching and learning. It concludes with a description of two classroom, two nursing labs, and one simulation center.

Digital tools used in the classroom
Whiteboard
Projectors
Smarts phones
Projector
Desktop computers
WIFI

Teaching tools used in Face-to-Face, synchronous	or asynchronous classes
PowerPoint	Learning management system
Excel	Email
Microsoft	Blogging
Web file sharing and editing: Google Docs	Twitter
Prezi	Simulated digital clinical experience:
Educational video: You Tube	Shadow Health
Podcast	Skype
e-Library	Zoom
Gaming software: Scavenger hunt, Jeopardy,	Camtasia
Minecraft,	NCLEX-RN simulation software
Student response system: Kahoot, Socrative	Ebooks
Peerwise	Health informatics modules
Powtoon	Pause practice guided meditation
Photo Novella	Electronic health records
Website	Students Smartphones
Facebook	
Word clouds	
Turnitin	

Items used within a Learning Management System
Crossword puzzles, word searches, match the definition
Newsclips
Grading
Syllabus
Discussion forums
Quizzes
Study guides
Self-study packages
Attendance
Pre-recorded lecture
Case studies
Course syllabus
Weekly class outlines/ learning objectives
Web recourses

Digital tools in the Lab
Low to High fidelity simulators
Student Smartphones
Smartphone Applications: drug guide, cardiac rhythms, QR codes
Electronic vital sign machine
Monitors
Glucometers
IV pump
LMS: course syllabus, quizzes, learning activities, video, class outline/learning objectives
Software to video record skill: WeVu
Student response systems: Kahoot
Smartboards
Desktop application: PowerPoints
Projectors
Wi-Fi

Digital tools used in clinical practice	
Online learning modules	Smartphone applications:
Intranet resources	Drug Guide
Smart phones	Health Assessment
Desktop computers	Lab values
IV pumps	Medical dictionary
Glucometer	Weight conversions
Electronic vital sign	
PCA pumps	
Fetal heart monitoring	
Bed alarms	

Ceiling lifts
Electronic Medication Systems
Electronic Health Records
iPad
Research Databases
Up-to-date
Digital clinical experience: Shadow Health, VSims
Google Drive
Zoom
QR codes

Websites access by participants for teaching and learning
Baby's best chance
BC Perinatal
Bilitool
CASN NI competencies
CASN toolkit
Canadian Nurse's Protective Society
Healthy families BC Khan academy
Provincial regulatory website
Registered Nurses Association of Ontario Best Practice Guidelines

Observation tour

During the data collection period I was able to visit two labs, two classrooms and two faculty offices prior to the Universities placing restrictions on visits due to COVID. Classrooms at both sites were arranged similarly with tables and chairs situated in rows with a center aisle, and projector screens and smart carts for technology at the front of the rooms. The classrooms that I was able to visit were equipped with desktop computers (LMS, Microsoft office, websites), video recording for lecture capture, multimedia projector with video and audio connections, Wi-Fi, and Whiteboards.

One of the offices had a laptop, and the other had a desktop computer and a monitor. The desktop and laptop computer were installed with Microsoft Word and had a webcam. Both offices had wireless capabilities, access to a printer, scanner and photocopier located outside in a common faculty resource room.

The nursing simulated learning center was set to resemble the clinical setting with hospital beds and a mock nursing station. Both labs were equipped with desktop computer, Wi-Fi, and the ability to access LMS and health authorities' policies and procedure. There was a variety of equipment at students' bedside stations such as electric beds with an over-bed and bedside table, bedside sphygmomanometer and thermometer, wall mounted suction and oxygen

equipment, electric ceiling lift. Curtains could separate each bed station for privacy. as well as a sink to wash hands, sanitizer and soap, disposable gloves, paper towels,

In one simulation learning center, the learning labs were equipped with with the ability to live stream instructor demonstrating skills with audio and video recording capabilities. In one supply room that I was able to visit, there was many other digital tools such as IV pumps, glucometers, enteral feeding pumps, electronic vital sign machine, and mechanical patient lifts.

I was able to visit only one of the simulation centers. Both have a simulation technologist assisting faculty who facilitates the simulation experiences. In the observation/control room, there was a desktop computer, monitors, speakers and microphone. In the simulation room, there was a high-fidelity simulator. When connected, the simulator could simulate pulses, heart waveform, heart sounds, blood pressure, breath sounds, bowels sounds, blinking eyes, live and recorded vocal sounds. Other equipment included a monitor displaying cardiac rhythms and vital signs, sphygmomanometer, wall mounted functional suction, IV pole, electric hospital bed, and microphone to pick voices in the room, telephone, and a video camera. as well as a sink to wash hands, sanitizer and soap, disposable gloves, paper towels, and a medication cart covered with a sheet.

Appendix M

List of Journals for Publication

Focus	Potential journals	Impact factor
Findings	Computers, Informatics and Nursing	
	Online Journal of Nursing Informatics	
	Journal of Nursing Education	1.15
	Quality Advancement in Nursing Education	
	International Journal of Nursing Education	0.81
	Scholarship	