

Does work experience requiring the use of technology for College and University nursing students influence nursing informatics competency scores by the end of the 4th year program for one school in the province of Ontario, Canada?
A cross-sectional design.

By

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Abstract

The use of Information Technology (IT) in healthcare organizations is omnipresent. The nursing curriculum needs to include IT in order to prepare nursing students to acquire Nursing Informatics (NI) competencies before entering the workplace. The literature review suggests that pre-licensure nurses are ill prepared to enter the workforce because they lack some of the essential computer skills that employers are seeking when hiring new graduates (Fetter, 2009a; Gassert, 2008; Ornes & Gassert, 2007). The lack of defined competencies in NI is a worldwide problem (Chang, 2007; Fetter, 2009b; Staggers, Gassert, & Curran, 2001; Ragneskog & Gerdner, 2006). This thesis will examine two questions: 1) Do nursing students increase their NI competency scores progressively in their school program from year 1 to 4? 2) Do nursing students with work experience requiring the use of technology outside of the curriculum get higher scores for NI competencies than those without by the end of 4th year? A questionnaire was given to 176 nursing students asking them to rate their computer use and computer knowledge. The results were consistent for both independent variables of year of study and experience with technology in the work setting. There is no interaction present between variables; they each influence individually the total score for NI competencies for nursing students. The results show NI competencies progressively increasing over the four academic years. The nursing students scored higher still when they had technology experience in any work field on NI competencies. The combination of academic and work experience that uses IT provides nursing students with more opportunities to practice and assimilate their NI competencies before graduation.

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Glossary

Competency: “A complex know-act based on combining and mobilizing internal resources (knowledge, skills, attitudes) and external resources to apply appropriately to specific types of situations” (Canadian Association of Schools of Nursing [CASN], 2012).

Computer literacy (CL) or computer fluency (CF): “(Of a person) having sufficient knowledge and skill to be able to use computers; familiar with the operation of computers” (Bundy, 2004).

Electronic health record (EHR): “A record available electronically to authorized health care providers and the individual anywhere, anytime in support of high quality care. The record provides each individual in Canada with a secure and private lifetime record of their key health history and care within the health system” (CASN, 2012).

Health informatics (HI): “Health informatics is the interdisciplinary study of the design, development, adoption, and application of IT-based innovations in healthcare services delivery, management, and planning” (U.S. National Library of Medicine).

Health information systems (HIS): “A combination of vital and health statistical data from multiple sources, used to derive information and make decisions about the health needs, health resources, costs, use, and outcome of health care” (CASN, 2012).

Health information technology (HIT): “A tool to aid diagnosis and archive medical records” (Bitton, Flier, & Jha, 2012)

Information and communication technologies (ICTs): “Encompasses all those digital and analogue technologies that facilitate the capturing, processing, storage, and exchange of information via electronic communication” (CASN, 2012).

Information literacy (IL): “Were a person is able to recognize the need for information, determine the extent of information needed, access information efficiently, critically evaluate information and its sources, classify, store, manipulate and redraft information collected or generated and incorporate selected information into their knowledge base” (Bundy, 2004).

Information technology (IT): “The study or use of systems (especially computers and telecommunications) for storing, retrieving, and sending information” (Oxford dictionaries, 2014).

Nursing informatics (NI): “A science and practice [which] integrates nursing, its information and knowledge, and their management, with information and communication technologies to promote the health of people, families and communities worldwide” (CASN, 2012).

Patient health record (PHR): “A complete or partial health record under the custodianship of a person(s) (e.g., a patient or family member) that holds all or a portion of the relevant health information about that person over their lifetime” (CASN, 2012).

Simulator: Is a physical device that replicates the functions of an actual device used in the workplace or other environment and serves the purpose to train operators on their usage (Skjerve & Bye, 2011).

Work-based learning (WBL): “Is a method which brings together the employee’s knowledge and university leaning, along with the experience in the workplace. It is a means of articulating skills to provide a framework for skill-mix appraisal, provides purpose and role clarity, defines new roles and career pathways as practice advances, and ensures fitness for purpose” (Flanagan, Baldwin, & Clarke, 2000).

Rationale

Description of the context

In the early 1960's, computer systems were introduced in hospital settings to manage human and material resources more efficiently. In 1976, the field of informatics was introduced to the English language in the *Supplement of the Oxford English Dictionary* as stated by Collen's work (1995). In the 1980's, the term *Nursing Informatics* (NI) emerged to reflect the new set of technological competencies required from their nursing employees for a safer and higher quality of care (reference).

As early as the 1970's, the integration of NI competencies into the nursing curricula was debated by nursing researchers to ensure the development of skills required for NI (Anderson, Gremy, & Pages, 1974; Ronald & Skiba, 1987; Staggers, Gassert, & Curran, 2001; Staggers, Gassert, & Curran, 2002). By the early 1990's almost every nursing station in any healthcare facility had a computer for clerical work duties. The early 2000's the term Health Informatics (HI) evolved to what we now know as Electronic Health Record (EHR). EHR facilitate a more structured and integrated decision support system, clinical data repository and facilitate access by the use of networks (Protti, 2007).

With Information Technology (IT) use expanding in healthcare at an exponential rate, the need to know how to organise, find and evaluate the flow of information is emerging for healthcare professionals. The field of IT is comprised of the study, design, development, implementation, support and management of computer-based information systems, particularly software applications, computer hardware and electronic biomedical tools used by healthcare professionals. Furthermore, IT relies on computer software to collect, convert, store, protect, transmit, migrate and securely retrieve information. Today, with the affordability of computers

and the possibility to document and communication our data almost instantly (i.e., in real time) has increased the use of computers and various technologies for the nursing profession (e.g., cardiac monitors, intravenous pumps).

Description of the problem

In healthcare organisations IT is now a shared responsibility with the department of information technology and clinical experts, e.g., nurses and allied health. Today's nurses amalgamate clinical knowledge, work in many specialty areas in collaboration with other health professionals, and use technology on a daily basis to document, retrieve and communicate information about patient care. With patient safety concerns on the rise, the creation of an Electronic Medical Record (EMR) is seen as a tool to reduce medical errors in the healthcare system (Kohn, Corrigan, & Donaldson, 2000). The EMR is a summary of data from practice management systems and clinical information systems (CISs) or health information systems (HIS) that is specific to the facility (Turner, 2010).

The new reality of healthcare professionals is that they have to use many 'technical devices' in their daily work. As with any tool or technique, it is almost impossible to eliminate the human factor, even for a simple task like measuring a client's temperature. Nurses must interact with these 'technical devices' in order to accurately assess and document the patient health condition for the interprofessionnal team.

An interprofessional team can be comprised of physicians, respiratory therapists, dieticians, physiotherapists, and occupational therapists just to name a few. The work environment in healthcare has changed and the use of technology has become necessary. Healthcare professionals must shift their way of thinking about the use of technology. Instead of asking themselves, "what can technology do for us?", they are now faced with questions like, "how will

I use this technology in my client care?”, “which ‘technical tool should I use to perform an assessment and then document the data gained?” and, “where can I find a specific information piece on my client’s EMR?”.

The evolution of technology goes beyond the walls of one healthcare institution as the industries and government of Canada are implementing an EHR, which implicates one record for every person across the country. The expert use of this national EHR depends on a workforce capable of assimilating, integrating and safely navigating through this big data. The Pew Health Professions Commission in 1998 stated that communication and technology use was one of the 21 essential competencies needed by all healthcare professionals.

Canadian studies have shown that few universities include or measure the progression of NI competencies in their nursing curriculum (Canada Health Infoway [CHI], 2011; Nagle & Clarke, 2004). Reasons identified for this information gap included scarce resources, limited personnel, time and budgetary constraints. Many nursing faculties do not have access to EHR software because of their prohibitive costs including, human resources to develop and maintain software. The lack of supporting data on NI competencies makes it unclear if nursing students are acquiring informatics competencies prior to entering the healthcare industry workforce.

Literature review

An extensive literature search was conducted to locate published materials relating to terminology used in the field of Health Informatics (HI) and more specifically for NI. Key terms used in these searches included health informatics, nursing informatics, nursing informatics competencies, terminology nursing informatics, and health information technologies. Combinations of these terms were used to narrow the search using CINAHL, OVID, PubMed,

Google scholar with a preference for peer-reviewed articles and journals between 1994 and 2014.

From this search emerged evidence of terminology change over time in the topics covered.

Kenny (2002) is one of many who argue that nurses are “knowledge workers”, hence the nursing curriculum needs to prepare graduating students to manage information and high technology, combined with the ability to exercise complex clinical judgement in their practice. Therefore, NI competencies are a crucial part of preparing qualified graduated nurses.

De Gagne, Bisanar, Makowski, and Neumann (2012) found from their critical reading and synthesis of 19 studies, that four overarching themes emerged for HI in the nursing curriculum and they were: “A) lack of consensus on HI education; b) impact on patient care outcomes; c) faculty member professional development through organizational collaboration; and d) global disparities in HI education” (p. 677). One of the biggest challenges identified, other than standardized terminology, is the need to define and differentiate the set of skills that could be observed for this emerging competency.

In order to teach with technology necessary to develop NI competencies, terminology and evaluation tools need to be standardized within the nursing profession (Button, Harrington, & Belan, 2013; American Nurses Association [ANA], 2011; Skiba, Connors, & Jeffries, 2008). The literature review refers to three terms as being misused and misunderstood by nurses: Computer, technology, and information literacy (IL). Hou, Chang, Chan, and Dykes (2013) found that standardized terminology is a building block for the EHR.

As a result of these findings, this study will first identify and define the most current NI terms used in the nursing profession. What are NI competencies? What are the essential NI skills to form competent nurses the tools currently in place to adequately measure these new skills are inconsistent in educational institutions worldwide, and more importantly in our own

country (Canadian Nursing Informatics Association [CNIA], 2003; Carty & Ong, 2006; Thompson & Skiba, 2008)? Consequently, the following questions will be explored: Are nursing graduates exposed to, have gained experience with or have been assessed for these crucial skills before entry to practice?

Adult learning involves practical experience in order for theories to be fully grasped. To illustrate this concept, the following question will be looked at: To what extent does healthcare work experience play an important role in NI acquisition? A review of the published NI instruments and research using an instrument was also performed to facilitate the selection of a tool in order to collect the data for this thesis' research.

NI Definitions

Firstly, what is a competency? A competence, generally speaking, is the acquisition of knowledge, attitudes, skills, and abilities necessary for an optimal performance in a profession (as cited in Gillespie, Chaboyer, Wallis, & Werder, 2011, p. 79, Staggers et al., 2001). Tardif (2006) illustrates in his book "L'évaluation des compétences: Documenter le parcours de développement" that there does not seem to be a clear consensus in the definition of competencies. He defines competence on page 22 as knowing how to act (savoir-agir) in a complex situation by mobilization and combining a variety of resources (knowledge, skills and attitudes) both internal and external from similar experienced situations (Tardif, 2006). In other words, resources are like the equipment needed to perform a certain action. They are the pre-requisites that one needs to master and accumulate in order to enact the competence. For example, to master the competency of communication, one will have to use the resources of the non-verbal body language in combination with verbal discourse. Without the use of personal

resources, an individual is simply mirroring an action without fully understanding why it is being performed.

Furthermore, Tardif (2006) states that to be fully mastered a competency must possess five characteristics: 1) Integrating, 2) combining, 3) developing, 4) contextual and 5) evolving. He further states, that each competency comes with a list of indicators that the characteristics possess' as being assessable and observable manifestations of the critical learning needed for their development. Stereotypical nursing competencies used to include: Implementing appropriate administration and use of medication(s), use appropriate aseptic/sterile techniques, manage therapeutic nursing interventions (e.g., intravenous therapy, drainage tubes, and skin and wound care) just to name a few (College of Nurses of Ontario [CNO], 2014). In this research the main focus will be on NI competencies, which do not rely on the more typical nursing competencies covered in the bachelor program, but are documented in the EHR using NI.

What is informatics? The use of IT in healthcare is called informatics with its focus on information management. We often hear nurses say that they want to spend as little time on the computer as possible and more time taking care of their clients. A study conducted by the National League for Nursing (NLN) in 2008, reported that 50% of schools surveyed had integrated computer competency and Information Literacy (IL) in their program, while informatics competencies were not addressed. NLN reported that the term "informatics competencies" was a misnomer for computer use, IL skills and technology tools used in class. In the same vein educators are mistakenly identifying the use of simulation equipment and online courses as ways to learn about informatics. In a simpler example: One needs a hammer to make a nail enter a surface but it does not teach one how to build a house.

Nursing students must equip themselves with the skills of computer literacy, computer fluency, followed by IL before tapping into the NI competencies. We will define each of the terms seen in figure 1 to fully understand the building blocks leading to NI.

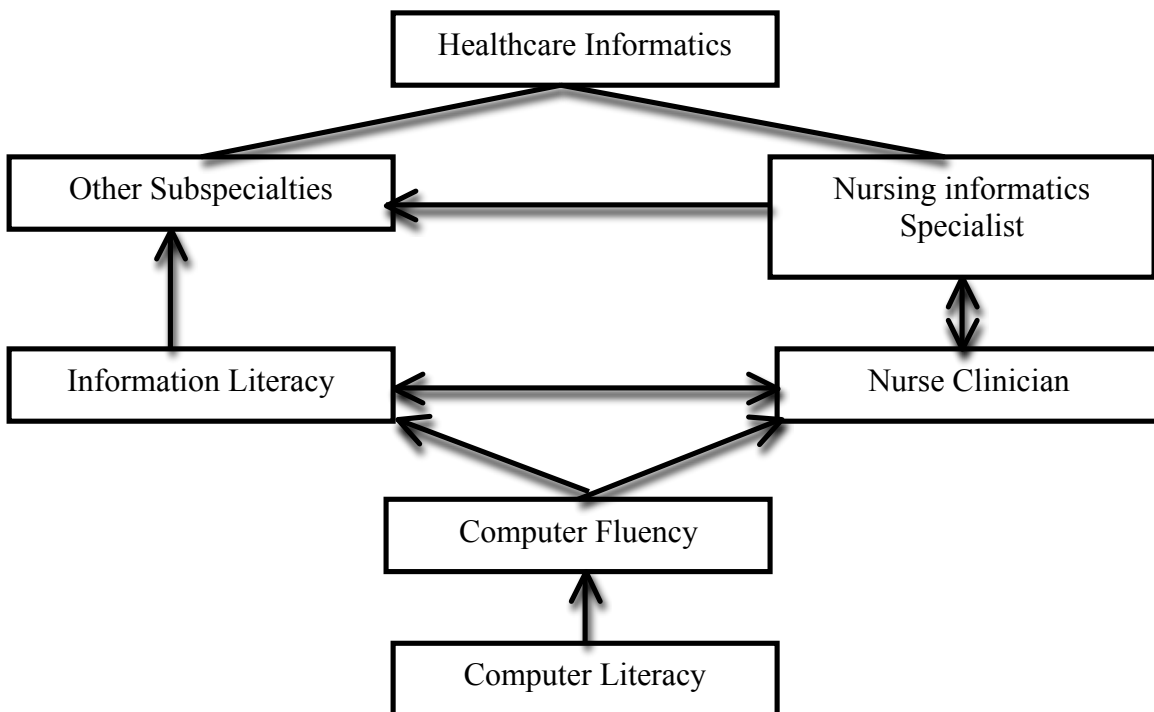


Figure 1. Skill set in nursing informatics.

From Thede, L. Q., & Sewell, J. P. (2010). *Informatics and nursing: Competencies and applications*. (3rd ed.). Philadelphia, PA: Wolters Kluwer Health/Lippincott Williams & Wilkins. Reprinted by permission.

Healthcare professionals need to understand the terminologies used in the field of informatics. Health Informatics (HI) is an umbrella term, Coiera (2003) defines as: “The study of information and communication systems in healthcare” (p. xxii). HI is focused on understanding these systems in order to develop interventions to improve them and evaluate the impact of these new interventions. HI focuses on managing information in healthcare. It is important to understand that this field is comprised of many disciplines and nursing is one of them.

Health Information Technology (HIT) involves the use of computer hardware and software to retrieve and share patient data from a clinical setting to ensure continuity of care with internal and external partners (Blumenthal, 2009). An EHR is part of HIT. Health Information Systems (HIS) or clinical information systems (CISs) are collections of tools and include all the electronic systems used to collect client information. A HIS can also be called “peopleware” because data is collected by machinery but it requires professional interpretation (Gremy, Fessler, & Bonnin, 1999). Examples of an HIS or CIS include, outpatient services, inpatient physician orders and treatment, nursing interventions, and laboratory and radiology results. By developing informatics skills, nurses will be able to participate and benefit from the evaluation process of these new tools by having a well-designed information system to work with.

Most Canadians use information and communication technologies (ICTs) routinely in their non-professional lives (email, social media, automatic teller machine, smartphones, Wi-Fi connectivity). ICTs are defined as: Basic skills for using a device or an application and encompass all digital and analogue technologies that facilitate the capturing, processing, storage, and exchange of information via electronic communication (Canadian Association of Schools of Nursing [CASN], 2012). “Device use” includes the use of a personal computer, hand held

device or a Bluetooth-enabled device. Some examples of ICTs “application use” are: Using emails, viewing multimedia presentations, using word processing and the intranet.

A Canadian research identified that ICTs helped students learn more rapidly, more efficiently, allowing them to acquire a greater level of knowledge for the same period of time spent in school than their predecessors (Karsenti, Villeneuve, Raby, Weiss Lambrou, & Meunier, 2007). Students are assumed to have basic ICTs skills prior to entering the nursing bachelor program and are seen as foundation skills in developing NI competencies (CASN, 2012).

The term “Computer Literacy” (CL) is defined as the ability to perform various tasks with the use of a computer (Thede & Sewell, 2010). The authors refer to the term Computer fluency (CF) instead of CL. Being fluent implies a constant evolution of skills, keeping up-to-date to stay effective in both work and personal life.

Information literacy (IL) is an informatics skill that signifies the ability of a person to recognize when information is needed, determine the amount of information needed, be able to retrieve information efficiently, evaluate its sources, classify and store. From these actions the user can extrapolate from the data, redraft and generate new data into the selected electronic HIS by applying a set of transferable skills and behaviours (Craig, 2009). Research shows that part of the problem is due to the fact that faculty professors assume that computer and IL levels are being met when students enter the nursing program (Bond & Procter, 2009; Deltsidou, Voltyraki, Mastrogiannis, & Noula, 2010; Maag, 2006).

Nursing Informatics (NI) is the intersection of three sciences: Computer, information and nursing. NI competencies are the skills required by the registered nurse to integrate these three sciences in order to manage and communicate data, information and knowledge in nursing practice (Graves & Corcoran, 1996). NI became an official subspecialty of the nursing

profession in 1992 and the first certification was available in 1995 in the United States (Newbold, 1996). The sole focus of the Nursing Informatics specialty at that time was to manage information collected by nurses. Simpson in 1998 recognized that it was difficult to manage information collected by nurses. Simpson in 1998 recognized that it was difficult to define NI because this specialty was a moving target. Stagers and Thomson in 2002 collaborated to define and differentiate ICTs from NI competencies. The most recent definition of NI is provided by the CASN by the “Nursing Informatics: Entry-to-Practice Competencies For Registered Nurses” defined as “a science and practice [which] integrates nursing, its information and knowledge, and their management, with information and communication technologies to promote the health of people, families and communities worldwide” (2012, p. 13).

CASN has established that the NI competencies is comprised of three subsets 1) information and knowledge management (e.g., uses pertinent information and knowledge to accompany the delivery of evidence-informed patient care, protect patient confidentiality); 2) professional and regulatory accountability (e.g., uses ICTs in accordance with professional and regulatory standards and workplace policies); and 3) use of ICTs (e.g., select and use information and communication technologies in the delivery of patient/client care) (2012).

NI competencies develop the ability to troubleshoot device problems, to report issues to the proper technical support services, and to communicate follow-ups on devices in need of repair to nursing colleagues. The attainment of NI competencies depends on internal factors: What a person knows about informatics, the person’s attitude towards technology in general, their interest and motivation to use electronic nursing data and to communicate using technologies. External factors also play an important role in the development of NI competencies and must be taken into account such as: Access to a computer, use of appropriate software for the profession,

the Internet, electronic scientific database, clinical-experience settings and attending classes in informatics not part of the nursing curriculum (Jetté, Tribble, Gagnon, & Mathieu, 2010). The development of the NI competencies will facilitate the participation of the nursing graduates in HIS projects to shape and test future system efficiencies. Nursing education programs have shifted from an education to practice gap (ability to apply theory into practice) to a practice to education gap (keeping up-to-date with new technologies used in the workforce).

A group of American researchers were able to match the NI competencies of working nurses depending on their area of practice and years of experience. As a result, the study of Stagers et al. (2001) defined four distinct levels of informatics competencies for practicing nurses: Beginning nurses (level 1), experienced nurses (level 2), informatics specialist (level 3), and informatics innovator (level 4). The first two pertain to all nurses and the last two refer to advanced informatics nurses. Experienced nurses are content experts in their domain of interest and are highly skilled in "...using information management and computer skills". The informatics specialist nurses focus' on information needs for practice of nursing and works closely with the experienced nurses. The nurse informatics innovator will conduct research and develop tools, which require different NI competencies not covered in this research (see Appendix A).

This thesis focuses on the informatics skills of the beginning nurses (level 1) to which nursing students belong. Beginning nurses demonstrate an ability to use fundamental information management, and computer technology skills. They are able to use existing information systems to retrieve information and effectively manage client cases.

NI Education

The Baccalaureate nursing program in Canada uses a competency-based approach designed over a four-year period. It provides a balance of theoretical and clinical placement learning experiences. More specifically, the first two years consist of nursing theory and conceptual frameworks. The curriculum explored in this research compares well to most nursing baccalaureate curricula found across Canada. While some universities cover technology in dedicated classes, others rely on a combination of theory and clinical placement to cover the subject.

In 2012, CASN introduced NI competencies accompanied by a list of measurable indicators that are assessable, observable manifestations of the critical learning needs of nurses. The CASN anticipates that nursing students will enter any Canadian affiliated bachelor program already competent in ICTs and in the use of informatics tools. However, if this is not the case, universities and colleges need to develop an ICT support plan with the school's libraries, IT help services desk, and school-run ICT workshops to enable students to acquire these competencies (CASN, 2012). The newly identified competencies incorporate the minimum knowledge level and skills new Registered Nurses must acquire to practice in an increasingly technology-enabled workplace. The curriculum does not need to expand, rather it needs to integrate NI competencies in each existing course to maximise learning.

A 2003 survey performed on Canadian Schools of Nursing revealed that half of the schools had a strategic plan or vision with goals and supporting policies to integrate ICTs and NI in nursing education (CNIA, 2003). Moreover, approximately three out of four schools integrate NI throughout undergraduate curriculum but fail to properly identify where or how many hours are devoted to NI. Approximately two out of three schools have a curriculum vision or design

that includes NI competencies without explicit outcome objectives. As a result, the gain associated with teaching NI competencies in schools is not effectively measured nor reported by all institutions (CNIA, 2003).

Since nursing informatics is an emerging competency and is not yet recognized as a speciality within nursing associations in Canada, it is uncertain if global NI competencies are attained at graduation in this country. No consensus exists among universities and nursing associations in Canada to officially validate nursing students' workforce entry preparedness or make NI skills evaluation mandatory as part of the curriculum (CNIA, 2003; Chastain, 2002; Fetter, 2009a; Skiba, 2004, 2009; Thompson & Skiba, 2008).

In order to become a Registered Nurse, candidates must pass a licensing exam from the province of study attesting they have met the 123 required competencies stipulated by the College of Nurses of Ontario (CNO) (2014). The CNO has adopted the "National competencies in the context of entry-level registered nurse practice". The document states that nurses have a professional responsibility to demonstrate critical inquiry in relation to new informatics knowledge and technologies that change, enhance, or support nursing practice.

Out of the 123 competencies outlined by CNO, only three relate to nursing informatics: 1) Demonstrate critical inquiry in relation to new knowledge and technologies that change, enhance or support nursing practice, 2) understand the significance of nursing informatics and other information and communications technologies (ICTs) used in health care, 3) use existing health and nursing information systems to manage nursing and health care data during client care (CNO, 2014). Unfortunately, CNO does not provide specific results from the Canadian Registered Nurse Examination (CRNE) to the public at large in regards to these tested competencies. Therefore, there is no point of reference on current NI scores for this study.

CASN published in 2012 the “Nursing informatics entry-to-practice competencies for Registered Nurses” validating the need to assess the NI skills and clearly identifying the key indicators to measure the NI competencies. Although no deadline has been identified for universities offering the nursing program to re-evaluate their curricula, the booklet was created to facilitate the process and future adoption of NI competencies.

Newer approaches to teach NI include the use of simulation of an EHR to facilitate the integration of technology into the nursing curriculum. The University of Kansas in the United States, in collaboration with Cerner Corporation, has developed the *Simulated E-hHealth Delivery System (SEEDS) project* (University of Kansas Medical Center, 2014). This innovative endeavour uses the known evidence-based learning approach by the Nursing faculty that fosters decision-making skills through access to technology used in the clinical settings (Connors, Warren, & Weaver, 2007; Connors & Weaver, 2002; Connors, Weaver, Warren, & Miller, 2002). This simulation trend is growing in the United States; it is unclear if Canada’s universities are actively seeking such opportunities (Skiba et al., 2008).

A study done by Button et al. in 2013 had the objective of reviewing the literature for International recommendations for nursing education. The researchers identified “19 of the 28 reviewed studies recommended that education providers incorporate information literacy and nursing informatics into the preregistration curriculum as a matter of urgency” (p. 11). Following these recommendations would ensure faculties from around the world met the current clinical work requirements for nursing professionals.

Factors influencing attainment of NI competencies

What could influence the attainment of NI competencies in the Nursing baccalaureate program? Gender, age or personal interest in technology, basic computer skills and formal

informatics education were hypothesised. Historically, the Nursing baccalaureate program has attracted predominantly women from non-minority backgrounds (Jeffreys, 1998; Griffiths & Tagliareni, 1999). Previous research on gender differences by Hoskins, Newstead, and Dennis (1997) found that academic performance had provided little evidence in difference in mean scores, thus limiting its possible influence. Therefore gender bears no impact on the attainment of NI competencies.

Studies show that mature-aged students have consistently higher grades than younger students entering the nursing program straight from high school and this could be linked to student motivation (Houltram, 1996; Hoskins et al., 1997; Kevern, Ricketts, & Webb, 1999; Ofori, 2000). Mature students are identified as being between 21-25 years of age; older mature students are over 25 years of age (Hoskins et al., 1997). Experience or interest in technology, although potentially relevant, is not systematically queried as part of the background of new students entering the program of this study.

A Korean study conducted by Hwang and Park in 2011 sought to identify specific factors associated with NI competencies for nurses currently employed. Their study identified nine influential characteristics of respondents and they were: Gender, age, educational level, clinical department, job position, clinical experience (in months), computer education, informatics education, and HIS education. This present study focuses on nursing students and six out of the nine characteristics identified above were investigated. The three excluded are clinical department, clinical experience (in months) and job position.

NI and Work Experience

The literature review and current workplace analysis that follow suggests that many nursing students have external work experience in the healthcare industry outside of the

prescribed curriculum. Some will have worked in non-nursing jobs in healthcare, but have performed tasks related to the profession before and while in their nursing program. Others, with current nursing shortages, have had the opportunity to work during the school year and over the summer in a new position called: Nursing students or nursing aids. This experience entitles pre-licensure nurses to perform certain pre-determined nursing acts in the hiring hospitals such as basic care and documenting electronically the care provided for patients (Hôpital Montfort, 2014).

In the past, studies have shown that spending over a certain amount of hours in a part-time employment will have a negative effect on the student's academic performance (Salamonson & Andrew, 2006; Lillydahl, 1990; Kablaoui & Pautler, 1991, Lammers, Onweugbuzie, & Slate, 2001; Quirk, Keith, & Quirk, 2001). However a recent study found that specialty education and work experience combined make a positive difference in the learning outcomes for students (Gillespie et al., 2011). Furthermore, learners who benefit from Work-Based Learning (WBL) appear to develop a better understanding of the conceptual frameworks and processes, and enhance their skills compared to theory approaches alone (Major, 2005). WBL is defined as: "A method which brings together the employee's knowledge and university learning, along with the experience in the workplace. It is a means of articulating skills to provide a framework for skill-mix appraisal, provides purpose and role clarity, defines new roles and career pathways as practice advances, and ensures fitness for purpose" (Flanagan, Baldwin, & Clarke, 2000). In light of these results, this study examined this combination of theory and work for nursing students on gaining NI competency scores.

Published NI Instruments

Selecting the proper tool to answer the questions of this thesis demanded a review of the literature on previously built instruments and to identify their purpose of measurement. The need to evaluate nursing student's competencies in regards to technology has been of interest in the literature since the 1980's (Chang, Poynton, Gassert, & Staggers, 2011; Hobbs, 2002; Stronge & Brodt, 1985). This study looked at Hobbs scoping literature search to identify global NI competencies assessment tools (2002). More specifically, the purpose was to identify a tool that was designed for self-perceived NI competencies and that had been previously been tested and/or used by nurses.

Some of the tools found in the literature measured computer competency relating to computer use and availability (Birx, Castleberry, & Perry, 1996). Hobbs found that others focused on measuring unnecessary skills (i.e., knowledge of hardware configurations), attitudes towards computers, or were aimed at working nurses using an electronic clinical information system (CIS) to enter data (2002). There exist many tools for the most part that were self-developed or part of a Delphi study. What distinguishes the tools is the clientele they were targeting and the outcomes they were measuring.

An Australian study conducted by Carter and Axford in 1993 surveyed nursing experts and clinical nurses to validate nursing information needs such as: Word processing at beginner level, basic computer terminology and knowledge of hardware configurations. The study findings indicated that these skills were unnecessary to nurses at that time. Hardware configuration knowledge was deemed unnecessary in the literature for developing NI competencies therefore this tool was excluded.

June Kaminski developed in 1996 an Internet assessment tool for nursing students called P.A.T.C.H. to evaluate attitudes and feelings towards technology. She illustrated that positive attitudes and feelings created openness towards the development of NI competencies. Although relevant, these findings were subjective in essence and therefore this tool was excluded for this study.

Two other tools identified by Hobbs (2002) surveyed nursing students in specialized disciplines: Mental health (Birx et al., 1996) and perioperative (Gillespie et al., 2011). They were adjusted to measure these specific populations, thereby limiting their re-use for general purposes. As a result, they were considered not suitable for this research.

A Delphi survey developed by Saranto and Leino-Kilpi (1997) captured a variety of populations: NI experts, clinical nurse managers, nurse educators, nursing students and patients sought to validate historical knowledge of computer hardware, general and specific applications. However, because it focused on history this survey was rejected for use in the current study.

An American study performed by Arnold in 1998, surveyed informatics nurses regarding their computer use, educational plans and expectations for certification content. The main purpose of this study was to find grounds to justify and legitimize the necessity of certification for the field of NI informatics. Although statistically important data was obtained, it was not designed for nursing students at the beginner level of practice.

Marini developed a pre and post-test NI competency-measuring tool that was administered to nursing students completing an elective nursing informatics course (2000). This test could not be retained for this study because no such class was given in the university selected.

Most tools found in Hobbs' (2002) research focused on only one of three aspects: Attitude, use and knowledge of computers. The exception was Stagers' tool developed in 1994 that

adopted a holistic and rigorous approach called the Stagers Nursing Computer Experience Questionnaire (SNCEQ).

The SNCEQ was selected for this research because it looked at all three spheres leading to NI competencies: Computer skills, informatics knowledge regarding general and HIS applications, and informatics skills. The Stagers questionnaire also explored subjective data such as: Computer attitudes, experience, and possible reasons why nursing students may not use computer often. It included a section for participants to rate themselves on a novice-to-expert scale. It is also the only tool that addresses specific NI competencies across several levels of nurses. For the complete list of tools evaluated see Annex 1.

Conceptual framework

A literature review was conducted to validate the conceptual frameworks used in previous researches with the focus of how NI competencies are developed in the nursing profession. Taking into consideration that the term “informatics” was defined in 1983 by Gorn and the first conceptual framework to emerge was from Graves and Corcoran in 1989 in a publication called: *The Study of Nursing informatics*. The framework entitled “Conceptual framework for the study of nursing information” sought to depict nurses as “knowledge workers” that continuously convert raw data into information and subsequently into knowledge.

The framework was intended to serve as a way to understand the relationship between the NI concepts (theory) and the procedural (applied) knowledge. This work was useful to begin: Mapping the process of incoming data, understanding its origins and tracing what becomes of the data once transformed by documenting into a HIS. The role of the Registered Nurse is then to assimilate and create new knowledge from that process. This model helped the nursing

researchers understand how the flow of information occurs. The framework from Graves and Corcoran was republished in 1996 with no changes.

Staggers and Parks created a framework describing the nurse-computer interaction with information called “Nursing Informatics Model” (1993). It portrays nurses and computers who interact in a system with the capacity of reciprocal influences, with the exchange of information between them along a nursing informatics developmental trajectory. It can be used to organize a sample of previous research from nursing informatics and human-computer interaction.

In 1996 Turley proposed a NI model to illustrate that NI is the interaction between cognitive science, computer science, and information science resting on a base of nursing science. Turley added cognitive science to the model of Graves and Corcoran (1989,1996). This model was used for the purpose of developing areas of research that were still unexplored and grouped associated existing nursing informatics studies. It also served as a guide for education and the development of the NI speciality.

In 2000 Goosen created a model called “Goosen’s framework for nursing informatics research”, which was an extension of Graves and Corcoran’s previous framework from 1996. Goosen included several processes such as collecting, aggregating, representing, and using information to enable nurses to make the right decisions and initiate the proper actions for patient care. This model focused on the different stages of information received by nurses and the actions they must put in motion with new data received.

The researcher Effken published in 2002 a hierarchical approach of analysis, with primary emphasis on the environment and the nurse. That same year Staggers et al. published the information management framework derived from a synthesis of nursing and informatics sources (2002). Effken then published an Informatics Research Organizing (IRO) model with the

purpose of developing the field of nursing informatics as a science and help structure research (2003). The IRO model is a meta-framework that enables other models and theories to be incorporated.

Staggers et al. developed in 2002 a conceptual framework to guide their study to help determine informatics competencies for nurses at four levels of practice. The framework was developed from synthesized concepts from diverse sources of nursing and informatics via a Delphi study including experts in the field of NI. Information management experts broke down NI competencies into three components: Computer skills (device use), informatics knowledge (application use), and informatics skills (see Appendix B). These different components are represented as interdependent and of equal importance in order to achieve informatics competencies. The creators of the framework explained that: “Informatics knowledge is the theoretical and conceptual basis for the specialty, while informatics skills are the use of methods, tools and techniques particular to informatics.” (Staggers et al., 2002, p. 385).

Informatics knowledge includes familiarity with nursing taxonomies and reasons for informatics systems malfunction. Informatics knowledge is demonstrated by nursing staff when they select the appropriate technological tool to perform the action of collecting patient data and effectively use the tool. It also includes the ability to communicate errors to solve documentation corruption issues to the right resource (e.g., the need to adjust documentation screens to reflect the best standard of practice). Informatics knowledge includes critically evaluating the authenticity of health websites to ensure patient safety, and maintaining privacy and confidentiality in electronic documentation.

The Staggers et al.’s (2002) framework defined a computer skill as the proficiency in the use of computer hardware and software. It is demonstrated when a user enters data, files, access’

folders, troubleshoots computer issues at a basic level, uses word processing, spreadsheets and uses a variety of search tools.

Informatics skills are best described as occurring when a user is able to navigate with ease through an application and/or software by using the appropriate keystrokes and commands to retrieve, enter and store information pertaining to the patient (e.g., cardiac monitors). The informatics skills include techniques and tools in systems analysis and project management (e.g., improving efficiency by reducing the number of clicks to access information).

Information management competencies combine informatics competencies and human information processing skills (cognition). Thus the information management (gather, sort, file, extract) competency signifies that nursing students or nurses have assimilated all these layers of skills to perform efficiently their nursing role.

For the selection of the framework for this present study, the author gathered studies with a similar focus i.e., identifying NI competencies or measuring them. Many were rejected because they focused on research topics or measuring the flow of information. From the literature searches with the key words “nursing informatics competencies”, a pattern began to emerge. Chang et al. (2011) conducted a comparable study and aimed to identify the required NI competencies in Taiwan. The researchers relied upon the framework from Staggars et al. (2002).

Since this study wants to evaluate the acquisition of NI competencies, it adopted the “Information Management Framework” developed by Staggars et al. (2002) and was adjusted with permission from the authors to reflect today’s new realities and incorporate the four levels of practice of nurses.

Benner’s novice to expert theory (2001) suggested that knowledge is acquired by gradual exposure to factors both internal and external as mentioned in Tardif’s work (2006). The

attainment of NI competencies for nursing students is no different and can be achieved through the use of known factors such as: Repetition of theory during courses, learning new skills during laboratories/simulations and applying these skills during practicums/clinical placements/summer job experiences. That is why the year of study factor was added to the conceptual framework, representing gradual exposure over a four-year period.

Hwang and Park (2011) identified factors that could impact directly on the learner's experience and professional development. They suggested querying: Current year of study, gender, age, perceived level of expertise with computers, attitudes, beliefs, behavioural intentions towards technology and computer courses taken by personal interest. They identified basic computer skills and formal informatics education as two significant factors positively associated with informatics competencies. These hypothetical potential influential factors (internal and external) were added to the conceptual framework of Staggars et al. (2002).

A study by Brown, Massey, Montoya-Weiss, and Burkman (2002) illustrated that perceived usefulness is a key antecedent of attitude. In other words, if the electronic tool was perceived as easy to use and brought something positive to the practice (e.g., saving time, one place to look for data, ease of finding data) then the attitude towards technology were positive and thus motivation to learn how to use the tool and usage (adoption) was therefore increased. It further stated that when adoption was voluntary, it facilitated positive attitudes towards the technology. Unfortunately, in healthcare settings this is rarely the case; new electronic systems are purchased or developed and mandatory use is then expected.

This study looks at the interaction of nursing students' knowledge of NI and external factors (i.e., work experience and educational experiences acquired outside the curriculum during their nursing baccalaureate program). Considering that the workplace is an increasingly

technology driven environment, it is a timely issue to measure if nursing students are graduating with NI competency and if personal work experience requiring the use of computers has a positive effect over the four years of study in the nursing program.

Excluded from this study are informatics skills because they are not expected of a level 1 beginning nurse as identified in the revised SNCEQ renamed by Chang in 2010 Nursing Informatics Competencies Questionnaire (NICQ). Similarly to the study conducted by Chang et al. in 2011, this research focuses on informatics competencies and therefore the area of human information processing skills and information management competencies will not be explored. The highlighted elements in gray are the focus of this study (See figure 2).

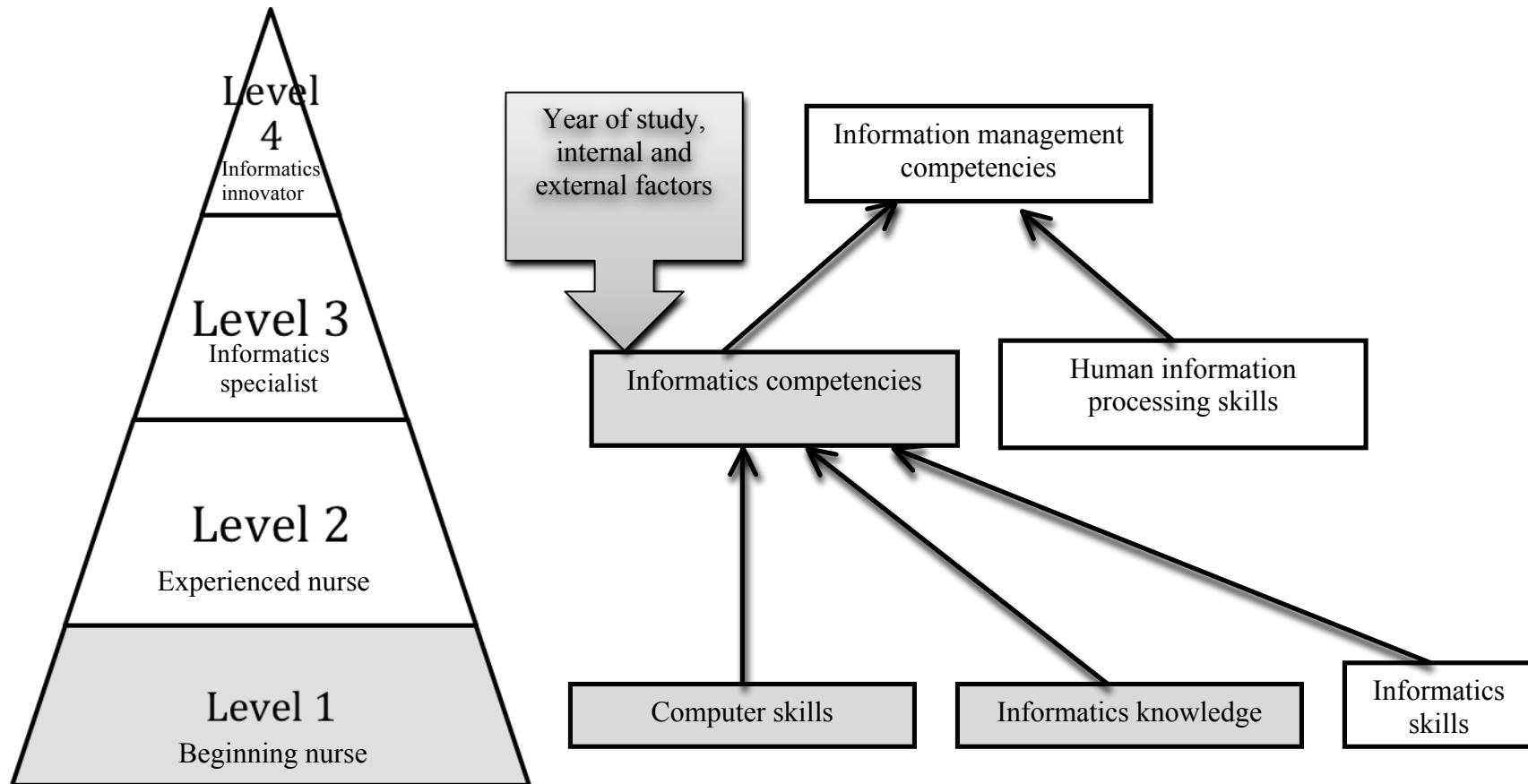


Figure 2. Information Management Framework

From 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. Adapted with permission from the author in 2011 to reflect the hypothesis of relationship of years of study, internal and external factors (i.e., work experience) in the attainment of nursing informatics competencies for nursing students (Level 1 beginning nurse). The areas in grey are the focus of this study.

Research Questions

This study will explore the following two questions:

1) Do nursing students increase their NI competency scores progressively in their school program from year 1 to 4?

2) Do nursing students with work experience requiring the use of technology outside of the curriculum get higher scores for NI competencies than those without by the end of 4th year.

This thesis also seeks to determine if an interaction exists between the year of study and work experience that requires the use of technology, and its effect on NI competency scores for nursing students. The research is based on the hypothesis that NI competencies scores will gradually increase from year to year, with the highest scores observed at the end of the nursing program. By the fourth year, it is hypothesized that nursing graduates will have acquired NI competencies that are part of the beginning nurse (Level 1). It is further believed that nursing students with any work experience that requires the use of technology outside of the school program in combination with the nursing curriculum objectives pertaining to NI will have higher scores than students without such opportunities.

Methodology

Research design

A 4 Year of study (1, 2, 3, 4) X 2 work experience requiring the use of technology (yes or no) between-subjects factorial design will look at the effects of classroom education and work outside of the curriculum on the attainment of NI competency for nursing students. Initially the author sought to have more than two categories of work experience and made the distinction between healthcare and non-healthcare work. When the data gathered from the nursing students was

analysed, however, a pattern began to emerge and categories needed to be adapted. Firstly, nursing students who qualified as having work experience related to healthcare represented a small number of the total participants. Secondly, many respondents identified themselves as having work experience that did not require the use of technology. But, when looking at the description that these respondents provided of the tasks they performed in their duties or the technology they used, they actually qualified as using technology (e.g., working as a waitress in a restaurant using an electronic tablet to take orders and organize tables). As a result of these findings, all work experience requiring the use of technology (not limited to healthcare as originally planned) was included for the analysis. The participants with work experience that did not require the use of technology and who had no work experience were combined because they each had low response numbers and were identified as being equal (i.e., no technology being used in their duties).

Since the study was granted a one-time opportunity by the Nursing faculty to submit the questionnaire to nursing students, the end of the winter semester was chosen as the ideal point in time to capture the full NI competency score potential. A cross-sectional design was chosen to provide a snapshot across all four years of study. Another important reason for the selection of this method was due to the rapid changes in technology; therefore this assured all participants were exposed to the same existing technology available at that time.

Instrument

The SNCEQ is a self-rated measurement tool, sensitive to the NI skills being evaluated. This tool was selected and permission to reprint and adjust it was granted by the author (see Appendix C). Dr. Nancy Staggers alluded in 2010 personal communication that she and fellow researchers Chang, Poynton and Gassert were in the process of revising the tool for wording and

re-evaluating the number of competencies (see Appendix D and E). The revised list of NI competencies from Dr. Chang et al. was not published at the time in 2010. The SNCEQ was adjusted to take into consideration the work underway by Dr. Chang et al. to classify the NI competencies under the four levels of nurse practice and incorporating 2010 technological advances (e.g., social media, smartphones).

The SNCEQ was first piloted in 1994 on 25 participants who had a baccalaureate of Science in Nursing and were engaged in nursing informatics activities. A panel of nursing informatics experts for content validity assessed responses and evidence was found that suggested some construct validity. The SNCEQ was then revised and retested in 1998 on 98 clinical nurses.

Other researchers have used the SNCEQ tool in the past. In 2000, Stagers and Kobus used the questionnaire as a part of their study to provide a description of 69 nurses' previous computer experience at different levels of education. The content validity of the questionnaire's subscales ranged from .83 to 1.00. Test-retest reliability was examined with a group of 24 graduate nurses and revealed a Pearson product-moment correlations ranged from .90 to .97 between the first and second test on the various subscales of the SNCEQ. The statistical results indicated that repeating the test gave similar responses for the participants and proved its constancy and rigour.

In 2002 Stagers et al. revised the list of NI competencies comprised in the tool. The researchers' goal was to identify the proper queries to survey nurses at all levels of practice for current studies using the SNCEQ. As part of her doctoral work in 2007 Dr. Jieh Chang further validated the list of competencies provided by Stagers, reaffirming them and adding competency statements needed for current and future practices. The SNCEQ instrument was revised to

classify NI competencies at the level 1 of practice for beginning nurse (Chang, 2010). The adjustments made to the questionnaire were sensitive to time and technology in the clinical setting and followed current informatics competencies for nursing. For example old questions included: “Did you enter or modify doctor’s orders (order entry) or chart nursing assessment in an electronic application (e.g., electronic documentation)?”. One example of a revised question was, “Uses a variety of search tools (information literacy)?”. Fetter referred to the Stagers’ tool as an innovation that “advanced informatics assessment by developing a data-based, comprehensive informatics competency instrument” (2009b, p. 86).

Despite its age and revisions, the tool is sought out by fellow researchers in the field of NI and remains up to date. The latest study using SNCEQ with 32 items reported internal consistency with an alpha coefficient of 0.86 (Akhu-Zaheya & Khater, 2013). The statistical results illustrated the tools’ precision and reliability. This confirmed that the tool was well suited to answer the thesis’ questions.

The amendments made to the instrument for this study are described below. The revised instrument included specific questions on demographics to better describe the participants in the study. Examples of questions asked to nursing students were: Identify their current year of study, gender, age, perceived level of expertise with computers and personal feelings towards computers.

Specific questions were added to inquire about work experience in order to validate if this variable would have an impact on the independent variables. In order for work experience to be retained from the respondents, the criteria for inclusion in the study were explained in class presentations and written on the on-line questionnaire: Work experience requiring the use of technology for a minimum of four consecutive weeks and participants had to identify the field of

their work (it was not mandatory to be in healthcare). If one of the two were not answered correctly, the participant did not qualify as having valid work experience.

Based on the NICQ under development by Chang et al. in 2010, it was deemed critical to include four questions on mobile technology used in clinical practice (see Appendix H). Results from Androwich in 2013 corroborated that mobile technology usage impacted the approach taken by healthcare professionals for their care delivery. The use of wireless technology cannot be dissociated from NI competencies, and therefore must be evaluated.

To evaluate the validity of the SNCEQ as an effective assessment tool for NI competencies, Dr. Stagers collected evidence concerning the five aspects of construct validity: 1) Content, 2) evidence, 3) responses process, 4) internal structure, 5) relationship with other variables and consequences (Downing, 2003; Downing & Haladyna, 2004; Varkey, Natt, Lesnick, Downing, & Yudkowsky, 2008). The results are detailed in the article published by the inventor of the tool and the many steps it took to construct (Stagers, 1994).

Even though the instrument used in this thesis was found through a literature search and modifications were made to it, the author assessed all five aspects of validity and reliability of the questionnaire using the framework described in Ian McDowell's book: *Measuring Health: A guide to rating scales and questionnaire* (2006) (see Table 1).

Table 1

Based on the framework for assessing validity and reliability by McDowell (2006).

Assessing validity	Description	Completed
1. Face validity	Does the instrument appear to be assessing the desired concepts?	Yes. Clinical experts were consulted and four peer nurses completed the questionnaire to assess clarity of wording (readability).
2. Content validity	Do questionnaire items adequately cover the themes that were specified in the conceptual definition of its scope; (expert advisory panel; pretesting with a small group of nurses for wording clarity.	Yes. The adjusted content was validated with the tool NICQ from an expert in the field Dr. Jieh Chang via personal communication of an unpublished revised questionnaire. The adjustments made to the questions were meant to reflect the new realities of the 21 st century with mobile devices, social media and web 2.0. All questions were validated with colleagues deemed experts in the field and non-experts for clarity and relevance to themes from the different sections of the questionnaire.
3. Criterion validity	Do scores on the instrument agree with a definitive measurement of the same theme?	Yes. Staggers evaluated the criterion validity. Overall questions on the SNCEQ were correlated with criterion such as: Overall, computer use, computer knowledge, role participation, role knowledge, courses relating to technology in 1994. Staggers' work defining NI competencies is the basis for the Canadian Association of Schools of nursing (CASN) entry-to-practice competencies for registered nurses (2012).

Table 1 (continued)

Based on the framework for assessing validity and reliability by McDowell (2006).

Assessing validity	Description	Completed
4. Construct validity	Includes conceptual definition of the topic (or construct) to be measured, indicating the internal structure of its components and the way it relates to other constructs.	Yes. Staggers validated that the individuals questioned with SNCEQ possessed a trait or quality that the instrument measured. Initial testing in 1994 used the contrasted groups approach (i.e., a group of female nurses who attend informatics meetings and are engaged in nursing informatics activities would use and know more about computers than a group of female graduate nursing students). It was hypothesized that informatics nurses would score higher than graduate nursing students. To evaluate construct validity a one-way analysis of variance was calculated to determine if the two groups significantly differed on the subscales and the total score. The following were compared in the two groups: a) Computer use subscale, b) computer knowledge subscale, c) role participation subscale, d) role knowledge subscale, e) overall SNCEQ scores, f) novice-expert rating, and g) total number of formal courses. Staggers results showed that informatics nurses scored significantly higher than the students for all subscales.

Table 1 (continued)

Based on the framework for assessing validity and reliability by McDowell (2006).

Assessing validity	Description	Completed
5. Reliability or consistency	The consistency or stability of measurement process across time, patients or observers (i.e., repeating measurements should give matching results).	In 1994, original version Stagers had a test-retest to estimate reliability of the tool with 24 nursing students from a graduate-level. Scores showed no significant differences between the first test administrations to the second. And also significant positive correlations.

The questionnaire was divided in six sections including: 1) Demographic characteristics, 2) computer use and knowledge, 3) level of computer experience, 4) reasons for not using a computer and two sections were added 5) formal computer knowledge, 6) work experience outside the curriculum.

The questionnaire consisted of two subscales including 33 items with a five-point scale (0=none, 1=low, 2= moderate, 3= High, 4=extensively or more). No modifications were made to the measuring scale. The questionnaire used the total score for computer use and computer knowledge (i.e., dependant variables) to quantify the NI competencies for nursing students. As per Stagers' instructions, the tool permits to tally and report the total scores for computer use

and knowledge separately. Stagers specified that the novice to expert scale had to be reported separately.

Usually Likert scales are used to measure attitudes, but in this study it measured use and knowledge of specific informatics tools. Controversy exists about using an ordinal scale to perform parametric statistics (Jamieson, 2004). Norman demonstrated that parametric statistics are robust to violations of the assumptions of ANOVA independences of cases, normality and homogeneity (2010). Norman indicated that there have been many studies pointing to the robustness of ordinal data. He further referred to the work of Carifio and Perla (2008) which stated that: “Their strongest argument appears to be that while Likert questions or items are ordinal, Likert scales, consisting of sums across many times, will be interval” (p. 629). Knapp stated that the sample size and distribution are more important than the level of measurement in determining the use of parametric statistics (1990).

The 33 questions had two scales. The first scale rated past or present computer use (CU) and the second scale rated respondents’ computer knowledge (CK). Here is an example of a question: Do you know all the features of your email application? Questions covered subjects such as: Internet applications, social media use, word processing software’s and use of an electronic health record (patient’s chart).

The total scores for CU questions ranged from 0 to 132 points and were calculated by summing the 33 items. Five questions were added to evaluate the CK of nursing students and used the same five-point scale of the CU questions. The total scores for CK questions ranged from 0 to 152.

Focused questions on NI asked if the nursing students had taken prior computer courses, attended NI conferences or read about the subject of technology/informatics. The total individual

scores of CU and CK were needed to answer the thesis' questions. Thus, a high score on this instrument indicated the participants had NI competencies.

A section of the questionnaire enumerated the 14 possible reasons for not using computers and participants could select as many responses as applicable. The answers included “not applicable, I use computers often”, “never had typing”, “no computers at work”, “clerks at the hospital do all computer interactions while in my clinical placements and/or personal job”, “using computers is not in my job description”, “no computer at home”, “computers make me anxious”, “not really interested in computers”, “not allowed to use computers during clinical placements”, “never had a computer course”, “no time during clinical placements to use computers”, “no need for computers at home”, “afraid of losing files or information, and “not enough computers or mobile devices during clinical placements” (this last item was added to reflect clinical realities).

The last section of the questionnaire was added to capture work experience of the nursing students. Emphasis was put on this section during class presentations and stressed how critical the student's responses were to answer the questions for the research project. Qualifying work experience for this study was defined and placed before the five questions: “At least 4 consecutive weeks of work as a ward clerk, nursing aid or nursing student summer job, etc. Anything relating to nursing, requiring helping nurses in their duties, documenting in the electronic chart, viewing the electronic chart, retrieving electronic information” (see Appendix H for the complete instrument). Participants not meeting these criteria were classified in the category of no work experience.

In 1994, when the SNCEQ was created, Stagers conducted a two session pilot test with 24 graduate-level volunteers from a nursing program. The test-retest approach used yielded a Pearson r results ranging from .90 and .97 on the various subscales. As a result, the tool's

reliability was deemed adequate (Staggers, 1994). Content and construct validity were examined and yielded satisfactory results (Staggers, 1994). Content validity evaluates whether the questions/items on an instrument truly represent the intended content domain (Waltz, Strickland, & Lenz, 1991). Construct validity helps evaluate if the individuals questioned possess the trait or quality the tool tries to measure (Waltz et al., 1991).

In 1998, the SNCEQ was revised and was used for studies between 1998 and 2013. Additional reliability testing was performed by a graduate student and proved satisfactory (see Appendix F). The SNCEQ was used and referenced by numerous authors working in different health related fields (Staggers & Kobus, 2000; Staggers et al., 2002; Balen, PharmD, & Jewesson, 2004; Booth, 2006; Staggers, Kobus & Brown, 2007; Fetter, 2009b; Koivunen, Välimäki, Koskinen, Staggers, & Katajisto 2009; Akhu-Zaheya & Khater, 2013). The researchers all used the same scale in their studies with satisfactory results.

For this study, a pilot test was performed to evaluate the reliability and content validity with four peer nurse experts in the NI field. The expert group was consulted to help identify relevant questions, to comment on wording, content, clarity, visual appearance, ease of completion of the questionnaire, questionnaire format and design. The SNCEQ tool inspired the instrument format used in this research. Comments of the experts were evaluated carefully and wording adjustments were made. Then a pre-test was performed with 5 non-expert nurses who viewed themselves as novices in the field to ensure proper understanding of the questions, terminology used and time required to complete the questionnaire. The adjustments recommended with the first pilot of experts proved to be efficient, as no wording issues were identified. It took between 20-30 minutes for the five novice nurses to complete the

questionnaire. Moreover, they felt the questionnaire applied to them professionally and asked what they could do to improve their score/competencies in NI.

The questionnaire was adjusted for this study to eliminate tools not used in Canada. Nursing students surveyed in Canada do not use, for example, CASE tools referred to in question 16 of the NICQ. Therefore this question was replaced with one that inquired about the use of social media/networks for school projects (see Appendix H). Cronbach alpha values were calculated to verify the revised instrument's internal consistency. The result for the computer use subsection (33 items) was .89 and knowledge subsection (38 items) was .93. The results revealed internal consistency for each of these subsections and were satisfactory.

Participants

Participants were nursing students from a pre-selected University and College collaborative program located in the province of Ontario and that followed the national competencies adopted by CNO. Nursing students of all four years from the French and English baccalaureate program were invited to participate in this study. The number of potential respondents was estimated at 1000 nursing students registered for both French and English programs per year. To be selected in the study, students had to be registered in the winter semester and the educational institution had to be accredited by the CASN in the province of Ontario, Canada. An accredited school means that the institution follows the nursing education standards that are national in scope. The curriculum incorporates expectations that graduates will be prepared to meet the requirements identified by the professional and regulatory associations (CASN, 2012).

There were 196 participants who responded. Twenty respondents had incomplete answers and were rejected. 176 nursing students remained for the final analysis. For each year of study,

over 30 participants fully completed the questionnaire. This sample size permitted to answer the thesis questions that looked at all four years of study for the nursing program.

All four school years were represented. The number of students per year of study were distributed this way: First year students represented 21.00% (n=37), second year had the highest number with 35.80% of respondents (n=63), third year students equal to first year with 21.00% (n=37), and fourth year had 22.20% (n=39). The results indicated that the highest number of participants were second year nursing students. The majority of respondents were females 95.50% (n=168) and males represented 4.50% (n=8). These results were in alignment with the reported statistics that state that fewer than 6% of American nurses are men (Spratley, Johnson, Sochalski, Fritz, & Spencer, 2001).

The participants' ages ranged from 18 to 48; the average age of students across all four years was 23.40 years (SD = 6.05). The participants' median age was 21 years, and had a mode of 20 years. Broken down by year of study the mean age for year one was 22.14 (SD=7.16), a median of 19 and a mode of 18; year two 23.35 (SD=5.23) a median of 20 and a mode of 19; year three 21.86 (SD=4.21) a median of 21 and a mode of 20; and year four 26.15 (SD=6.84), a median of 23 and a mode of 23.

The first year group was the youngest in age, as expected, and the factor of age gradually increased until graduation year. To enable a comparison of scores by age the sample was divided into four age groups: 18-19, 20-29, 30-39 and 40-48. The students who were aged between 18 and 19 (n=45) represented 25.60% of the total sample size. The largest age group (20-29) represented 60.80% of the total sample size. The third age group (30-39) represented 10.20% and the fourth age group (40-48) represented 3.40% of the total sample size (see Figure 3).

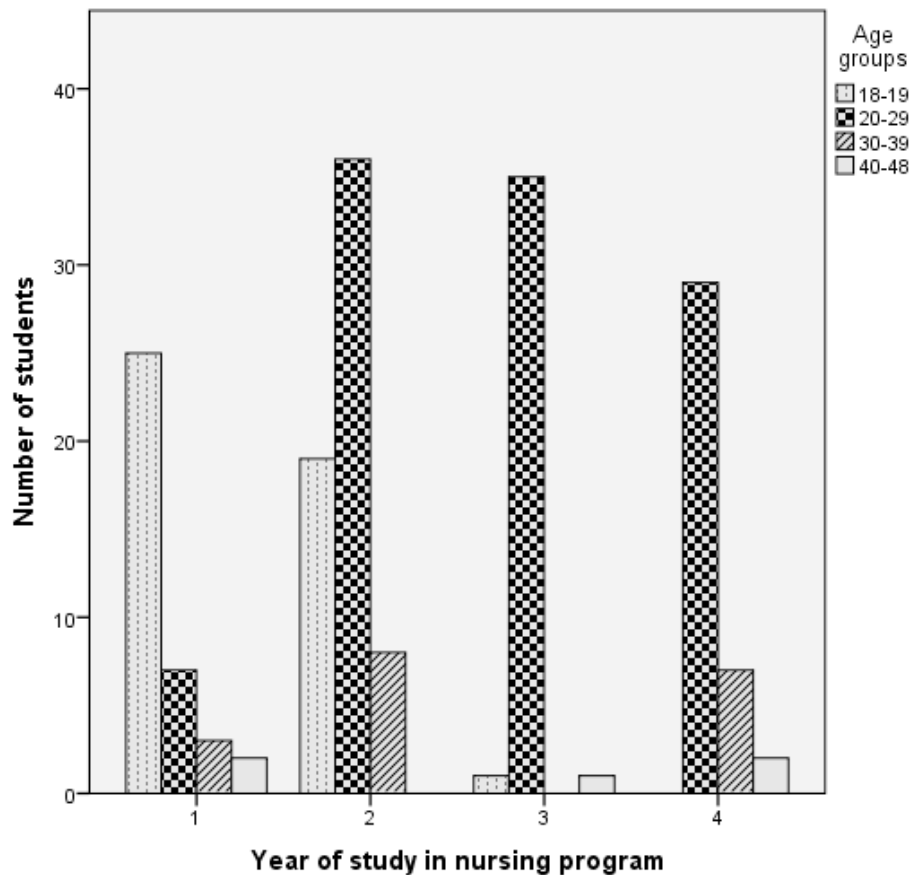


Figure 3. Age groups represented for each year of study in the nursing program.

Nursing students were asked to rate their level of expertise with computers (1=novice, 2=beginner, 3=intermediate, 4= advanced and 5=expert). For all four years, 55.10% rated themselves as intermediate (3), with a mean of 3.28 (SD=.69) placing them between intermediate (3) and advanced (4) for level of expertise with computers (see Figure 4). This finding is consistent with the literature review with results reporting that students in general viewed themselves as intermediate or advanced towards technology (Smith, Salaway, Caruso, & Katz, 2009).

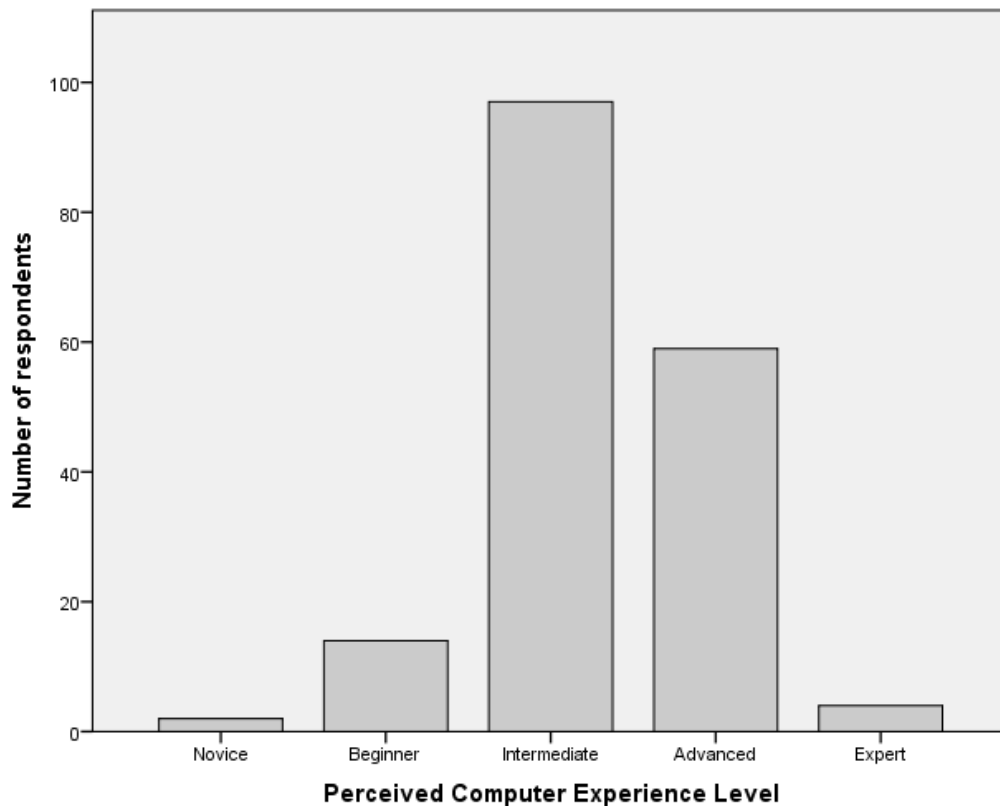


Figure 4. Perceived computer experience level for nursing students.

Looking at the different age groups, group one (18-19) rated their level of expertise with a mean of 3.36 (SD=.57); group two (20-29) rated their level of expertise with a mean of 3.34 (SD=.73); group three (30-39) rated their level of expertise with a mean of 3.00 (SD=.49); and group four (40-48) rated their level of expertise with a mean of 2.40 (SD=.89). The results indicated that the youngest students tended to rate themselves as intermediate. It is unclear if these results indicate that the students entering the program were either better prepared or tended to overestimate their level of experience because a self-rating scale was used.

The participants with work experience that required the use of technology totalled 68.18% (n=120) compared to those without 31.82% (n=56). The age group of 20-29 had the highest number of replies for this study and accounted for the majority of students registered in second, third and fourth year as seen previously in figure 3. Each individual group had a higher number of representations positive for work experience requiring the use of technology (see Figure 5). The age group of 20-29 year olds had the largest representation for work experience requiring the use of technology out of the four age groups.

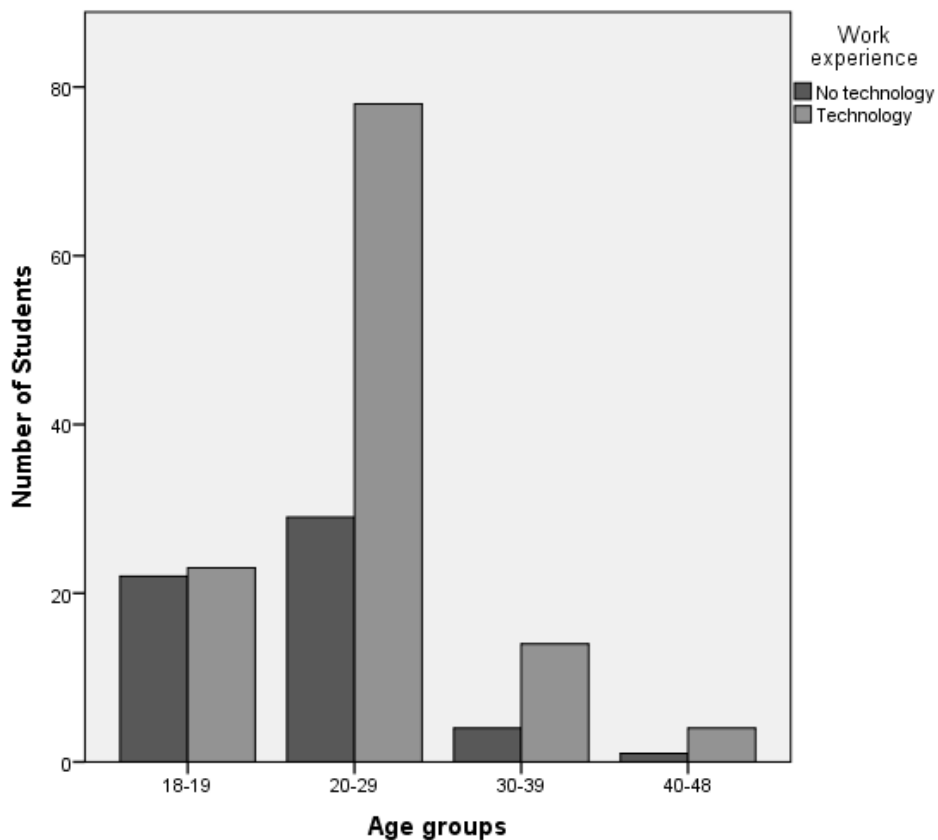


Figure 5. Students with work experience requiring the use of technology by age groups.

When comparing from year to year, the fourth year participants had the highest number of students with work experience requiring the use of technology. This attribute was expected from the participants since this group had the greatest chance to work outside of their school program during the four years. It is common practice for clinical facilities to specifically recruit nursing students as nursing assistants to enhance nursing graduates' recruitment and retention (Hôpital Montfort, 2014). Salamonson and Andrews' research (2006) reported more than three-quarters (78%) of second year students had paid employment, with the majority in nursing related-jobs. This characteristic was comparable to the present study that had 68.18% of its participants identifying themselves as having work experience during the duration of their four-year educational program.

Participants unanimously identified themselves as having access to a computer at home. The road blocks to computer use identified by the respondents were related to lack of education or equipment availability in educational settings: "Never had typing", "never had a computer course", "not enough computers or mobile devices during clinical placements" and "not enough time during clinical placements". See Annex 2, for the complete graphs of all fourteen detailed reasons for not using a computer.

Procedure

The educational institution selected for this research was an accredited school of nursing in Canada (see Appendix I). In January 2012, the author was granted a one-time window to survey the nursing students at a University in Ontario, Canada (see Appendix I). Since no financial grants were received for this study, the closest school was selected because of its convenient proximity to the researcher.

The University and affiliated College surveyed for this study begin clinical placements in the winter semester of the second year. The NI objectives found in the curriculum evaluated nursing students on their usage of technologies to communicate in the workplace. The third year of the program evaluated the use of appropriate tools and technologies. Finally in the fourth year, previous objectives were repeated with an additional objective of managing information effectively. The curriculum selected for this research referred to the identified NI competencies from CNO. The three NI competencies identified in their curriculum's objectives were skills the nursing student must demonstrate before graduating.

On January 17, 2012 the researcher was granted permission to access the faculty of nursing students of both selected schools (see Appendix J). In February, a letter was sent to both Deans requesting permission to recruit students. Mid-February, a bilingual recruitment letter was sent to the faculty's Assistant Director of the undergraduate program with the request to email the research project information letter and consent form to all nursing students (see Appendix K and L). At the same time the faculty's administration secretariat sent the recruitment details by email to all nursing teachers, asking them permission to present the research project in class (see Appendix M). A period of four weeks was given to complete the online questionnaire for all nursing students. The faculty's administration secretariat sent a reminder to all nursing students two weeks prior to closure of the online questionnaire address.

The timing of data collection had to be in the winter semester, closest to graduation, in order to maximize the potential for answering the thesis' questions. The nursing faculty agreed to send communication before the scheduled final exams. Mid-March, class presentations began and emails were sent out to all nursing students via the faculty secretariat detailing the study,

seeking voluntary participants and instructing participants to enter the website link to access the questionnaire.

The online site brought the participants directly to the cover letter. It explained the purpose and nature of the study, data confidentiality, assured anonymity of the respondents and gave the researchers' coordinates (see Appendix N). After reading the information letter, nursing students had the choice to consent or decline participation. When choosing to participate they obtained access to the online questionnaire. This process provided implied consent (see Appendix O).

Results

Descriptive statistics

The data was first analyzed by looking at all years of study. Secondly, each year was looked at individually to identify possible trends. The mean score for CU with work experience requiring the use of technology for all four years of the program was 56.24 (SD=1.44) compared to a mean score of 49.57 (SD=2.50) for those without work experience. The mean score for CK with work experience and technology for all four years of the program was 60.30 (SD=1.72), compared to a mean score of 53.31 (SD=3.00) for participants with no work experience. The findings illustrated that the mean score for students with work experience requiring the use of technology was higher for both CU and CK, thus giving them a slight advantage over their counterparts (see Table 2).

The data for each year of study was analyzed looking at the responses of work experience requiring the use of technology to validate if it had an effect on the mean scores for CU and CK. First year students (n=37) who reported being employed in a job requiring the use of technology (n=17) had a mean score for CU of 49.85 (SD=15.50). Second year students (n=63) who

reported working using technology (n=40) had a mean score for CU of 54.90 (SD=14.81). Third year students (n=37) who reported working using technology (n=25) had a mean score for CU of 59.12 (SD=17.78). Lastly, fourth year students (n=39) who reported working using technology (n=35) had a mean score for CU of 61.09 (SD=15.46) (see Table 2). The data showed that mean scores for CU progressively increased over the years and that the group in each year of the program with work experience requiring the use of technology had a higher mean score for CU.

Looking now at the mean scores for CK, year one students with work experience requiring the use of technology (n=20) had mean scores of 54.75 (SD=18.15). Year two students with work experience requiring the use of technology (n=40) had mean scores of 59.05 (SD=16.65). Year three students with work experience requiring the use of technology (n=25) had a mean score of 62.56 (SD=24.17). Lastly, year four students with work experience requiring the use of technology (n=35) had a mean score of 64.86 (SD=17.41).

The findings for the mean scores of CK illustrated three things: 1) Scores increased progressively as nursing students moved towards the final year of the program, 2) a gap existed between mean scores for CK for nursing students who had work experience requiring the use of technology and those who did not and 3) by fourth year, the gap between mean scores for CK was smaller for those with work experience requiring the use of technology and those without work experience.

By fourth year the gap between mean scores for both CU and CK were not as pronounced. This result indicated that students without work experience caught up or were not disfavoured in attaining NI competencies compared to those who had worked with technology outside of the curriculum (see Table 2).

Table 2

Mean Scores for C.U. and C.K with Work Experience with Technology by year of study.

Year of study Work & technology	N	Mean Score C.U.	SD C.U.	Mean Score C.K.	SD C.K.
1					
With	20	49.85	15.50	54.75	18.15
Without	17	42.41	13.38	45.59	15.73
2					
With	40	54.90	14.81	59.05	16.65
Without	23	45.61	14.25	48.13	15.30
3					
With	25	59.12	17.78	62.56	24.17
Without	12	51.00	11.51	57.00	15.77
4					
With	35	61.09	16.06	64.86	17.41
Without	4	59.25	9.91	62.50	25.51
Total	176				

Overall, the CU and CK scores appeared to be normally distributed (see Figure 6). To assess the normality of the data, the Kolmogorov-Smirnov test was performed for CU and CK scores. Both tests results had a $p > .05$ (.95 and .80, respectively). These results indicated that the data were drawn from normal distributions and indicated that variability was present in the scores.

The Levene's test of homogeneity showed equal variance across conditions for computer use $F(1,3) = .18, p = .91$ and computer knowledge $F(1,3) = .75, p = .53$. These results indicated that the ANOVA assumptions were met and that the variance present in the sample was equal.

Norman in 2010 stated in his study: "Parametric statistics can be used with Likert data, with

small sample sizes, with unequal variances, and with non-normal distributions, with no fear of ‘coming to the wrong conclusion’ ” (p. 631).

Work experience requiring the use of technology was represented by the number 1 and no work experience by the number 2 for this study. The calculated mean score for work experience was below 2. This finding indicated that the majority of nursing students had prior work experience and/or were currently employed during the school year. The work experience condition had a mean of 1.57 (SD=0.50), a median of 2 and a mode of 2.

The possible scores for CU ranged from 0 to 132 points. The minimum score recorded for CU was 17.00 and the highest was 101.00 with a mean score of 53.57 (SD=16.11). The median was 52 and the mode was 49. Looking at CU scores with employment experience requiring the use of technology, the data indicated that students were scoring higher than their counterparts who reported not having work experience for all years of the program with an average difference of 6.75 (SD=2.63) and a median of 7.50 (see previous Table 2).

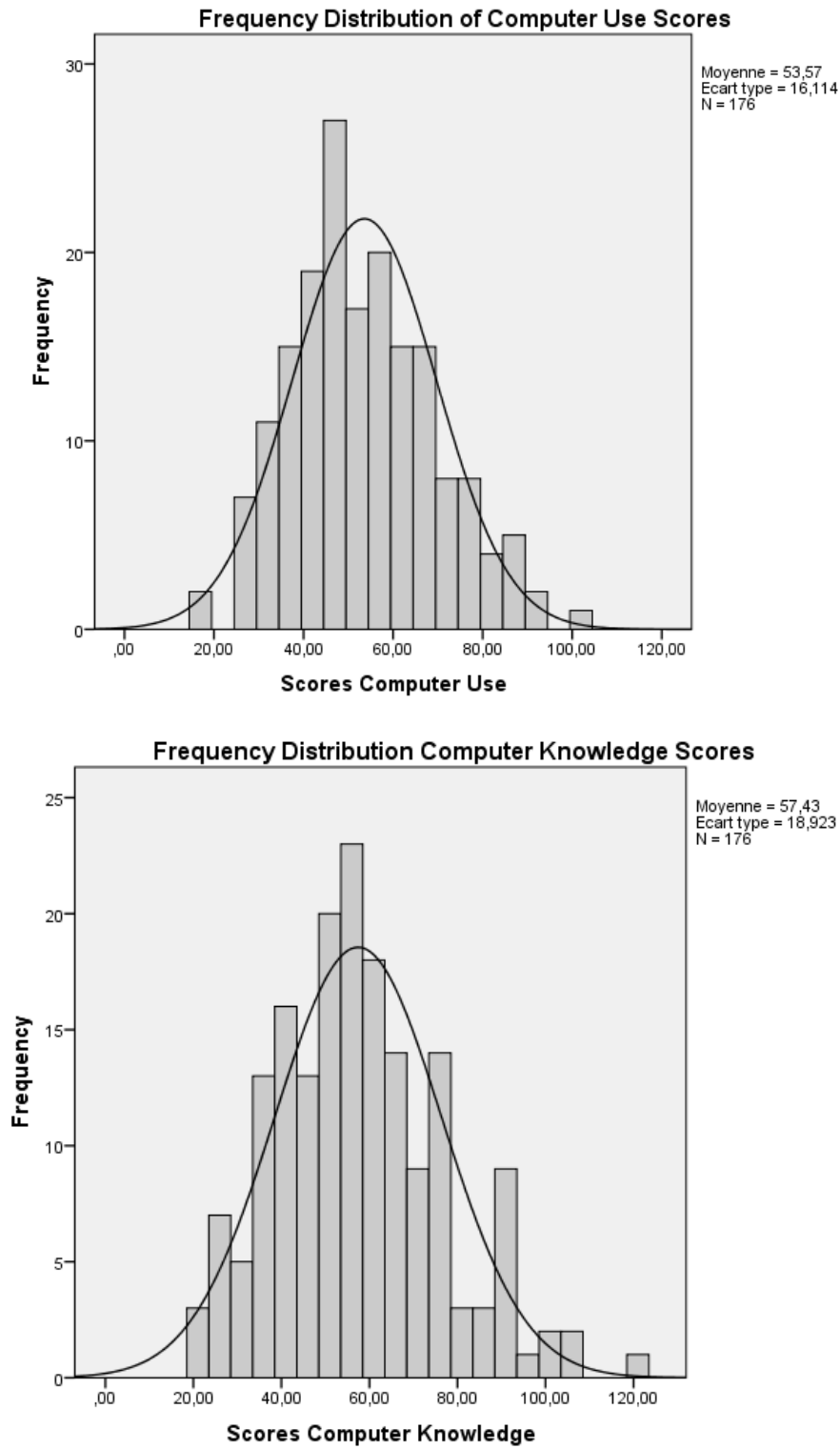


Figure 6. Frequency distribution of scores of computer use and computer knowledge for all four years of the nursing program.

The possible scores for CK ranged from 0 to 152 points. For CK the minimum score reported was 21.00 and the highest was 120.00 with a mean score of 57.43 (SD=18.92). For CK results the median was 56 with a mode of 58. The data was then analyzed for CK scores with employment experience requiring the use of technology. The data indicated that students were scoring higher than their counterparts who reported not having work experience for all years of the program with an average difference of 6.75 (SD=4.03) and a median of 7. As nursing students got closer to graduation, the difference in scores for CU and CK lessened (see previous Table 2).

Inferential statistics

The computer use and computer knowledge scores were each subjected to a four year of study (1, 2, 3, 4) by two work experience using technology (yes, no) between-subjects analysis of variance. The results showed no interaction between year of study and work experience requiring the use of technology for both scores of computer use $F(3,176) = .24, p=.87$ and computer knowledge $F(3,176) = .298, p=.83$. Results indicated that the main effect of year of study was significant for computer use $F(3,176) = 3.83, p=.011$ and computer knowledge $F(3,176) = 2.83, p=.040$. The main effect of work experience requiring the use of technology for computer use $F(1,176) = 5.36, p=.02$ and computer knowledge $F(1,176) = 4.11, p=.04$ were also significant. Hence, these 2 factors influence the total scores for NI competencies.

Follow-up pairwise comparisons were conducted using the Tukey HSD test for the year of study variable. Computer use scores were compared across all four years of the program. Year one scores compared with year two scores were insignificant at ($p=.37$); year one scores compared to year three scores proved to be significant ($p=.03$) and year one scores compared to year four scores were significant ($p<.001$). Year two scores compared to year three scores were

found not significant ($p = .39$), and year two scores compared to year four scores proved to be significant ($p = .01$). Year three scores compared to year four scores were not significant ($p = .58$) (see Table 3). The results indicated that the mean scores for year three on computer use were higher than year one scores increasing from 46.43 to 56.49. Fourth year students scored higher than year one and two for computer use with a mean score of 60.90.

Table 3

Pairwise Comparison for Year of Study and Total Scores for Computer Use.

Current Year of study	Compared Year of study	Sig.
1	2	.37
	3	.03
	4	.00
2	1	.37
	3	.39
	4	.01
3	1	.03
	2	.39
	4	.58
4	1	.00
	2	.01
	3	.58

The difference of means is significant at level .05 using the Tukey HSD test

Pairwise comparisons were also performed for computer knowledge scores. Year one scores compared to year two scores returned were not significant ($p=.63$), year one scores compared to year three scores ($p=.08$) were also insignificant, while year four scores were significant ($p=.01$). Furthermore, mean scores of computer knowledge for year two and year three compared to all other years of the program revealed to be insignificant with $p's > .05$. Year four scored higher than first year, indicating that for nursing students the computer knowledge increased gradually before graduation. In summary, the results illustrated that by graduation nursing students had greater scores in computer use and computer knowledge (see Table 4).

Table 4

Pairwise Comparison for Year of Study and Total Score for Computer Knowledge

Current Year of study	Compared Year of study	Sig.
1	2	.63
	3	.08
	4	.01
2	1	.63
	3	.43
	4	.05
3	1	.08
	2	.43
	4	.79
4	1	.01
	2	.05
	3	.79

The difference of means is significant at level .05 using the Tukey HSD test

In response to the study's first question; the results suggest that the year of study variable has an effect on NI competency scores for nursing students. This effect is observable by the sustained increase in value for NI competency scores from when they first entered the program to graduation (see Figure 7).

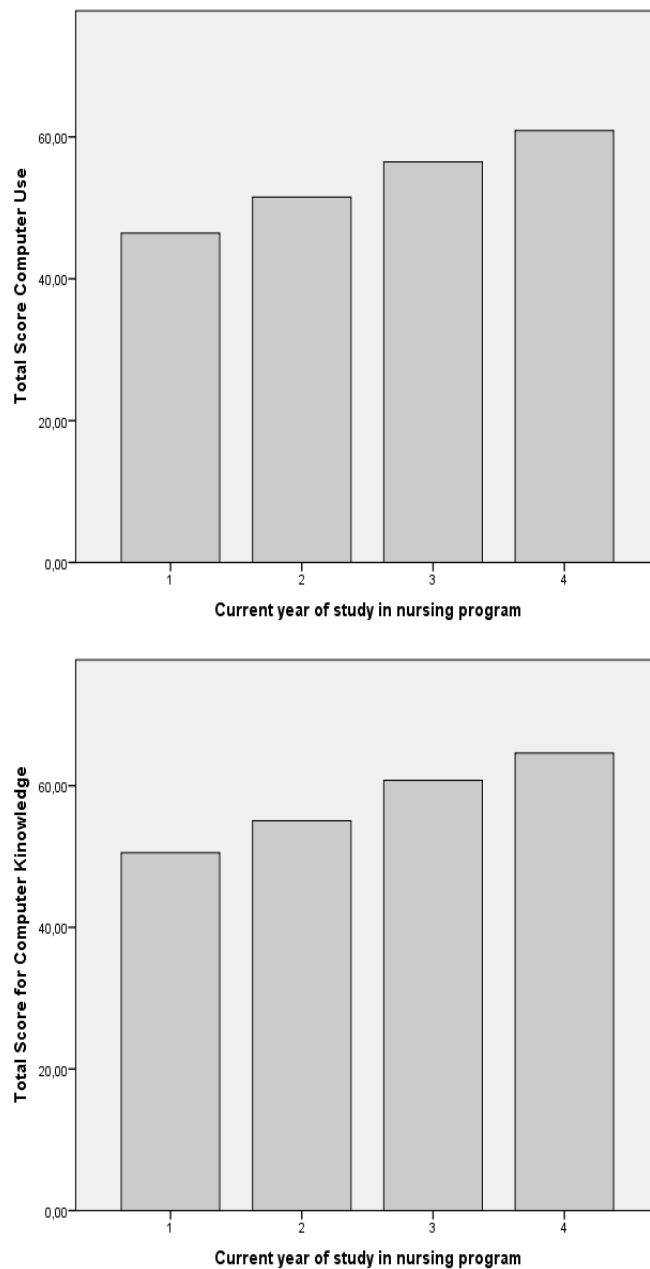


Figure 7. Histogram representing the distribution of scores for computer use and computer knowledge throughout the four years of the nursing program.

In response to question number two; results indicate that NI competency scores were higher for computer use and computer knowledge for all nursing students who had work experience requiring the use of technology outside of the curriculum. Furthermore, students who had extra exposure to technology entering the program scored higher still on their NI competencies and seemed to maintain this advantage throughout the four years of the program (see Figure 8).

Graveley, Lust, and Fullerton (1999) stated that age was negatively related to technological skills, as observed in older students having lower computer abilities. A study done almost ten years later found that the student population entering higher education called the ‘digital natives’, were technology savvy and desired to use and learn new technologies (Skiba et al., 2008). The results of the mean scores for computer use showed that older age groups scored higher for CU. The same group had mean scores closer to those of their fellow students on CK scores (see Table 5).

To further explore the data, the researcher validated if the nursing students’ NI competency scores were influenced by age, by year of program and work experience or all three variables. An ANOVA for main effects of year of study on age was performed. The results were significant with $F(3,175) = 4.26, p = .01$. This indicated, as expected, that the age of the participants increased with each year of the program. Another ANOVA was performed for main effects of work on age and revealed to be significant with $F(3,175) = 8.00, p = .01$. This indicated that students with work experience requiring the use of technology were older than those without such work experience (See figure 8).

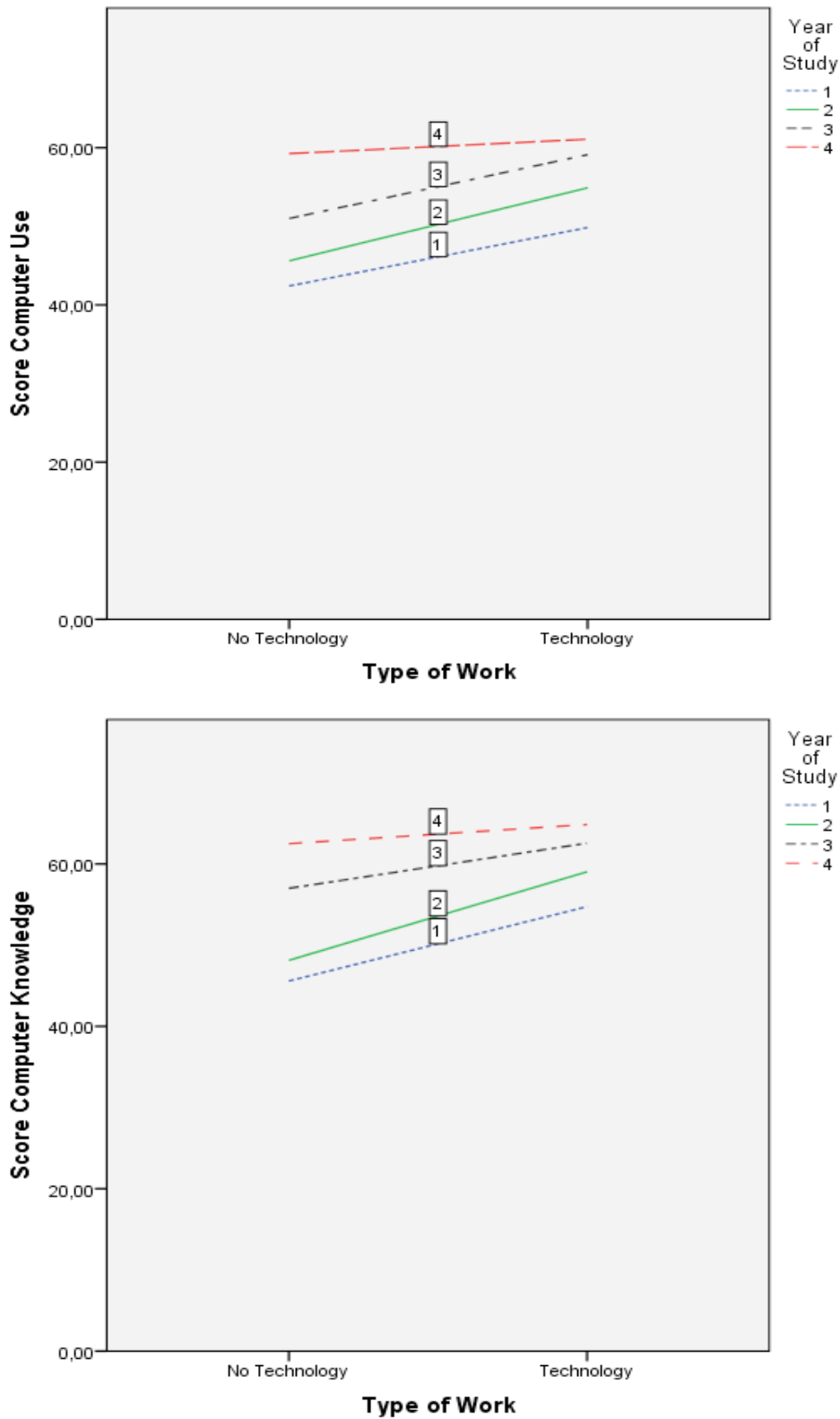


Figure 8. Technology for computer use and knowledge scores by year of study and type of work (no technology includes those with no work experience).

Table 5

Distribution and Mean Scores for C.U. and C.K. for Age Groups.

Groups of ages	N	Mean Score	SD	Mean Score	SD
		C.U.		C.K.	
18-19	45	48.64	16.04	52.00	16.08
20-29	107	57.05	15.79	61.77	19.47
30-39	18	46.17	12.90	48.17	14.20
40-48	6	50.67	17.05	48.50	21.64
Total	176	53.57	16.11	57.43	18.92

Non-significant correlations between age and total scores for computer use and computer knowledge were observed; computer use $r(174) = -.04, p > .05$ and computer knowledge $r(174) = .11, p > .05$. The factor of age did not seem to be responsible for the main effects of year of study and work experience on the total NI competency scores. In light of these findings it can be concluded that nursing students of all ages were acquiring part of their NI competency scores through work experience.

The reasons why nursing students were not using computers during their four years of study was explored and participants could select more than one answer. The top three most popular answers were “Not applicable, I use computer often” (63.60%), “Never had a computer course” (26.10%) and lastly “Not enough computers or mobile devices during clinical placements” (21.60%) (see Table 6).

In the questionnaire, the questions related to information and communication and technologies (ICTs) skills had the highest scores. The top three answers rated as “extensive” computer use by nursing students were: Using wireless devices (43.80%), sending electronic mail or texting (42.00%) and using different navigation systems (41.50%). The nursing

students' top three answers rated as "high" computer knowledge were: Electronic mail (50.00%), virtual classroom (46.00%) and word processing (43.80%).

On the other hand, the questions relating to the computer knowledge of health information systems (HIS) used in clinical settings scored the lowest. In fact, the response "none", meaning never used or no computer knowledge had the highest score for these particular questions. The questions were: Order or update electronically a list of supplies (CU 80.10% and CK 76.70%), entering electronically doctors' orders in the electronic chart (CU 79.50% and CK 71.00%) and electronically providing information to complete the discharge plan for the patient (CU 75.60% and CK 72.70%). The results reflect the fact that these tasks are frequently not allowed to be performed by nursing students, and remain the responsibility of employed staff.

Table 6

Reasons why student nurses are not using computers often.

Reasons	N	% of Response
Not Applicable, I use often	112	63.6 %
Never had typing	6	3.4 %
No computers at work	7	4.0 %
Clerks do all computer interactions	21	11.9 %
Not in my job description	11	6.3 %
No computer at home	0	0 %
They make me anxious	6	3.4 %
Not really interested in them	18	10.2 %
Not allowed to use them in clinical placement	22	12.5 %
Never had a computer course	46	26.1 %
No time to use during clinical placement	18	10.2 %
No need for one at home	0	0 %
Afraid of losing files or information	9	5.1 %
Not enough available during clinical placement	38	21.6 %
Total	176	

Discussion

Hypotheses

The researcher's first suggested hypothesis was a gradual increase in NI competency scores across all four year of the educational programs and was confirmed. The results implied that more exposure to technology yielded higher scores on NI competencies upon completion of the nursing program. The second hypothesis suggested an interaction between the year of study and external work requiring the use of technology on the attainment of NI competency. This hypothesis was disproved.

A third hypothesis hoped to prove a more sizable difference in NI competency scores between years three and four for nursing students without work experience. This was hypothesized because fourth year consisted mostly of clinical placements. However, this was refuted. Instead, higher scores were obtained for computer knowledge just before the end of 4th year. The gathered computer use scores depicted that year three and year four had significantly higher scores than year one and year two respectively. In summary, nursing students who had exposure to technology by having external work experience began with and maintained higher NI competency scores compared to those without work experience.

Limitations

The research study may have had limitations that could have affected the internal and external validity. The research was not funded and one university and its affiliated college were surveyed in the province of Ontario, Canada. Therefore inferences cannot be made about NI competencies status for nursing students for the whole province of Ontario.

Sampling technique of voluntary participation, may have introduced a personal interest bias. The participants may have agreed to partake in the study because they were attracted to the research for personal reasons, personal experience or previous exposure to the subject outside of school and work. In order to limit this possible bias, specific questions were introduced in the questionnaire to identify the proportion of participants who fitted this description. The nursing students were asked if they had taken extra courses on computers or attended conferences relating to technology. The majority of nursing students responded “none” ranging from 76.70% to 96.60% out of all the possible answers.

The literature review looked at specific tools used to measure NI competencies starting in the 1990’s. Even though the tool dated from 1998, it was proven to be current and was still being referenced and used in recent researches. The author stayed closer to the original format and total number of questions developed by Dr. Stagers rather than adding extra questions. The adjustments for wording and inclusion of newer NI competencies (e.g., wireless devices) in the instrument were done in consolidation with the revisions underway from Dr. Chang’s work (NICQ instrument).

Furthermore, five questions were added to the existing 33 Stagers questions to further inquire about “formal” computer knowledge e.g., courses taken, conferences attended, and readings on technology). The adjustments were deemed valid after conducting a pilot study with NI experts in the field to fully capture the participants’ full experiences that influenced the total score for computer knowledge. The revised version of the instrument used in this study was proven to fully address the new technologies but lacked testing on a large-scale population to fully validate its merits.

Although a pilot study was performed to validate the revised tool, there were only eight participants of whom four were experts in the field of NI and four working nurses who considered themselves as novices. Because the instrument was adjusted, it would have been preferable to pilot it with a larger sample and with respondents from the targeted nursing student population. If a pre-test had been performed, an even lower response rate would have been obtained, as the pre-test participants would have had to be excluded from the actual study.

The timing (near final exams) was crucial to answer the thesis questions, but it may have contributed to the difficulty in recruiting participants. The faculty members of nursing limited access to the student in order to protect them from too much soliciting at the end of the semester.

The instrument was built as a self-perceived NI competencies assessment tool. It measured perceived competencies rather than change in knowledge and skills of NI. As a result, study participants could have exaggerated or underrated their NI competency scores, also called social desirability bias (Gillespie et al., 2011). Self-reporting can be viewed as an inaccurate measurement when used as a retrospective evaluation. However, Rockwell & Kohn in 1989 were able to illustrate a change in knowledge by retrospectively evaluating the impact of a previously taken course.

Furthermore, the questionnaire format comprised 2 scales per question (assessing CU and CK). The possibility existed that participants were inclined by acquiescence to respond in an affirmative way to the second scale and could have impacted the results (Messick, 2005).

The literature indicated that web-questionnaire studies generated low response rates, which proved to be true. Despite a low response rate (n=176 out of the possible estimated 1000 registered nursing students per year for both English and French programs), the sample size

represented well each individual year of the program. Even with a draw prize incentive for participants who completed the questionnaire, response rates remained low (17.6%).

A low number of participants may have impeded the robustness of the ANOVA. Norman stated:

Thus both theory and data converge on the conclusion that parametric methods examining differences between means, for sample sizes greater than 5, do not require the assumption of normality, and will yield nearly correct answers even for manifestly non-normal and asymmetric distributions like exponentials (2010, p. 628).

The study's cross-sectional design use as opposed to a longitudinal design use could have contributed to NI scores being non-representative of the nursing student population. In order to alleviate this, questions were introduced to ensure nursing students' experiences with technology were comparable across the four years of the program. The assumption that most nursing students entered the program with similar NI competency skills was supported by the responses obtained from the added questions.

The majority of the respondents were females at 95.50%. Two studies were found to identify gender as a possible bias because males seem more inclined than females towards informatics (Maag, 2006; Wishart & Ward, 2002). Gender was not retained as a possible limitation given that the same gender distribution was reported in the general nursing population (Spratley et al., 2001).

The sample was unevenly distributed between all four years. There was a greater response return from second year nursing students. As a result, a type 1 error cannot be ruled out.

Recommendations

Informatics technology is evolving at a fast pace and the theory covering the subject needs constant updating. This study recommends revising the current NI definitions to include trends already found in the literature.

The adjusted definition needs to include that nurses are patient advocates toward judicious use and selection of trustworthy Internet health related websites. Nurses act as key resources for patients accessing and assist them in keeping their patient portal or personal health records (PHR) current. The Markle foundation defines the PHR as: “Encompass a wide variety of applications that enable individuals to collect, view, manage, or share their health information and conduct health-related transactions electronically” (2008).

The revised instrument used in this study portrayed a positive picture of the NI competencies for nursing students. The results indicated that NI competencies were present and that they gradually increased throughout the four-year nursing program. As presented in the literature (CASN, 2012), this study’s findings validated that ICT skills were already perceived as mastered by nursing students. Rather than retesting ICT skills, the focus of future researches necessitate the in-depth evaluation of NI competencies relating to computer use and computer knowledge of computer information systems found in clinical settings.

Before generalizations can be drawn, it is recommended that the adjusted questionnaire on self-perceived NI competencies for nursing students be retested on a larger sample size and using varied educational institutions in order to validate its reproducibility of results and reliability.

Further studies that evaluate computer use and computer knowledge but performed with different methodology are recommended to depict the current situation. A longitudinal study, following the same nursing students over the four-year trajectory, would provide a more in-depth

analysis of their NI competencies acquisitions. New research should seek to identify and categorize the NI competencies nursing students need to demonstrate for each year of the program.

The researcher recommends that future studies focus on developing a NI competencies assessment tool that does not rely on self-perceived data. It is recommended that the tool be constructed in a manner that easily allows its use and incorporation into the nursing curriculum because the literature has identified a direct relationship between the educational preparedness of nurses and patient outcomes (Aiken, Clarke, Cheung, Sloane, & Silber, 2003; Estabrooks, Midodzi, Cummings, Ricker, & Giovannetti, 2005; Tourangeau et al., 2007).

The development of an NI assessment tool for the nursing faculty can be done in conjunction with the newly available booklet called: Nursing informatics entry-to-practice competencies for registered nurses (CASN, 2012). A partnership is favoured between nursing faculties and healthcare organizations to address job expectations and translate them into a NI competency assessment tool. Nursing faculties in Canada should urgently address NI competencies and measure these skills as part of the standard curriculum for all their students within the next five years.

The nursing faculty needs to create a nursing informatics position to facilitate the addition of NI competencies to its curriculum. There is no need or place to add courses to the four-year nursing program already in place. Rather it is advised to incorporate an EHR simulator to actively practice within each class how to retrieve, enter and store electronically patient care information covered. A simulator is a physical device that replicates the functions of an actual device used in the workplace or other environment and serves the purpose to train operators on their usage (Skjerve & Bye, 2011).

Basic notions of an EHR should be addressed in class. It is advised to prepare students to the reality of many CIS tools present in the workplace. The nursing educators should focus on the documentation principles underlying the use of a CIS, rather than focusing on mastering one CIS. They need to illustrate the long-term advantages of using CIS for documentation (e.g., epidemiology trends). Educators need to foster nursing students to get involved in the workplace to adapt the electronic tools to the realities of practice and not make compromises when documenting using a CIS.

One of the biggest challenges in education today is probably the language barrier with technology terms. Instructors are part of a generation called the “digital immigrants” teaching “digital natives” who speak a totally different language (Prensky, 2001). In order to prepare Nursing educators to teach effectively, they need to have time and money protected by the nursing faculty yearly on healthcare technology. They need to be supported to obtain annual training, on-site visits to healthcare organizations that are already using an EHR and attend conferences on the emerging technologies. At a minimum they need to be following the changes seen in the workplace but ideally they need to be informatics innovators to prepare nursing students for what’s to come.

An educational plan and dedicated resources need to be put in place by the nursing faculty to support nursing students experiencing difficulties acquiring NI competencies. It is recommended to have laboratories reserved for the nursing students with a virtual EHR populated with fictional patient data. Online learning modules with predetermined case scenarios need to be developed and readily available to facilitate self-learning in these laboratories.

The findings of this study indicated that working outside of the nursing curriculum in a position that required using technology was favourable to increase NI competency scores.

Nursing faculties could support, encourage and provide a list of summer jobs that foster exposure to technology. The nursing students would have to document objectives, provide a description of the perceived benefits of the job position and submit a final report at the end of their summer employment to the nursing program for accreditation.

Conclusion

It was identified in the research performed by Hwang and Park in 2011 that the nursing curriculum needed to incorporate informatics in order to improve the nurses' competencies with CIS. Just like technical, social and ethical skills learned in the nursing program, NI competencies must have their place in the curriculum. Incorporating NI competencies as part of each topic covered would prove more efficient than adding an extra mandatory course.

A recent status report performed on baccalaureate nursing students still indicated that the integration of informatics content through the curriculum was not meeting work expectations (Hunter, McGonigle, & Hebda, 2013). This research found that nursing students engaging in extra curricular work requiring the use of informatics technology had higher NI competency scores than their non-exposed peers. Self-learning and or practice on EHR simulators could effectively close the knowledge gap for students who chose not to work during their school years.

Measuring NI competency scores remains an elusive challenge as informatics technologies and terminology continuously and rapidly evolves. Nursing students need to develop their critical thinking toward NI and engage themselves in the process of improving the EHR. Nurses have to be active participants in advancing NI competencies to the next level. Patient safety lies in the data, whether it is securing, sharing or documenting it. Since electronic

documentation is a component of the nursing process, the body of profession needs play an important role in developing strategies to reduce errors and improve patient outcomes.

As this research was approaching its completion for collecting the data, the CASN (2012) in collaboration with the Canada Health Infoway developed the “Nursing Informatics Entry-to-Practice Competencies for Registered Nurses”. It comprised the nursing informatics competencies that all registered nurses should possess upon graduating from an undergraduate-nursing program in Canada. Many questions remain how this guide will be applied and how outcomes will be measured. Future research will need to identify a specific set of measurable NI skills to assess that nursing students are achieving baseline NI competencies for practice. It was hoped that this study increased awareness of nursing students and educational institutions on the importance of incorporating NI competency development and evaluation within the nursing curriculum. The best is yet to come for the field of nursing informatics.

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Annexes

Annex 1**Summary Review of Instruments Developed to Measure Computer Knowledge and Use.**

Reprinted by permission from article by S. Hobbs, 2002.

Authors/ Years published	Sample	Design (Nonexperimental)	Competencies	Results
Carter and Axford 1993	10 Australian nursing experts 150 randomly selected clinical nurses	Delphi survey of 75-item questionnaire	System specific items, analyze nursing information needs, communicate needs to IS personnel, security. Focus of the research is on computer knowledge.	Skills the groups specifically believed were unnecessary for nurses. i.e., word processing for beginners, basic computer terminology, knowledge of hardware configurations.
Staggers 1994	Pilot included 24 graduate nursing and excluded males. In 1991, 110 clinical nurses took the questionnaire. In 1998, revised and tested with 98 nurses.	The Staggers Nursing Computer Experience Questionnaire (SNCEQ) is a self-developed, 32 item (questions) 5-point Likert scale.	General computer use, knowledge of Health Information – systems applications. Focus of the research is both computer use and knowledge.	To measure self-perceived use and knowledge. Participants rate their level of expertise on computers. Internal consistency ranged from 0.86 to 0.95 for the two subscales of the questionnaire.

Annex 1 (continued)

Summary Review of Instruments Developed to Measure Computer Knowledge and Use.

Reprinted by permission from article by S. Hobbs, 2002.

Authors/ Years published	Sample	Design (Nonexperimental)	Competencies	Results
Birx, Castleberry, and Perry 1996	38 senior nursing students (20 experimental, 18 control) enrolled in a mental health class.	Self-developed 10-item multiple-choice tool combined with 10 to 12 task checklists.	Basic computer terminology, email, word processing, library searches. Focus of the research is on both computer use and knowledge.	Students were given a laptop in a nursing course and other were not. No statistical difference between the two groups. There was significant increase in computer skills for students given a nursing course with laptops.
Saranto and Leino-Kilpi 1997	15 identified experts: 5 clinical nurse managers, 5 nurse educators, 3 student nurses and 2 patients.	Delphi Survey	Knowledge of basic components, able to use word processing, database, spreadsheet, email, computerized patient, virus, the use of equipment, and system security. Focus of research was on both computer use and knowledge.	

Annex 1 (continued)

Summary Review of Instruments Developed to Measure Computer Knowledge and Use.

Reprinted by permission from article by S. Hobbs, 2002.

Authors/ Years published	Sample	Design (Nonexperimental)	Competencies	Results
Arnold 1998	497 respondents to a mailing of listees on a continuing computer conference mailing list.	Self-developed 7-item mail survey on Education Needs Survey (EDS).	Word processing at 73,4%, email at 49,6%, database at 46%, spreadsheet at 44,1%, hospital information systems (HIS) at 43,4%. Research focus on computer use.	This survey targeted nurses already in informatics regarding their computer use, educational plans, and expectations for certification content.
Marini 2000	30 BSN and 6 RN nursing students.	Self-developed 21-item course evaluation.	Word-processing, presenting graphics, Internet searches. Research focus on computer knowledge.	Measured the effect of an elective nursing informatics course on nursing students using a pre and post comparative study design.

Annex 1 (continued)

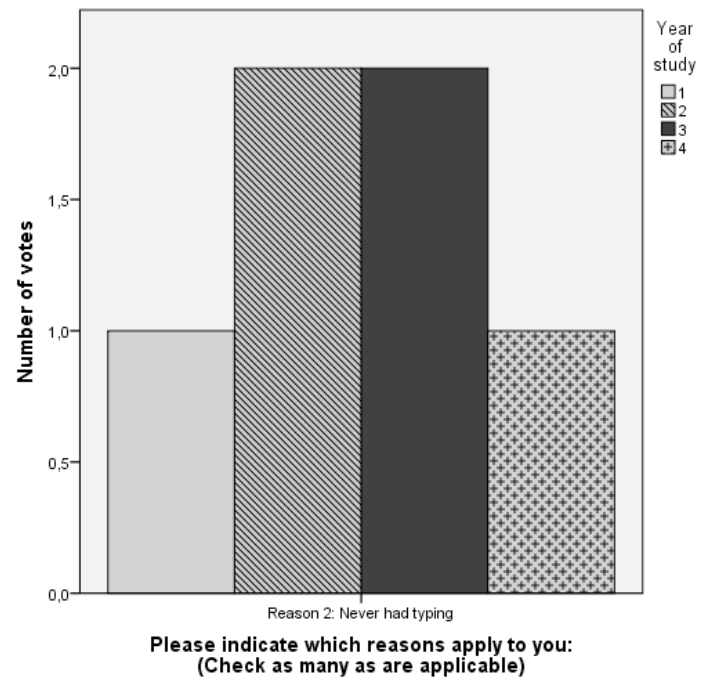
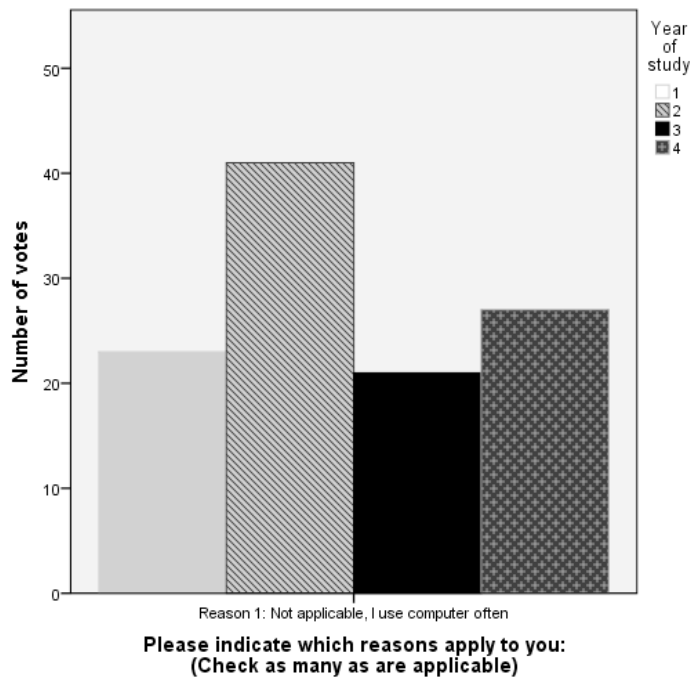
Summary Review of Instruments Developed to Measure Computer Knowledge and Use.

Reprinted by permission from article by S. Hobbs, 2002.

Authors/ Years published	Sample	Design (Nonexperimental)	Competencies	Results
Liu, Pothiban, Lu, and Khamphonsiri 2000	169 clinical staff nurses in the People's Republic of China.	Evaluation, self- developed, 20-item true- false questionnaire named: The Nurse' Computer Knowledge Questionnaire (NCKQ).	Basic computer knowledge (i.e., components, on-off) 8- item. HIS knowledge (i.e., operation sequences, order entry, error correction) 8- items. System security (i.e., changing password, virus protection) 4-item. Focuses on computer use and knowledge.	This tool was developed to measure the computer knowledge of Chinese nurses in a Beijing hospital 1 year after HIS implementation.

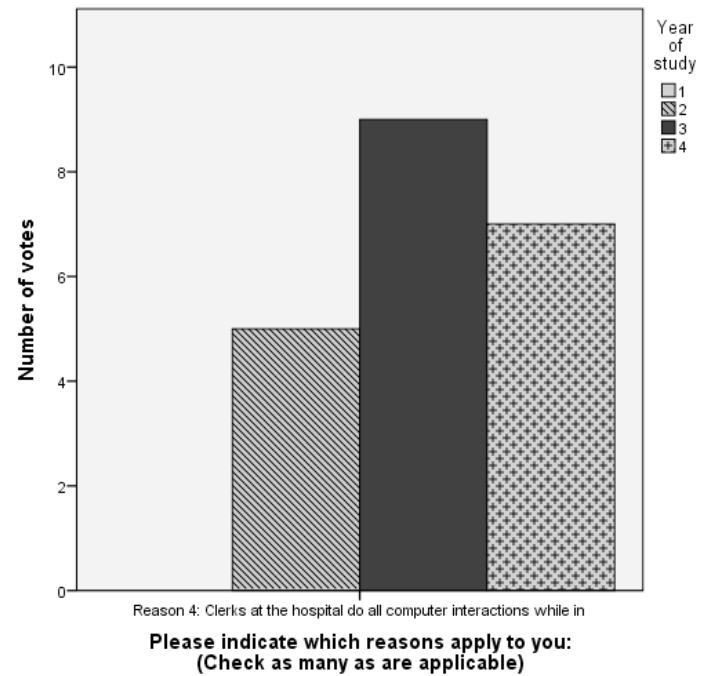
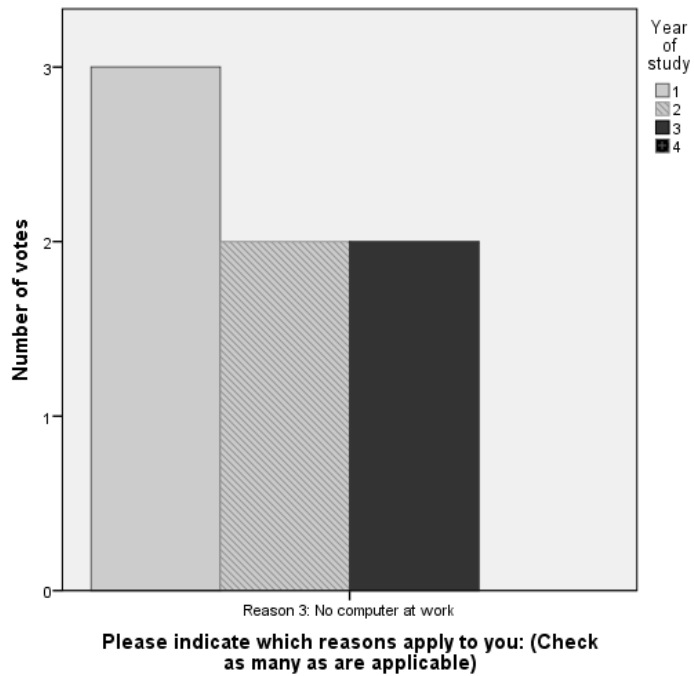
Annex 2

Fourteen reasons why nursing students may not use computer often.



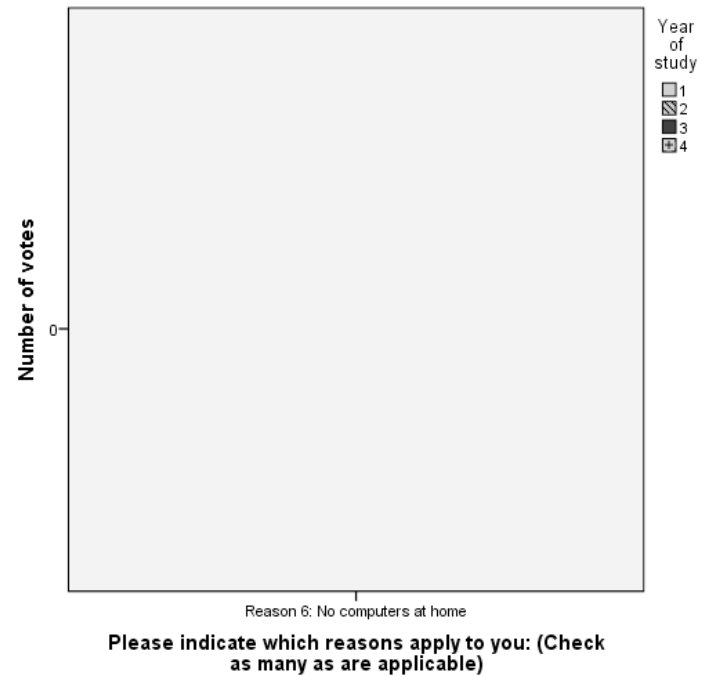
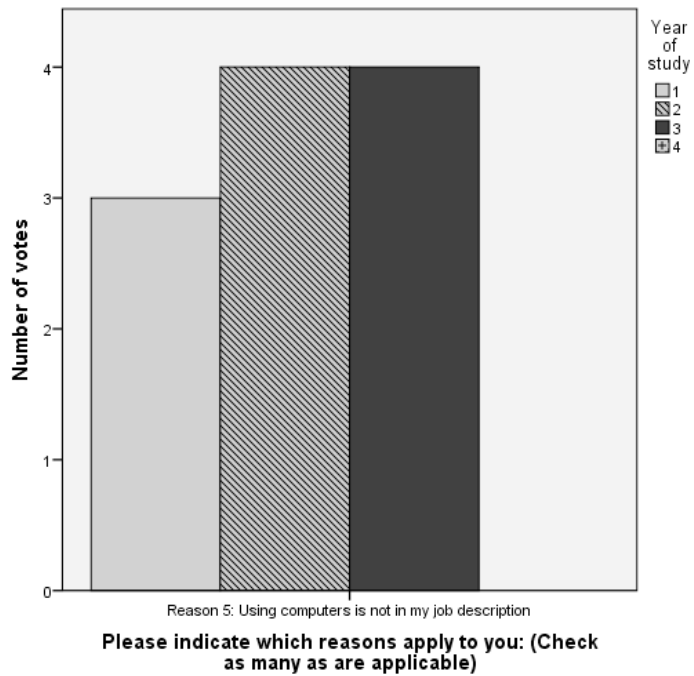
Annex 2 (continued)

Fourteen reasons why nursing students may not use computers often.



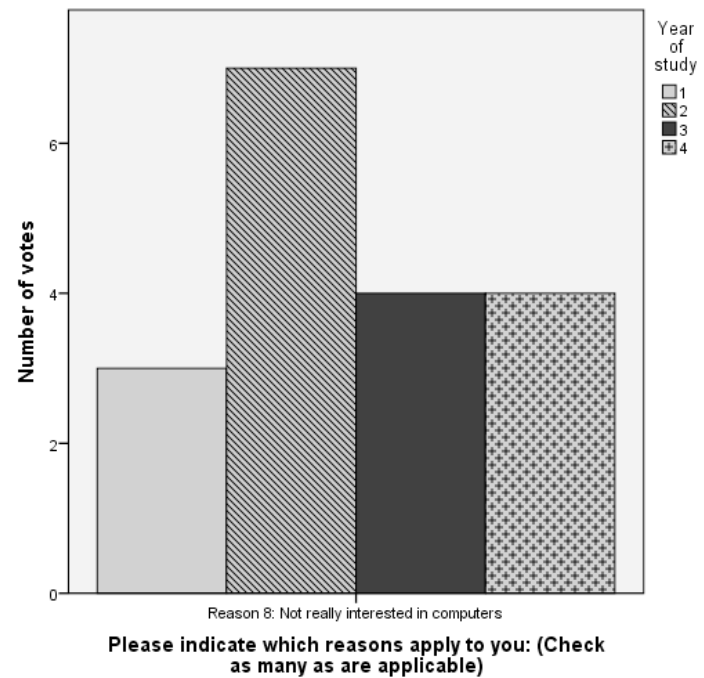
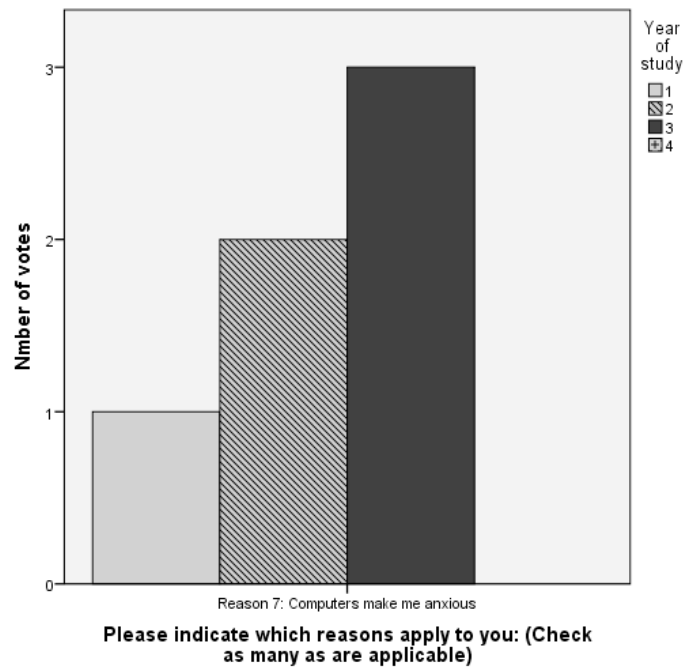
Annex 2 (continued)

Fourteen reasons why nursing students may not use computers often.



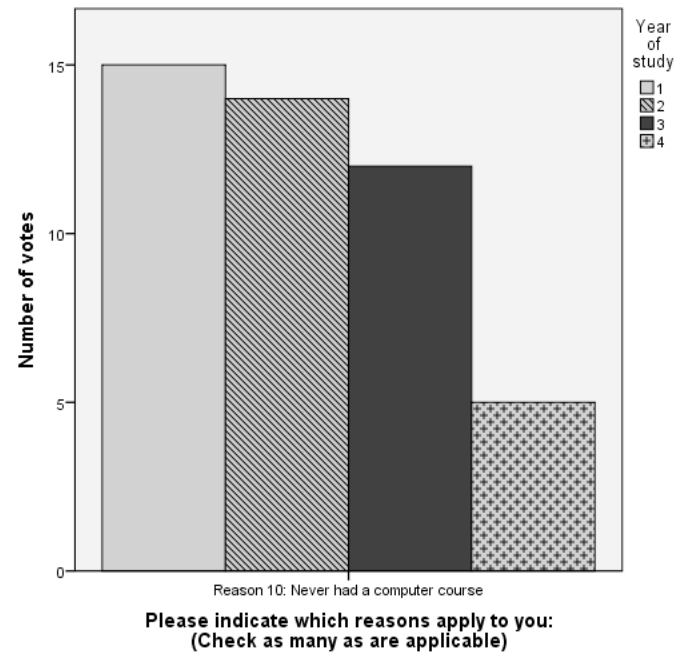
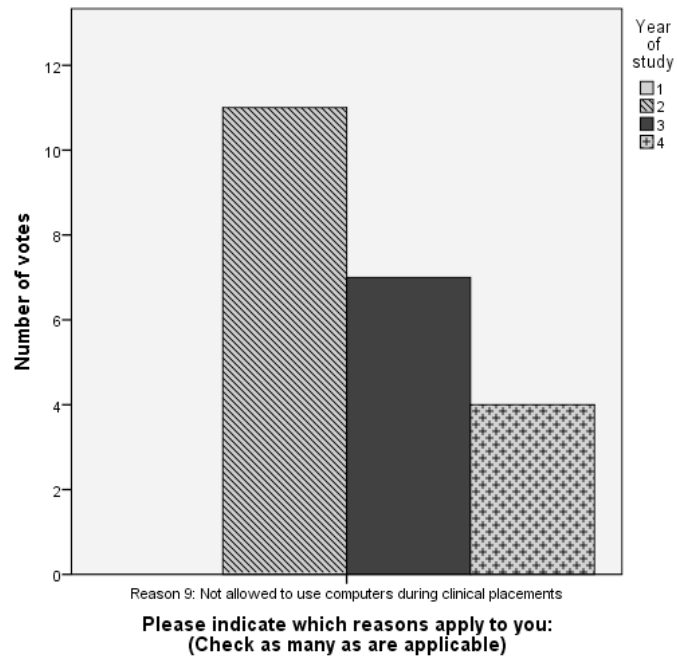
Annex 2 (continued)

Fourteen reasons why nursing students may not use computers often.



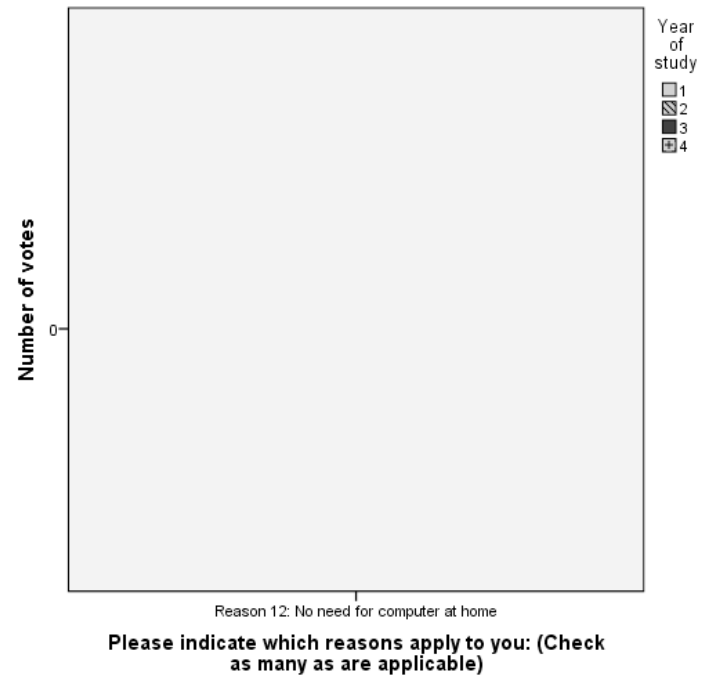
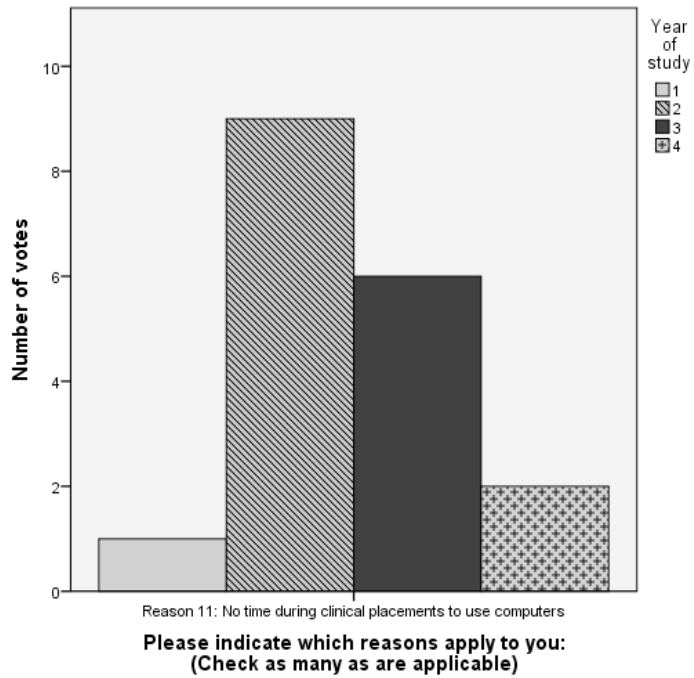
Annex 2 (continued)

Fourteen reasons why nursing students may not use computers often.



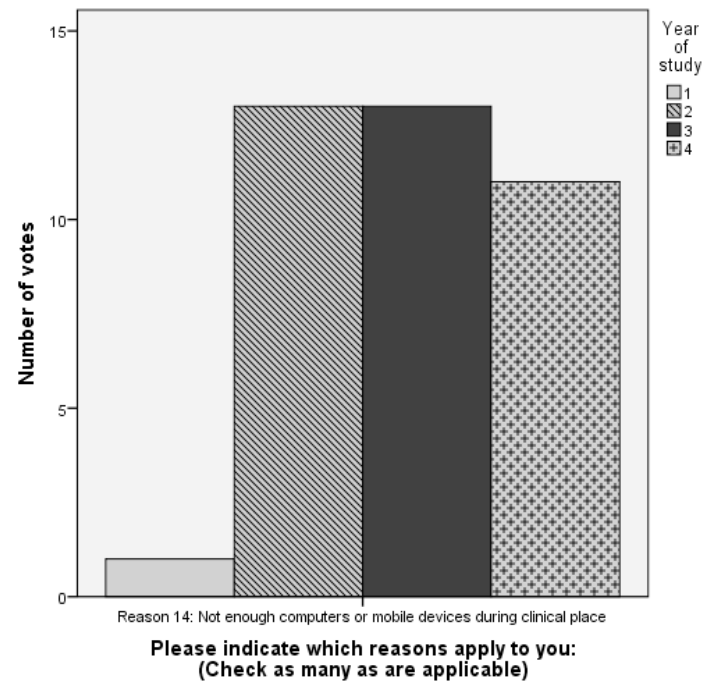
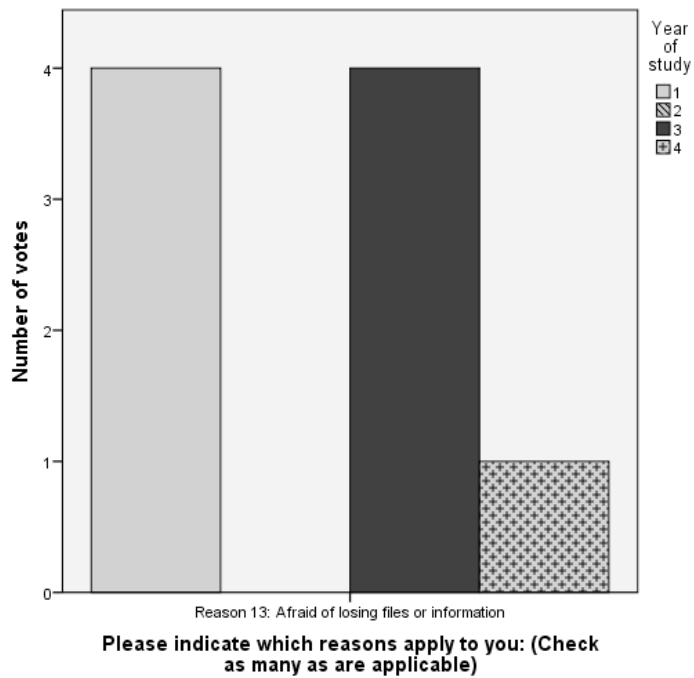
Annex 2 (continued)

Fourteen reasons why nursing students may not use computers often.



Annex 2 (continued)

Fourteen reasons why nursing students may not use computers often.



Appendice

Appendix A

Definitions of the levels of practices for nurses

1. Beginning nurses (Level 1): have fundamental information management and computer technology skills and use existing information systems and available information to manage their practice.
2. Experienced nurses (Level 2): have proficiency in their domain of interest (e.g., public health, education, administration). These nurses are highly skilled in using information management and computer technology skills to support their major area of practice. They see relationships among data elements, and make judgments based on trends and patterns within these data. Experienced nurses use current information systems but collaborate with the informatics nurse specialist to suggest system improvements.
3. Informatics specialists (Level 3): are registered nurses prepared at least at the baccalaureate level who possess additional knowledge and skills specific to information management and computer technology. They focus on information needs for the practice of nursing, which includes education, administration, research and clinical practice. Informatics specialist' practices are built on the integration and application of information science, computer science and nursing science. In their practice, informatics specialists use the tools of critical thinking, process skills, data management skills (includes identifying, acquiring, preserving, retrieving, aggregating, analyzing, and transmitting data), systems development life cycle, and computer skills.
4. Informatics innovators (Level 4): are educationally prepared to conduct informatics research and to generate informatics theory. These nurses lead the advancement of informatics practice and research because they have a vision of what is possible, and a keen sense of timing to make things happen. Innovators function with an ongoing healthy scepticism of existing data management practices and are creative in developing solutions. Innovators possess a sophisticated level of understanding and skills in information management and computer technology. They understand the interdependence of systems, disciplines, and outcomes, and can finesse situations to maximize outcomes.

From: Stagers, 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.

Appendix B

Letter of permission to use the conceptual framework

From: [Nancy Staggers](#)

To: [Marie-Pierre Dionne](#)

Sent: Sunday, December 06, 2009 5:35 PM

Subject: RE: Hello from a fellow researcher

Hello Ms. Dionne,

Glad you found the framework of use! Certainly you may use this framework for your work. Just cite it in your thesis and you're all set.

Nancy Staggers

From: Marie-Pierre Dionne

Sent: Sunday, December 06, 2009 2:02 PM

To: Nancy Staggers

Subject: Hello from a fellow researcher

Hello Mrs. Staggers,

My name is Marie-Pierre Dionne, I am an RN currently doing a masters in Education with thesis. The subject of my Thesis is in regards to Nursing Informatics Competencies for Graduate Nurses. And it relates to many research and articles you have published.

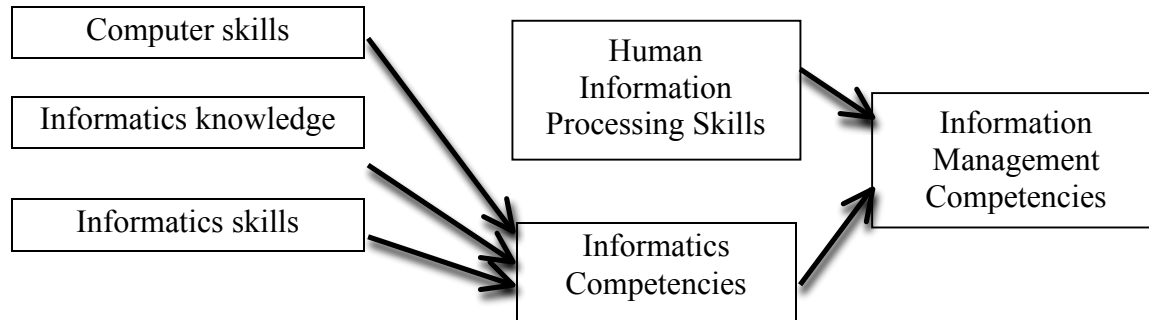
I was looking at the one title: A Delphi Study to determine Informatics Competencies for Nurses at Four Levels of Practice.

And I was wondering if I could use the conceptual framework of Information Management you developed? It is in direct relation with my research proposal.

Thank you for your time

Marie-Pierre Dionne, RN, BScN, NI, MA[ed] candidate,

Ottawa, Ontario, Canada



Information management framework. From Staggers et al., 2011. Reprinted with permission from the author.

Appendix C

Personal communication with Dr. Nancy

From: Staggers, Nancy
Sent: Tuesday, June 28, 2011 10:07
To: Nancy Staggers
Subject: RE: Requesting The Staggers Nursing Computer Experience Questionnaire

Hi Marie-Pierre,

Thank you for asking about the SNCEQ. Attached please find the instrument and a letter with additional information about the tool.

Good luck with your work! Please let me know of any questions.
Nancy Staggers

Nancy Staggers, PhD, RN, FAAN
Professor, Informatics
School of Nursing
University of Maryland
Cell: xxx.xxx.xxx

From: Marie-Pierre Dionne
Sent: Sunday, June 26, 2011 14:56
To: Nancy Staggers
Subject: Requesting The Staggers Nursing Computer Experience Questionnaire

Hello Mrs Staggers,

I was just reading an article you wrote about "The Staggers Nursing Computer Experience Questionnaire". At the end of the article, it is said that the instrument is available from the author.

Would it be possible to share this instrument with me.

Thank you so much for your help
Best regards
Marie-Pierre Dionne, RN, BScN, NI, MA[ed] candidate
Ottawa, Ontario, Canada

Appendix D

Personal communication with Dr. Jieh Chang for revised NI competencies

Le 2010-01-17 à 20:15, Jieh Chang a écrit :

Hi Marie-Pierre :
I have attached the revised list of NIC to you.
Enjoy your study!!

Have a good day.

Jieh Chang
National Taichung Nursing College

----- Original Message -----

From: Marie-Pierre Dionne
To: Jieh Chang
Sent: Fri, 15 Jan 2010 08:43:27 -0500
Subject: Fw: Question from a fellow researcher

Hello Dr. Chang,

Dr. Stagers has referred your name to me. I am a student, currently pursuing her master's thesis on the nursing informatics subject. I am referring to the nursing informatics competencies for the 4 level of practice for nurses, and I believe it is being reviewed. I was wondering if you could share this updated list of nursing informatics competencies. I will of course give you credits/reference you in my thesis.

Also, would you happen to know if an assessment tool has been developed to evaluate the attainment of those nursing informatics competencies? This is the area of interest of my thesis: Evaluation.

Thank you so much for your help.
I hope to hear from you soon.

Marie-Pierre Dionne, RN, BScN, NI, MA[ed] candidate
Ottawa, Ontario, Canada

From: Marie-Pierre Dionne
Sent: Tuesday,
January 12, 2010 1:39 PM To: Nancy Staggers
Subject: Question from a fellow researcher

Hello Dr. Staggers,

it is me again fellow researcher Mrs. Dionne. I am currently doing a master's thesis pertaining to the assessment of the beginning level nurse upon graduation of the baccalaureate nursing program in Canada.

Sorry to disturb you, but I was just wondering if you had ever developed a survey to assess those nursing informatics competencies for the 4 levels of nurses? I just thought I would go directly to the source.

If not, would you know anybody who has developed or who is developing a survey on beginning level nurses informatics competencies? I would really love to get in touch with them and talk about this type of survey.

Thank you so much for your time.
Marie-Pierre Dionne, RN, BScN, NI, MA[ed] candidate
Ottawa, Ontario, Canada

Appendix E

Information letter of the SNCEQ tool

June 28, 2011
School of Nursing
University of Maryland

Marie-Pierre Dionne, RN, MS candidate

Dear Ms. Dionne:

Thank you for your interest in the Stagers Nursing Computer Experience Questionnaire (SNCEQ). Enclosed please find a copy of the instrument. I hope you find it useful.

The instrument was originally developed as part of a larger study. The article in *Applied Nursing Research* describes development and pilot testing for the instrument. The instrument was then used in a main study with a sample of 110 clinical nurses in 1991, 98 nurses in 1998 and 20 nurses in 2006. The instrument was last revised in 1998.

There has been much interest in this instrument, and many authors have used the scale in their studies. Additional reliability testing was done by a graduate student who examined home health nurses' attitudes toward computers. The resulting internal consistency reliability for the first 6 sub-scales is listed below:

General computer applications = .86
Knowledge of above = .89
Use of HIS = .92
Knowledge of above = .95
Role participation = .88
Role Knowledge = .89

The scoring for the instrument is straightforward. The subscales are summed separately for computer use and knowledge, except that the score for knowledge about CASE tools is omitted for the first subscale. You may report total and/or subscale scores as part of your results. The novice to expert scale is separate and not included in the total score for the instrument.

In a study completed in late 1999, a graduate student used only the scales for computer applications and HIS (minus the role questions). Her calculated Cronbach's alpha was .89. However, please be aware that the validity assessments were completed for the instrument with all scales, so validity is not known without the roles subscales.

If you have any other questions, please let me know. You may reach me at e-mail address.

Nancy Stagers, RN, PhD, FAAN
Professor, Informatics
School of Nursing, University of Maryland

Appendix F

Personal communication regarding study using the SNCEQ tool

Le 2012-10-05 à 15:59, Staggers, Nancy a écrit :

Bonjour Marie-Pierre,

For the reference, I did have the name at one time as this was a student's master's thesis on implementing EHRs, but alas, I don't have it any longer. I think you can reference this as "personal communication" if your chair/committee agrees.

Nancy Staggers

Nancy Staggers, PhD, RN, FAAN
Professor, Informatics
School of Nursing
University of Maryland
phone: xxx.xxx.xxx (cell)

From: Marie-Pierre Dionne
Sent: Monday, October 01, 2012 19:59
To: Nancy Staggers
Subject: question

Hello Mrs. Staggers,

I hope you are doing well! I am in need of your help once more. In the SNCEQ letter sent June 28th 2011, you mention:

« In a study completed in late 1999, a graduate student used only the scales for computer applications and HIS (minus the role questions). Her calculated Cronbach's alpha was .89 ».

Would you happen to have the study name or researcher? Or even a journal name. I am trying to reference this information about the questionnaire.

Thank again for your help.

Marie-Pierre Dionne, RN, BScN, NI, MA[ed] candidate
Ottawa, Ontario, Canada

Appendix G

Revised master list of nursing informatics competencies 2010 for the level 1 beginning nurse

Adapted from Dr. Chang's master list in order to reflect the evolution of computer and information technology.

Level 1 Beginning Nurse

Computer Skills - Administration

1. Uses administrative applications for practice management (e.g., searches for patient, retrieves demographics, billing data)
2. Uses applications for structured data entry (e.g., patient acuity or classification applications)

Computer Skills – Communication (email, internet, telecommunications)

3. Uses telecommunication devices (e.g., modems or other devices) to communicate with other systems (e.g., access data, upload, download)
4. Use e-mail (e.g., create, send, respond, use attachments)
5. Uses the Internet to locate, download items of interest (e.g., patient, nursing resources)
6. Uses social softwares (Facebook, Pixo, Twitter)
7. Uses new wireless communication devices (e.g., Smart phone)

Computer Skills – Data access

8. Uses sources of data that relate to practice and care
9. Accesses, enters, and retrieves data used locally for patient care (e.g., uses HIS, CIS for plans of care, assessments, interventions, notes, discharge planning)
10. Uses database applications to enter and retrieve information
11. Conducts on-line literature searches

Computer Skills - Documentation

12. Uses an application to document patient care
13. Uses an application to plan care for patients to include discharge planning
14. Uses an application to enter patient data (e.g., vital signs, demographic and psychological data)

Computer Skills – Education

15. Uses information management technologies for patient education (e.g., identifies areas for instruction, conducts education, evaluates outcomes, resources)

Computer Skills-Monitoring

16. Uses computerized patient monitoring systems

Computer Skills – Basic Desktop Software

17. Uses multimedia presentations
18. Uses word processing
19. Demonstrates keyboarding (typing) skills
20. Uses spreadsheet application, such as Microsoft Excel

Computer Skills - Systems

21. Uses basic computer terminology, especially for help-line support

22. Uses networks to navigate systems (e.g., file servers, www, intranet)
23. Operates peripheral devices (e.g., bedside terminals, hand-helds, iphone, PDA)
24. Uses operating systems (e.g., copy, delete, change directories)

Level 1 Beginning Nurse, cont.

25. Uses existing external peripheral devices (e.g., CD-ROMs, zip drives)
26. Uses computer technology safely
27. Is able to navigate Windows (e.g., manipulate files using file manager, determine active printer, access installed applications, create & delete directories)
28. Identifies the appropriate technology to capture the required patient data (e.g., fetal monitoring device)
29. Demonstrates basic technology skills (e.g., turn computer off & on, load paper, change toner, remove paper jams, print documents)
30. Is able to connect to a wireless network and troubleshoot
31. Understands the concept of compatibility and the impact of various versions of software

Computer Skills – Research

32. Uses a variety of search tools (information literacy)

Informatics Knowledge – Data

33. Recognizes the use and/or importance of nursing data for improving practice (Evidence-based-practice)

Informatics Knowledge - Information literacy

34. Recognizes when information is needed and communicates that need
35. Understands the procedure of scholarly information
36. Understands the importance of organized collection of information
37. Understands and applies essential information-seeking concepts and practices
38. Searches medical dictionary, pharmacy information, and health information via Internet
39. Presents data analysis and statistical capabilities

Informatics Knowledge - Impact

40. Recognizes that a computer program has limitations due to its design and capacity of the computer
41. Recognizes that it takes time, persistent effort, and skill for computers to become an effective tool
42. Recognizes that health computing will become more common
43. Recognizes that the computer is only a tool to provide better nursing care and that there are human functions that cannot be performed by computer
44. Recognizes that one does not have to be a computer programmer to make effective use of the computer in nursing
45. Recognizes the need for continual learning informatics skills, applications, and knowledge

Informatics Knowledge – Privacy/security

46. Seeks available resources to help formulate ethical decisions in computing
47. Describes patients' rights as they pertain to computerized information management
48. Applies the principles of data integrity, professional ethics and legal requirements for patient confidentiality and data security
49. Maintains privacy and confidentiality in clinical log management

Informatics Knowledge - Systems

- 50. Recognizes the value of clinicians' involvement in the design, selection, implementation, and evaluation of applications, systems in healthcare
- 51. Describes the computerized or manual paper system that is present

Level 1 Beginning Nurse, cont.

- 52. Identifies the basic components of the current computer systems, wireless and other electronic communications (e.g., features of a PC, fix and mobile workstation,)

Informatics Knowledge – Education

- 53. Analyzes patient information needs, accesses technology resources to meet needs and evaluates effectiveness
- 54. Evaluates health information on the Internet using a structured critique format

Informatics skills are not part of the level 1: beginning nurse

Four questions were added from the original Dr. Jieh Chang revision, they are highlighted in grey: #6, 7, 30 and 31.

Appendix H

The Stagers Nursing Computer Experience Questionnaire (SNCEQ), revised in 1998 and adjusted with permission from the author

The Stagers Nursing Computer Experience Questionnaire adjusted by Marie-Pi...

Université d'Ottawa | University of Ottawa
Faculté de l'Éducation | Faculty of Education
Concentration, Teaching, Learning and Evaluation

1. I agree to complete this survey?

Yes

No

Demographic

***2. What is your current year of study in your nursing program?**

1

2

3

4

***3. To thank you for your time, a draw of a \$100 gift certificate at The Nordik Spa, in Chelsea, QC. will be awarded to one participant. In order to receive this gift, please provide a valid email or mailing address. Good luck!**

Appendix H (continued)

A. General Computer Applications

Instructions: Each item should be rated in two ways using two sets of numbers. the first rating describes your past or present computer use. The second rating describes your level of the named computer function.

***4. Writing reports, papers, documents, or other text using a word processing tool (e.g. microsoft word)**

	None	Low	Moderate	High	Extensive
Past or Present Computer Use	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Computer Knowledge	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

***5. Sending messages to others via electronic mail or texting (outlook, gmail, etc)**

	None	Low	Moderate	High	Extensive
Past or Present Computer Use	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Computer Knowledge	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

***6. Using a virtual classroom (e.g. Taking a virtual online class, getting class presentations, notes from the website)**

	None	Low	Moderate	High	Extensive
Past or Present Computer Use	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Computer Knowledge	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

***7. Website evaluation relating to healthcare (i.e. Is it reliable, does it have trustE logo, is it peer reviewed and can you recommend to patients and families)**

	None	Low	Moderate	High	Extensive
Past or Present Computer Use	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Computer Knowledge	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

***8. Searching for books, articles, or other library information (e.g. bibliographic retrieval, with the school software, google, peer reviewed and scholar articles)**

	None	Low	Moderate	High	Extensive
Past or Present Computer Use	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Computer Knowledge	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

***9. Creating pictures, slides, or overhead displays (e.g. Power Point presentations)**

	None	Low	Moderate	High	Extensive
Past or Present Computer Use	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Computer Knowledge	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Appendix H (continued)

***10. Managing projects (e.g. using microsoft project management, making gantt charts, defining timelines or any other tool to manage school projects to share tasks and track deadlines)**

	None	Low	Moderate	High	Extensive
Past or Present Computer Use	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Computer Knowledge	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

***11. Using online educational tutorials relating to your studies (e.g. wikis, blackboard, online education survey)**

	None	Low	Moderate	High	Extensive
Past or Present Computer Use	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Computer Knowledge	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

***12. Using online educational material for patients (e.g. podcast, webcast, youtube)**

	None	Low	Moderate	High	Extensive
Past or Present Computer Use	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Computer Knowledge	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

***13. Using excel (spread sheets)**

	None	Low	Moderate	High	Extensive
Past or Present Computer Use	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Computer Knowledge	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

***14. Communicating problems with computer systems (e.g. reporting issues to technical support)**

	None	Low	Moderate	High	Extensive
Past or Present Computer Use	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Computer Knowledge	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

***15. Copying, deleting, saving in a specific folder, and performing updates when needed, scanning for viruses (i.e. keeping the operating system of the computer functional)**

	None	Low	Moderate	High	Extensive
Past or Present Computer Use	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Computer Knowledge	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

***16. Retrieving specific data, a file in a folder (e.g. word file or electronical patient data)**

	None	Low	Moderate	High	Extensive
Past or Present Computer Use	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Computer Knowledge	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Appendix H (continued)

***17. Using advanced feature in word or excel (e.g. formulas, chars, making pamphlets)**

	None	Low	Moderate	High	Extensive
Past or Present Computer Use	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Computer Knowledge	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

***18. Intelligent software decision making (e.g. Lexi-comp, medication interaction, etc.)**

	None	Low	Moderate	High	Extensive
Past or Present Computer Use	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Computer Knowledge	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

***19. Using social networks for school projects (e.g. blogs, metmeeting for brainstorming purposes)**

	None	Low	Moderate	High	Extensive
Past or Present Computer Use	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Computer Knowledge	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

***20. Using wireless devices (e.g. smart phones, iphone, ipod, ipad, tablets and androids)**

	None	Low	Moderate	High	Extensive
Past or Present Computer Use	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Computer Knowledge	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

***21. Using different internet navigation system (e.g. Safari, google chrome, firefox, explorer, etc.)**

	None	Low	Moderate	High	Extensive
Past or Present Computer Use	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Computer Knowledge	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

***22. Managing your school or social network account, posting material, images (facebook, twitter, blackboard, etc.)**

	None	Low	Moderate	High	Extensive
Past or Present Computer Use	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Computer Knowledge	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

***23. Using the world wide web typing the right keywords (www access, interaction, retrieval)**

	None	Low	Moderate	High	Extensive
Past or Present Computer Use	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Computer Knowledge	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Appendix H (continued)

B. Clinical or Hospital Information System Applications using technology***24. Looking up electronically a patient's test results (results reporting)**

	None	Low	Moderate	High	Extensive
Past or Present Computer Use	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Computer Knowledge	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

***25. Charting electronically patient's data such as vital signs or medications (data entry)**

	None	Low	Moderate	High	Extensive
Past or Present Computer Use	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Computer Knowledge	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

***26. Entering electronically doctors' orders in the electronic chart (order entry)**

	None	Low	Moderate	High	Extensive
Past or Present Computer Use	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Computer Knowledge	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

***27. Electronically create/modify a patient's care plan (patient care planning)**

	None	Low	Moderate	High	Extensive
Past or Present Computer Use	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Computer Knowledge	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

***28. Entering/modifying parameters for biomed equipment (e.g. cardiac monitor, automatic vital sign machine, IV pumps, glucometer, etc.)**

	None	Low	Moderate	High	Extensive
Past or Present Computer Use	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Computer Knowledge	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

***29. Electronically charting nurses' notes/progress notes (e.g. Interventions, documentation)**

	None	Low	Moderate	High	Extensive
Past or Present Computer Use	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Computer Knowledge	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

***30. Electronically monitoring patients' physiological parameters with wireless devices (e.g. Telemetry)**

	None	Low	Moderate	High	Extensive
Past or Present Computer Use	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Computer Knowledge	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Appendix H (continued)

***31. Looking up electronically politics and procedures via the intranet of the healthcare institution (data access)**

	None	Low	Moderate	High	Extensive
Past or Present Computer Use	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Computer Knowledge	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

***32. Ordered or updated electronically a list of supplies (order request)**

	None	Low	Moderate	High	Extensive
Past or Present Computer Use	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Computer Knowledge	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

***33. Electronically provide information to complete the discharge plan for the patient**

	None	Low	Moderate	High	Extensive
Past or Present Computer Use	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Computer Knowledge	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

***34. Charting electronically multidisciplinary assessments**

	None	Low	Moderate	High	Extensive
Past or Present Computer Use	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Computer Knowledge	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

***35. Printing a report such as a medication due list or shift report (report generation i.e. summary sheet of important actions)**

	None	Low	Moderate	High	Extensive
Past or Present Computer Use	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Computer Knowledge	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

***36. Using an approved website to lookup medication, medical diagnosis, nursing standards of practice (with mobile intelligent phones that require apps / applications)**

	None	Low	Moderate	High	Extensive
Past or Present Computer Use	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Computer Knowledge	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Appendix H (continued)

C. Formal Computer Knowledge

***37. The number of College/University computer science courses you have taken:**

Please circle one None 1 2 3 4 or more

***38. The number of College/University information system management/informatics courses you have taken offered in your school program (e.g. Excel, word, technology related courses)**

Please circle one None 1 2 3 4 or more

***39. The number of short courses (less than 1 week) on computer applications(e.g. Word) you have taken on your own initiative (personal interest):**

Please circle one None 1 2 3 4 or more

***40. The number of conferences relating to technology (less than 1 week) you have attended on your own initiative (personal interest):**

Please circle one None 1 2 3 4 or more

***41. How many computer magazines, books or electronic journal do you read annually:**

Please circle one None 1 2 3 extensively 4 or more

D. Computer Experience Rating

***42. Please rate your level of computer experience:**

Select the level that best describes you Novice Beginner Intermediate Advanced Expert

E. There are several reasons why nursing students may not use computers oft...

***43. Please indicate which reasons apply to you: (Check as many as are applicable)**

- | | | |
|--|--|--|
| <input type="checkbox"/> Not applicable, I use computer often | <input type="checkbox"/> No computer at home | <input type="checkbox"/> No time during clinical placements to use computers |
| <input type="checkbox"/> Never had typing | <input type="checkbox"/> Computers make me anxious | <input type="checkbox"/> No need for computers at home |
| <input type="checkbox"/> No computer at work | <input type="checkbox"/> Not really interested in computers | <input type="checkbox"/> Afraid of losing files or information |
| <input type="checkbox"/> Clerks at the hospital do all computer interactions while in my clinical placements and/or personal job | <input type="checkbox"/> Not allowed to use computers during clinical placements | <input type="checkbox"/> Not enough computers or mobile devices during clinical placements |
| <input type="checkbox"/> Using computers is not in my job description | <input type="checkbox"/> Never had a computer course | |

Appendix H (continued)

F. Relevant work experience

Relevant work experience in healthcare: At least 4 consecutive weeks of work as a ward clerk, nursing aids or nursing student summer job, etc. Anything relating to nursing, requiring helping nurses in their duties, documenting in the electronic chart, viewing the electronic chart, retrieving electronic information.

***44. Do you have work experience in healthcare using technology? (Please refer to description provided above)**

Yes

No

***45. If not in healthcare, do you have work experience in other areas using technology? (Please refer to description provided above)**

Yes

No

Relevant work experience - descriptive

***46. What is/are the job title(s)?**

***47. Describe your job responsibilities and/or duties:**

***48. Did your position require a user code and password to access patient data?**

Yes

No

***49. How many weeks / months / years have you worked in a healthcare related job? (please put an estimated number where it applies)**

Weeks	<input type="text"/>
Months	<input type="text"/>
Years	<input type="text"/>

Appendix I

Accredited schools of nursing in Canada

Canadian Programs

1. Alberta

University Baccalaureate Nursing Programs

A - University of Alberta

A - University of Calgary

University and College Collaborative Baccalaureate Nursing Programs

A - University of Calgary with Medicine Hat College

A - University of Alberta with Red Deer College, Grande Prairie Regional College, and Keyano College

2. British Columbia

University and College Baccalaureate Nursing Programs

A - Kwantlen Polytechnic University

A - Trinity Western University

A - University of British Columbia

A - Douglas College

Collaborative for Academic Education in Nursing (CAEN)

A - University of British Columbia Okanagan

A - Thompson Rivers University

A - Vancouver Island University with North Island College

A - University of Victoria with Aurora College, Camosun College, College of the Rockies, and Selkirk College

3. Ontario

University Baccalaureate Nursing Programs

A - Brock University

A - Lakehead University

A - Université Laurentienne, French Program

A - Laurentian University, English Program

A - McMaster University

A - Nipissing University

A - Queen's University

A - Ryerson University

A - Trent University

A - University of Ottawa

A - University of Toronto

A - University of Western Ontario

A - University of Windsor

A - York University

University and College Collaborative Baccalaureate Nursing Programs

A - Brock University with Loyalist College

A - Lakehead University with Confederation College

A - Laurentian University with Northern College, Cambrian College, and Sault College

A - Laurentian University with St. Lawrence College of Applied Arts and Technology

A - Laurentian University with Collège Boréal

A - McMaster University with Mohawk College and Conestoga College

A - Nipissing University with Canadore College

A - Ryerson University with Centennial College and George Brown College

A - Trent University with Fleming College

A - Trent University with George Brown College

A - Humber College with University of New Brunswick

A - University of Ontario Institute of Technology with Durham College

A - University of Ottawa with Algonquin College and La Cité collégiale

A - University of Western Ontario with Fanshawe College

A - University of Windsor with Lambton College and St. Clair College
A - York University with Georgian College and Seneca College

4. New Brunswick

University Baccalaureate Nursing Programs

A - Université de Moncton

A - University of New Brunswick

University and College Collaborative Baccalaureate Nursing Programs

A - University of New Brunswick with Humber College

5. Newfoundland and Labrador

University Baccalaureate Nursing Programs

A - Memorial University

Collaborative Baccalaureate Nursing Program

A - Memorial University with the Centre for Nursing Studies and Western Regional School of Nursing

6. North West Territories

Collaborative for Academic Education in Nursing (CAEN)

A - Aurora College with University of Victoria

7. Nova Scotia

University Baccalaureate Nursing Programs

A - Cape Breton University

A - Dalhousie University

A - St. Francis Xavier University

8. Prince Edward Island

University Baccalaureate Nursing Programs

A - University of Prince Edward Island

9. Quebec

University Baccalaureate Nursing Programs

A - McGill University

A - Université Laval

A - Université de Montréal

A - Université du Québec en Outaouais

A - Université de Sherbrooke

10. Saskatchewan

University and College Nursing Programs

A - University of Saskatchewan

A - Saskatchewan Institute of Applied Science and Technology

International Programs

Collaborative Baccalaureate Nursing Programs

A - University of Calgary - Qatar Nursing Program

University Baccalaureate Nursing Programs

A - Queensland University

Please note that only nursing programs successful in achieving accreditation status from the CASN Accreditation Bureau and within the term limit of the accreditation status granted are eligible to state that they are a "CASN accredited program". Any other use of the latter terms without written CASN approval will result in legal action.

Appendix J

Letter of permission to present research to the nursing faculty

----- Original Message -----

From: Dave Holmes

To: Marie-Pierre Dionne

Sent: Tuesday, January 17, 2012 6:25 AM

Subject: RE: Master Education Student - MPDionne - Nursing Informatics

Bonjour Marie-Pierre,

Il me fera plaisir de vous accommoder. Cependant, tel que spécifié par Dre Cragg, ex-directrice de l'École, nous n'offrons plus de cours en informatique. Si cela ne pose pas de problèmes pour votre étude vous êtes la bienvenue lorsque le Comité d'éthique de la recherche vous en donnera l'autorisation. Veuillez SVP utiliser ce courriel pour votre Comité d'éthique.

Dave

Dave Holmes, Inf., PhD/Dr Dave Holmes, RN.
Directeur et Doyen associé/Director and Associate Dean

Professeur titulaire/Full Professor
Université d'Ottawa/University of Ottawa
Faculté des sciences de la santé/Faculty of Health Sciences
École des sciences infirmières/School of Nursing

Chaire universitaire de recherche en soins infirmiers médico-légaux/
University Research Chair in Forensic Nursing

Rédacteur en chef/Editor-in-Chief
APORIA - La revue en sciences infirmières
APORIA - The Nursing Journal
www.aporiajournal.com

>>> Barbara Foulds, 2/15/12 2:54 pm >>>

I authorize Marie-Pierre Dionne to survey "xxx" site BScN students to evaluate the nursing informatics competencies of nursing students across the 4 years of the program via their university email addresses.

Barbara Foulds, Ph.D
Acting Dean, Health
Faculty of Health, Public Safety and Community Studies

Appendix K

Recruitment letter to the Assistant Director of the undergraduate program

Hope you are all doing well. I need your help.

I was granted permission to survey nursing students at your facility via email. Please forward this information letter to all students enrolled in the Nursing program from year 1 to 4.

Please make it known to them that their email has not been shared, and that they will need to follow instructions contained on the information letter to complete the survey, which will take about 15-20 minutes of their time.

If they wish, they can email me or call if to answer any specific questions.

Thank you in advance for your precious help

Marie-Pierre Dionne, RN, BScN, NI, MA[ed] candidate
email: xxx@xxx.ca

Appendix L

Bilingual recruitment text for email to nursing students



Université d'Ottawa | University of Ottawa

Faculté de l'Éducation | Faculty of Education

Concentration, Teaching, Learning and Evaluation

(French follows)

Your help is needed to participate in a study to validate the global attainment of nursing informatics competencies for students during their baccalaureate program. This project was approved by the ethics committee of the University of Ottawa and the Director and Associate Dean School of Nursing and the Associate Dean Health Sciences at the Algonquin College. The survey is in English only, you must be fluent in this language.

If you wish to participate, please complete the survey at this address:

<https://www.surveymonkey.com/s/NURSINGINFORMATICS>

Password: NURSING (in caps)

Your decision to complete the survey will be interpreted as your consent to participate in this study. It will take you approximately 15-20 minutes. We hope you will be able to complete it within 4 weeks.

If you experience difficulties in completing this survey please contact:

Lead researcher

Marie-Pierre Dionne, master student in Education

xxx@xxx.ca

Tel: xxx-xxx-xxxx

Thesis Supervisor

David Trumpower, Ph.D.

Affiliated professor

University Of Ottawa



Université d'Ottawa | University of Ottawa

Faculté de l'Éducation | Faculty of Education

Concentration, Teaching, Learning and Evaluation

Votre aide est requise pour remplir un questionnaire dans le cadre d'une recherche cherchant à valider l'acquisition des compétences infirmière sur les technologies pour les étudiants inscrits au programme des Sciences Infirmières. Ce projet est approuvé par le comité d'éthique, ainsi que par le Directeur et Doyen associé de l'École des sciences infirmières de l'Université d'Ottawa et la Doyenne associée, Health Sciences, Algonquin College. Ce questionnaire est en anglais seulement.

Si vous désirez participer à cette recherche, S.V.P. cliquez sur ce lien :

<https://www.surveymonkey.com/s/NURSINGINFORMATICS>

Password: NURSING (en majuscule)

En complétant ce questionnaire vous donnez automatiquement votre consentement à participer à cette recherche. D'une durée approximative de 15-20 minutes et qui se terminera d'ici 4 semaines.

Si vous éprouvez des difficultés vous pouvez contacter :

Chercheuse principale

Marie-Pierre Dionne, master student in Education

xxx@xxx.ca

Tel: xxx-xxx-xxxx

Thesis Supervisor

David Trumpower, Ph.D.

Affiliated professor

University Of Ottawa

Appendix M

Recruitment text for the teachers of the school of nursing

English follows

Marie-Pierre Dionne, infirmière, est étudiante à la maîtrise en éducation, Faculté d'éducation UO. Son projet de recherche est sur l'informatique et les soins infirmiers. Elle a reçu l'approbation du comité éthique de UO et la permission de demander aux étudiants en sci.inf. de répondre à son questionnaire de recherche.

Sa question de recherche est la suivante :

Do graduates from Baccalaureate nursing program have acquired necessary competencies in nursing informatics as defined by the Canadian Nursing Association and the American Nurses Association?"

The work is based on "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" and includes recent upgrades to the Master List of Nursing Informatics Competencies 2010 from Dr. Chang.

Votre contribution:

Elle va communiquer avec vous pour vous demander de tout simplement aviser vos étudiants au début de votre cours qu'elle veut les rencontrer pour 5-10 minutes après votre cours afin de leur présenter son projet. Les étudiants seront invités à compléter le questionnaire en ligne. J'ai bien précisé qu'elle ne peut pas prendre du temps de cours pour s'adresser aux étudiants. Voir horaire soumis ci-dessous

Merci beaucoup

Marie-Pierre Dionne is a masters student (she is a nurse) from the UO Faculty of Education doing her thesis research on nursing informatics. She is asking if she can survey our students, her questionnaire is on line takes 15 minutes and is in English. Her letter of intent is in French and in English. She has received approval from Ethics at UO. She has received permission to asked the to survey our students and is now ready to proceed.

The working version of the research question is:

"Do graduates from Baccalaureate nursing program have acquired necessary competencies in nursing informatics as defined by the Canadian Nursing Association and the American Nurses Association?"

The work is based on "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" and includes recent upgrades to the Master List of Nursing Informatics Competencies 2010 from Dr. Chang.

Your collaboration:

She will be contacting you to let you know that she will be meeting with your students AFTER class. She will be asking you to inform the students at the beginning of your class, that she will be meeting with them after class (5-10 minutes) to invite them to participate in her research. Students will be asked to complete her questionnaire on line on their own time. I have informed her she is not to take any of your class time to meet with the students. Refer below to schedule I suggested

Thank you!

Sylvie Corbeil, Inf., M.Sc.Inf./ RN, MScN

Directrice adjointe aux programmes d'études de premier cycle / Assistant Director of the Undergraduate Programs

Université d'Ottawa /University of Ottawa

École des sciences infirmières/School of Nursing

Appendix N

Letter of information for the study



Université d'Ottawa | University of Ottawa

Faculté de l'Éducation | Faculty of Education

Concentration, Teaching, Learning and Evaluation

Information letter

Your help is needed in a study conducted by Marie-Pierre Dionne under the supervision of Professor David Trumpower. We hope that this will help identify if students attain global nursing informatics competencies before graduation of their program. This project was approved by the ethics committee of the University of Ottawa.

Participants must be fluent in the English language. If you wish to participate, please complete the survey at this address: <https://www.surveymonkey.com/s/NURSINGINFORMATICS>
Password: NURSING (in caps)

By completing the online survey it implies consent to participate in this study. It will take you approximately 15-20 minutes. We hope you will be able to complete it within 4 weeks of receiving this email and/or in-class presentation.

In exchange for your consent and your time, questionnaire respondents will be entered for a draw of a \$100 gift certificate to the Nordik Spa in Chelsea, province of Quebec. Automatically by filling out the questionnaire you are eligible for the draw. If only provide an email and then decide to withdraw from the study without entering any data via the questionnaire, you will not be eligible for the draw. If you were to withdraw, given the anonymous nature of this study, technically, data will be included in the data set as it will be impossible to retrieve personal surveys.

The information's provided for this study will remain confidential and will only be used for the purpose this research. Only the thesis supervisor and lead researcher will have access to the data of the research. Anonymity is guaranteed since your name is not given on the questionnaire.

Upon request, the results of this study can be communicated to participants in a detailed summary of the conclusion obtained.

If you have questions or wish to receive details about the study itself, please communicate with the thesis supervisor or lead researcher. To obtain information in regards to the ethics of this study, please communicate with the person responsible for the ethics in research at the University of Ottawa.

Thank you in advance for your time and participation to this research!

Thesis Supervisor

David Trumpower, Ph.D.
Affiliated professor
University Of Ottawa

Lead researcher

Marie-Pierre Dionne, master student in Education
xxx@xxx.ca
Tel: xxx-xxx-xxxx or text

Appendix O

Consent form given in class presentation and on the online questionnaire



Université d'Ottawa | University of Ottawa

Faculté de l'Éducation | Faculty of Education

Concentration, Teaching, Learning and Evaluation

Consent Form

Title of the study: DOES WORK EXPERIENCE FOR UNIVERSITY NURSING STUDENTS INFLUENCE THE GLOBAL LEVEL OF INFORMATICS COMPETENCIES IN THEIR BACHELOR PROGRAM IN CANADA? A cross-sectional design.

Lead researcher is Marie-Pierre Dionne, master student at the Faculty of Education, University of Ottawa, xxx@uottawa.ca, XXX-XXX-XXXX.

Thesis supervisor is Dr. David Trumpower, Assistant Professor, Faculty of Education, University of Ottawa, xxx-xxx-xxxx, xxx@xxx.ca

Invitation to Participate: I am invited to participate in the above mentioned research study conducted by *Marie-Pierre Dionne* under the supervision of Professor Dr David Trumpower.

Purpose of the Study: The purpose of this instrument is to determine my computer experience. Please consider each item carefully and select the number that corresponds to my use, knowledge of, or participation in computer-related activities. This study will help identify if nursing students develop the global technological skills to prepare them for the workforce.

Participation: My participation will consist essentially of completing an online questionnaire taking approximately 10 to 15 minutes of my time.

Risks: My participation entails to take some time to complete this online survey. Only general information will be gathered in regards to experience/exposure within the classroom, clinical placements and personal use of technology. To lessen this risk, I can contact the lead researcher to ask questions.

Benefits: My participation in this study will give me a better understanding about nursing informatics competencies in general and give me a sense of my current level on this subject. It will give me a better picture of the technological realities of my future job. Your participation could potentially contribute to adjust future curriculum content for nursing and better prepare future nursing students.

Confidentiality and anonymity: I have received assurance from the researcher that the information I will share will remain strictly confidential. I understand that the contents will be used only for this study and that my confidentiality will be protected because it is a voluntary

participation and that no names or signatures will be asked. By completing the questionnaire online, I therefore give my consent to participate in this study. My name and mailing address are necessary for sending the prize and will be asked at the beginning of the questionnaire. Please be advised that Survey Monkey is American software, which fall under the Patriotic Act that contains a clause on "delayed warrants", that grants access to data without prior consent.

Conservation of data: The data collected via the web-based questionnaire will be kept in a secure manner in the locked office of my thesis supervisor for a period of 5 years from May 2012-2017. Only the lead researcher and the thesis supervisor will have access to this data. After a period of 5 years, all documents will be destroyed by means of shredding. As for the electronic data, it will be stored on the researcher's laptop and access will be protected by a user name and password. The electronic data will also be kept on a USB key and this device will be stored in a locked drawer in the supervisor's office at the Lamoureux Campus University of Ottawa. Again after the 5 years, this data will be purged from this laptop.

Compensation: In exchange for my consent and my time to complete this questionnaire, my name will be entered for a draw of a \$100 gift certificate to the Nordik Spa in Chelsea, Quebec. Automatically by completing the online questionnaire I am eligible for the draw, my email address or mailing address will be asked to send the prize at the beginning of the questionnaire. If I only provide an email and then decide to withdraw from the study without entering any data via the questionnaire, I am not eligible for the draw.

Voluntary Participation: I am under no obligation to participate and if I choose to participate, I can withdraw from the study at any time and/or refuse to answer any questions, without suffering any negative consequences. If I were to withdraw, given the anonymous nature of this study, technically, data will be included in the data set as it will be impossible to retrieve personal surveys.

Acceptance: By completing the online questionnaire I agree to participate in the above research study conducted by Marie-Pierre Dionne of the Faculty of Education from the University of Ottawa, *which research is under the supervision of* Dr. David Trumpower.

If I have any questions about the study or issues on the website, I may contact the lead researcher or her supervisor.

If I have any questions regarding the ethical conduct of this study, I may contact the Protocol Officer for Ethics in Research, University of Ottawa.

Important Notice: Please print a copy of the consent form to keep for your personal records.