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INFORMAL LEARNING OF REGISTERED NURSES USING MOBILE DEVICES IN THE HEALTHCARE WORKPLACE

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Abstract

This dissertation research study explored how registered nurses (RNs) use mobile devices as tools to support and enhance informal learning in their work settings. The mixed methods inquiry involved select Canadian practicing and regulated RNs who used mobile devices in their workplaces. A sequential explanatory research design collected quantitative and qualitative data using an online survey and semi-structured interviews. Quota sampling for the quantitative component yielded 170 usable online surveys. From the survey respondents, interview volunteers were purposively selected and ten (10) interviews were conducted. Descriptive, inferential, inductive, and integrated data analyses were conducted in order to explore strategies, processes, purposes, modes of use (individual [non-collaborative] or collaborative), and age-generational differences associated with RNs' use of mobile devices for informal learning in the workplace. Findings indicated that the study participants primarily used their handheld devices for self-directed informal learning with non-collaborative strategies or processes in their work settings for accessing online resources for a range of reasons including: evidence-based support, new procedures/treatments, professional development, patient/client teaching, and maintaining competency. Age differences related to the use of mobile devices for informal learning were minimal. However, workplace-related influences including deficiencies in formal educational resources, Internet access, and/or employer support were relevant to the informal learning experiences. Positive perceptions of efficiencies, self-confidence, patient/client safety, patients/clients' reactions, and the need for sanctioned resources for using mobile technologies in the healthcare workplace were articulated. The

findings pointed to the significance of mobile devices as learning tools for RNs' informal learning for construction of knowledge and meaning-making to inform professional development and continuing competence.

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CHAPTER 1

INTRODUCTION

The Canadian healthcare workplace has been in a state of flux for several decades, with continuous restructuring, reform, and reorganization affecting the delivery of healthcare. Downsizing and cost-cutting measures have caused demoralization, overwork and stressful working conditions, and created challenges for meeting staffing needs, skill requirements, and rising service demands (Lowe, 2002). In this climate, barriers of accessibility, lack of time, and financial constraints have interfered with the ability of registered nurses (RNs) to attend workplace-based education and training programs (Griscti & Jacono, 2006; Penz et al., 2007) and caused them to seek other means to "obtain, maintain, and continue to enhance their competence through continuous learning" (Canadian Nurses Association & Canadian Association of Schools of Nursing, 2004, p. 2). These alternative means may include using mobile devices as tools for informal learning,

In places of work, most learning is informal in nature (Cross, 2007). Although the preparation for a job or career typically involves formal education or training of some kind, once employment is obtained, informal learning is the primary way in which skills and knowledge are sought. Informal learning focuses on practical knowledge from the ubiquitous experiences of daily life (Rubenson, 2007). It includes "any activity involving the pursuit of understanding, knowledge or skill which occurs outside the curricula of educational institutions, or the courses or workshops offered by educational or social agencies" (Livingstone, 2000, p. 2). Informal learning in the healthcare workplace is widely prevalent (Wihak & Hall,

2011) and nurses have seen their need for informal learning increase (White et al., 2000).

Nurses form the largest component of the healthcare workforce (Canadian Nurses Association, 2007). In Canada, the regulated nursing profession includes licensed practical nurses, registered nurses, registered psychiatric nurses, and nurse practitioners. Of these, RNs represent the largest professional grouping As a regulated profession, RNs are required to maintain competency through mandated continuing education and reflective practice on professional development (Nelson & Purkis, 2004). As the barriers of inaccessibility, lack of time, and financial constraints create challenges to attend formal workplace educational activities (Griscti & Jacono, 2006), RNs have had to look elsewhere for the means to meet their continuing professional education and professional development requirements. Informal learning provides an appealing alternative, especially considering, as Cross (2007) points out, that "80 percent of workplace learning occurs through informal means" (p.17). Informal learning does not require attendance at a classroom or training venue or adherence to the prescribed framework of a formal educational institution (Hager & Halliday, 2009; Wihak, Hall, & Durand, 2010). Rather, it offers optimal flexibility as it includes "learning outside of formally structured, institutionally sponsored, classroom-based activities" (Marsick, Watkins, & Lovin, 2011, p. 63). In the absence of formal educational activities, informal learners will use whatever techniques, resources, and tools may meet their learning needs (Clough, Jones, McAndrew, & Scanlon, 2009). Handheld mobile technologies, such as personal digital assistants (PDAs), mobile phones, notebooks, or other portable

wireless devices enable users to interact with others, connect to information of their own choosing, and capture ideas (Traxler, 2010). Mobile devices have also expanded the boundaries of just-in-time learning (McGreal, 2005), providing convenient access to formal education through mobile learning, as well as for informal learning. As technologies become more available and accessible worldwide, there is the potential for mobile devices to support and rapidly accelerate participation in informal learning (Santos & Ali, 2011; Wihak & Hall, 2011)

Within the healthcare workplace, mobile devices have become more commonplace. RNs are using mobile devices for a variety of purposes, including as learning tools (Doran, Haynes, Kushniruk, et al., 2010); however, how they use these learning tools is not well known. In response to these changes and to address the dearth of research noted above, this study explored how RNs use mobile devices for informal learning in the healthcare workplace.

The Context of the Problem

The healthcare workplace is both publicly and privately funded and includes hospitals, long-term care facilities, community health settings, and other workplaces such as physicians' offices, private nursing agencies, educational institutions, governments, or associations where healthcare workers are employed or self-employed. Since the late 1990s, the healthcare workplace has undergone major restructuring in on-going attempts to meet societal demands related to demographic changes, economics, technologies, and social-cultural issues (Shannon & French, 2005).

The changing demographics of Canadian society are affecting the healthcare workplace. Increased population aging, declining birth rates, and increasing longevity is resulting in increased healthcare needs (Carstairs & Keon, 2009). Currently, approximately 4.2 million adults are over the age of 65 in Canada and this number is increasing (National Advisory Council on Aging, 2006). The most recent Canadian census indicated that "the number of people aged 100 or older increased 50 percent between 1996 and 2006, and is set to triple to more than 14,000 by 2031" (Carstairs & Keon, 2009, p. 2). In relation to economics, healthcare costs are rising due to population growth and healthcare-specific inflation (Carstairs & Keon, 2009). Additionally, the introduction of innovative and emerging technologies for specialized kinds of medical treatment, diagnostic testing, and communication and information management have created new demands on the healthcare sector (Canadian Nurses Association, 2006; Romanow, 2002). Gender, cultural, and generational diversity have also had an impact on the Canadian healthcare workplace, particularly in the following areas:

- increased number of males and members of different cultures working within the healthcare workplace;
- demand for work–life balance for young families;
- increasing numbers of workers preparing for retirement (Spinks & Moore, (2006).

These changes have influenced the restructuring of the healthcare workplace, as well as the performance and delivery of quality health care.

In attempts to improve healthcare workplace performance, restructuring initiatives have included changes in management structure and resource management, staff reductions, and alterations in the ratio of professional regulated nurses to unregulated, non-licensed healthcare workers (Shannon & French, 2005). In this evolving work environment, knowledgeable healthcare workers must continually update their knowledge and skills to ensure the provision of quality patient care (Schweitzer & Krassa, 2010).

Historically, workplace education and training for nurses has been delivered in a traditional, face-to-face format (Jantzen, 2008). However, attendance at face-to-face activities has become limited due to barriers of "workplace budget constraints, lack of employer or administrative support, and lack of time due to staff shortages, shift work, scheduling difficulties, and family responsibilities" (Penz et al., 2007, p. 58). To obtain the minimum number of attendees required to offer a formal education or inservice training program, nurses often have to travel to another healthcare workplace location (Schweitzer & Krassa, 2010) resulting in increased costs to the employer. The inconvenience associated with travelling long distances to unfamiliar destinations may also be a deterrent to attending such programs. In addition, the shortfall of nurses has also reduced the availability of educators and facilitators to provide continuing education (Schweitzer & Krassa, 2010; Skar, 2010). Consequently, workplace education and inservice training of nurses is shifting to more autonomous and diverse means (Kenny, Park, Van Neste-Kenny, Burton, & Meiers, 2009). As Kenny et al. (2009) assert "addressing these 'new age' challenges

requires ‘new age’ approaches and tools to support the teaching and learning of health care professionals [including RNs]” (p. 79).

Theoretical Framework

The complex nature of today’s healthcare workplace and the changing requirements for skills and knowledge for the healthcare workforce makes it necessary to look beyond the confines of formal learning and established curricula to investigate the opportunities that informal learning offers. As such, the theoretical framework of this study is eclectic, drawing from theories of workplace learning and informal learning within the field of adult education. Theory and research regarding mobile devices as learning tools in cognitive constructivism and/or socio-constructivism also form part of the theoretical context of the study.

The workplace provides an important context for the intertwining processes of learning and work (Streumer & Kho, 2006). Learning within the places where people are actually employed can be viewed from within the fields of human resource development and continuing professional education (Bierema & Eraut, 2004). Human resource development incorporates training, career development, and organizational development activities; whereas, continuing professional education builds on the initial training for professional membership, specialist knowledge and expertise, and accountability. Within the context of the dynamic and demanding healthcare workplace, continuing professional education requires a new approach, one that goes beyond formal learning and acknowledges that workplace learning is often informal (Eraut, 2004; Sefton-Green, 2004).

Informal learning includes learning that is self-directed and intentional, incidental or unplanned learning that becomes conscious after an experience, and tacit learning that is neither intentional nor conscious (Schugurensky, 2000). Watkins and Marsick's (1992) theory of informal and incidental learning in the workplace contains the following central elements:

- based on learning from experience;
- embedded in the organizational context;
- oriented to a focus on action;
- governed by non-routine conditions;
- concerned with tacit dimensions that must be made explicit;
- delimited by the nature of the task, the way in which problems are framed, and the work capacity of the individual undertaking the task; and
- enhanced by proactivity, critical reflectivity and creativity (p. 287).

More recent models of informal and incidental learning in the workplace include the concepts of implicit learning as part of tacit/implicit knowing, whole-person learning theory, and communities of practice (Marsick, Watkins, Callahan, & Volpe 2006).

Marsick and Watkins (2001) explored how technology is changing the face of workplaces and affecting informal and incidental learning in this context. They claim that the nature of technology-facilitated interactions is such that "more may be learned incidentally by learners reading between the lines" (p. 32). Clough, Jones, McAndrew, and Scanlon (2009) explain that, when used as a learning tool, mobile devices can potentially support and enhance learner-centred control, allowing learners "to engage with both the social and the physical contexts of the learning they are

undertaking … and to decide whether and how to collaborate with other learners, to pool and share resources, or simply engage in individual reflection" (p. 361). Further, they caution that the impetus to use mobile devices in the healthcare workplace should not arise from a technical determinist viewpoint, but rather that these learning tools should be used to construct knowledge and meaning from reflections on experiences, thoughts, and ideas (Clough et al., 2009).

The creation of knowledge and meaning that occurs through the informal learning that results from RNs' use of mobile devices can be viewed from the perspective of cognitive and socio-cultural constructivism. Cognitive constructivism contends that learners construct new knowledge individually based on previous learning (Kanselaar, 2002); whereas, socio-cultural constructivism asserts that knowledge is constructed collaboratively through social discourse (Crawford, 1999). Depending upon the context, either theory may help to explain the processes involved in the use of mobile devices as a tool for informal learning.

Statement of the Problem

The research problem associated with this study on the informal learning of RNs using mobile devices in the healthcare workplace focused on two main areas:

1. The challenges for RNs to meet their learning needs for continuing professional education, professional development, and continuing competence within the evolving healthcare workplace.
2. The dearth of research addressing informal learning of RNs using mobile devices in the healthcare workplace for informing professional development and continuing competence.

As members of a self-regulating profession, RNs are responsible for seeking out quality educational experiences relevant to their specific area of practice in order to meet their learning needs (Canadian Nurses Association & Canadian Association of Schools of Nursing, 2004). In addition, individual RNs must demonstrate "commitment to continuing competence through life-long learning, reflective practice and integrating learning into nursing practice" (Canadian Nurses Association & Canadian Association of Schools of Nursing, 2004, p. 1).

As previously discussed, the restructuring of the healthcare workplace has produced a work environment that is creating barriers for RNs to meet their learning needs in formal educational settings. In response, informal learning has "emerged to challenge the hegemony of 'formalized education'" (Sawchuk, 2008, p. 2), and is recognized to provide an abundance of learning opportunities within the workplace. This situation raises several questions: how are RNs learning informally in the healthcare workplace? What means and processes are they using? For what purposes are RNs learning informally in their workplaces? As new technologies such as mobile devices become more common in the healthcare workplace, are RNs using these tools to meet their learning needs for knowledge construction and meaning-making? The dearth of research underscores the importance of these questions and the results from this dissertation research study, as the literature review revealed no studies that specifically addressed informal learning of RNs using mobile devices in a healthcare context. In doing so, this study adds to the body of knowledge on informal learning in the workplace. Furthermore, the study's findings and recommendations

point to the use of mobile devices for informal learning, continuing professional education, professional development, and on-going competency of regulated nurses.

Purpose and Research Questions

Within the context of the healthcare workplace described earlier, this mixed methods study was conducted to initiate and/or add to the body of research by exploring how RNs engage in informal learning using mobile devices in the healthcare workplace. The research questions for the study are listed below.

1. What informal learning strategies or processes do RNs engage in when using mobile devices in the healthcare workplace?
2. For what purposes do RNs employ informal learning strategies or processes using mobile devices in the healthcare workplace?
3. Are there differences between how RNs use individual and collaborative modes of informal learning with mobile devices in the healthcare workplace?
4. Is there a relationship between the age of RNs and their use of mobile devices for informal learning in the healthcare workplace?

Delimitations and Limitations

Delimitations refer to the boundaries that are placed on the scope of the study by the researcher (Mauch & Park, 2003). This study was confined to diploma-prepared practicing RNs who used mobile devices in their workplaces. Additionally, these RNs were registered in a Bachelor of Nursing program at a single-mode distance university in Western Canada.

Limitations are factors not under the control of the researcher that may have possible effects on the outcomes of the study (Mauch & Park, 2003). As the RNs in

this mixed methods study were students enrolled in an online program, they may have been more engaged with technology, including mobile devices, than other RNs. As will be found in the descriptive analysis in Chapter 4, nearly 97% of the participants perceived themselves to be highly receptive to adopting new technologies in their healthcare workplace. This finding suggests that the study participants might be more receptive to new technologies including mobile devices than the general population of RNs.

Definition of Terms

This section defines key terms in order to ensure clarity and consistent understanding of common terms used in the study.

Baby Boomers - persons born between 1943 and 1964 inclusive (Canadian Federation of Nurses Unions, 2009).

Co-learning - a form of "learning with and in communities; it is respectful of the other's place; it involves knowledge making as much or more than knowledge consumption [and] it is done in informal settings" (Rutherford, 2009, p. 6). It equalizes power relationships and promotes mutual learning from and with one another (Curry & Cunningham, 2000).

Collaborative learning - "involves the joint construction of meaning through interaction with others and can be characterised by a joint commitment to a shared goal" (Hron & Friedrich, 2003, p. 70).

Competence - "ability of a registered nurse to integrate and apply knowledge, skills, judgement, and personal attributes required to practice safely and ethically in a designated role and setting" (Canadian Nurses Association, 2000, p. 6).

Continuing professional education - ongoing development of initial training for professional membership, specialist knowledge and expertise, and accountability (Bierema & Eraut, 2004).

Generation X - persons born between 1965 and 1980 inclusive. This group is also referred to as the Nexus Generation (Canadian Federation of Nurses Unions, 2009).

Generation Y - persons born between 1981 and 2000, inclusive. This group is also referred to as the Millennium Generation or the Net Generation (Canadian Federation of Nurses Unions, 2009).

Healthcare workplace - all publicly and privately funded sectors including hospitals, long-term care facilities, community health settings, and other workplaces such as physicians' offices, private nursing agencies, educational institutions, governments, or associations where healthcare workers are employed or self-employed.

Human resource development - "process of developing and unleashing expertise for the purpose of improving individual, team, work process, and organizational system performance" (Swanson & Holton, 2009, p. 4).

Incidental learning - a type of informal learning that is unintentional or unplanned resulting from the experiences of other activities (Watkins & Marsick, 1992). Following this experience, the learner is conscious that something has been learned "through a process of retrospective recognition that is either internally generated or externally led" (Schugurensky, 2000, p. 6).

Informal learning - "any activity involving the pursuit of understanding, knowledge

or skill which occurs outside the curricula of educational institutions, or the courses or workshops offered by educational or social agencies" (Livingstone, 2000, p. 2). Informal learning includes learning that is self-directed and intentional, incidental as well as unintentional or unplanned learning, and tacit learning that is neither intentional nor conscious (Schugurensky, 2000).

Mobile device - a handheld device such as a Smartphone, personal digital assistant (PDA), tablet, or other portable device that provides access to the Internet, e-mail, telephone, or other form of communication.

Nurse practitioner - a registered nurse with additional education in "health assessment, diagnosis and management of illnesses and injuries, including ordering tests and prescribing drugs" (Canadian Institute for Health Information & Canadian Nurses Association, 2006, p. 2).

Professional development - knowledge and skills acquired for personal development and professional practice (Jasper, 2007).

Registered nurse (RN) – refers to the following:

> a self-regulated healthcare professional who works autonomously and in collaboration with others. RNs enable individuals, families, groups, communities and populations to achieve their optimal level of health. RNs coordinate health care, deliver direct services and support clients in their self-care decisions and actions in situations of health, illness, injury and disability in all stages of life. RNs contribute to the healthcare system through their work in direct practice, education, administration, research, and policy in a wide array of settings" (Canadian Nurses Association, 2007, p. 6).

Regulated nurse - "licensed and registered to practise nursing by the provincial and territorial professional colleges and/or associations" (Canadian Nurses Association, 2011a).

Self-directed learning – a type of informal learning undertaken either alone or as part of a group that is intentional and conscious; whereby, the learner has a purpose in learning something even before the process begins and is aware that learning has occurred after the learning process has been completed (Schugurensky, 2000).

Tacit knowledge - a type of learning that occurs without the conscious knowledge of the learner and is associated with learning conditions, tends not to be expressed through free recall, promotes a sense of intuition, and is robust over time (Marsick et al., 2006).

Veterans - persons born between 1925 and 1945, inclusive (Canadian Federation of Nurses Unions, 2009).

Workplace learning - "an emerging interdisciplinary field that encompasses the theory and practice of management and leadership, individual and organizational learning, formal, informal and incidental learning, and training, development and education, that takes place within the workplace" (Walden, 2008, p. 9).

Chapter Summary and Overview of the Dissertation

This chapter provided an overview of the context and importance of the study and described the research problem. Research questions, limitations, and delimitations of the study were discussed.

Chapter 2 provides a critical review and synthesis of the literature relating to informal learning of RNs using mobile devices in the healthcare workplace.

Chapter 3 describes the methodology of the study. Included in this chapter is a detailed description of the research design, as well as the procedures for the participant selection, data collection, and data analysis employed in this investigation.

Chapter 4 presents and discusses the findings from the quantitative analysis of the descriptive and inferential statistics from the online survey.

Chapter 5 presents and discusses the results from the inductive analyses of the qualitative data including the purposive selection of the interviewees.

Chapter 6 presents and discusses the integrated quantitative and qualitative results for this mixed methods study. An eight-stage model for informal learning of RNs using mobile devices in the healthcare workplace for informing nursing professional practice is also presented.

Chapter 7 contains the conclusions of the dissertation research study on informal learning of RNs using mobile devices in the healthcare workplace. Recommendations for practice, as well as suggestions for future research, are provided.

CHAPTER 2

LITERATURE REVIEW

The literature review analyzes theories and research related to workplace learning, adult informal learning, and mobile devices. This chapter discusses current and seminal research that underpins the background for this study. It also points to gaps and limitations of the research in order to justify the need and significance for conducting the study.

Workplace Learning

During much of the 20th century, much of the learning related to the workplace occurred in the formal classrooms where individuals engaged in vocational training and education prior to entering the workforce (Le Clus, 2008). However, since the early 1990s, the focus of workplace learning has been on learning after employment, including on-the-job training, in-services, workshops, and the like within the authentic learning environment of the workplace. This shift of focus has caused great interest among educators and researchers from different theoretical views (Streumer & Kho, 2006). Theoretical approaches from multiple disciplines have blended, leading to "insights of the sociology of work and cultural analysis of workplace practice, psychology of learning and reflection, human narratives, feminist and labor analysis of division of labor, economic trends affecting workplaces, organizational theory, and the philosophy of knowledge" (Fenwick, 2002, p. 26). Streumer and Kho (2006) posit that common to nearly all of these approaches is the importance of the context of learning and the intertwining processes of learning and work. As Choy (2009) contends "renewed understandings about the potential of the

workplace as an authentic learning environment have given it visibility and saliency" (p. 1).

The workplace, as a rich context for formal and informal learning, can be viewed from the training and development perspectives of continuing professional education and human resource development (Bierema & Eraut, 2004). Embedded in the field of adult education and directed toward the ongoing learning needs of professionals, continuing professional education emerged in the 1960s (Cervero, 2001; Sleezer, Conti, & Nolan, 2004). The focus of continuing professional education is on further development of initial training for professional membership, specialist knowledge and expertise, and accountability (Bierema & Eraut, 2004). Professionals work in community- or service-based occupations that "apply a systematic body of knowledge to problems that are highly relevant to the central values of society" (Sleezer, Conti, & Nolan, 2004, p. 22). Professionals, such as RNs, engage in continuing professional education for further knowledge, competence, and performance for increasing quality client service and ongoing certification (Sleezer et al., 2004).

In a review of the historical research into continuing professional education from 1981 to 2000, Cervero (2001) determined that the patterns of learning for practitioners vary, depending on the profession, workplace location, and participation. From this study, Cervero described five common trends affecting continuing education in all professions:

1. the amount of workplace continuing education surpasses that offered by any other type of provider;

2. an increasing number of programs are being offered in distance education formats by universities, professional associations, and for-profit providers;
3. there are increasing collaborative arrangements among providers, especially between universities and workplace;
4. the corporatization of continuing education has increased dramatically for revenue generation;
5. continuing professional education is being used more frequently to regulate professional practice.

Although this historical review did not address the nursing profession specifically, it suggested trends that affect professions generally. Cervero (2001) claimed that these trends compel many professions "to improve the ways continuing education is conceptualized, organized and delivered" (p. 17). More recently, Jeris (2010) argued that, while there are some commonalities affecting professions, recognizing diversity in learning and development trajectories, and extending the context in continuing professional education from formal to informal learning may improve the quality of professional practice.

In contrast to continuing professional education, the other perspective of workplace learning includes human resource development and focuses on training, career development, and organizational development activities (Bierema & Eraut, 2004). Human resource development, which was introduced into workplace learning in the 1970s, is considered to involve a "process of developing and unleashing expertise for the purpose of improving individual, team, work process, and organizational system performance" (Swanson & Holton, 2009, p. 4). This

perspective of workplace learning concentrates on individual actions and interactions within an organization or collective entity based on theories of performance and change processes (Sleezer et al., 2004). Garavan, Morley, Gunnigle, and McGuire (2002) point out that traditionally human resource development has subscribed to the notion of human capital investment, where human resources contribute to the bottom line. They contend that human resource development includes "the processes involved in learning from work, at and through work" (p. 61).

Despite the different perspectives on workplace learning, Streumer and Kho (2006) assert that learning in the workplace includes the following common characteristics:

- the context within which learning develops;
- the different levels of learning for individuals and organizations including different levels for groups or teams;
- the degree of self-direction in learning;
- different forms of learning such as formal, informal, and incidental;
- less emphasis on information and skill-based acquisitions and more on the development of the ability to learn.

Although these characteristics point to different aspects of workplace learning, the emphasis remains on learning and constructing knowledge in the workplace.

In a recent study, Skar (2010) used a hermeneutic approach to explore the meaning that Norwegian professional nurses ascribed to the experience of their workplace as a learning environment. Individual interviews and focus groups with nurses working in different healthcare workplace settings were conducted and

analyzed. The themes that emerged included participation in the work community, engagement in interpersonal relations, and access to important knowledge resources. The nurses in this study actively sought experiences and guidance in the workplace "to confirm, construct and develop their practical and professional knowledge" (Skar, 2010, p. 16). However, this guidance was not always accessible due to the constraints of allocation and structuring of the work, cultural practices, and interpersonal relations in the workplace. Skar asserts that these workplace constraints affect the learning processes of nurses and their professional development. Although the small sample size and focus on Norwegian nurses are limitations of this study, its findings contribute to an understanding of the experiences of professional nurses in healthcare workplaces and the necessity for nurses to be able to access resources for information acquisition in order to construct knowledge and meaning.

The epistemology of workplace learning can be further explained as using multiple learning strategies and meaning-making processes, such that people want to engage in learning to achieve personal and organizational goals (Walden, 2008). Within the workplace, knowledge can be conceptualised, contextualized, and transformed into meaningful outcomes for the individual (Choy, 2009). The context that influences how professionals participate and elect to engage in workplace learning, both formally and informally, is the *sine qua non* for understanding learning at work and the construction of knowledge (Billett, 2002).

Within this context, the substantial changes in the nature of work and its meaning for 21st century workers due to globalized capitalism and the knowledge-

based economy are creating challenges for the workplace and learning (Fenwick, 2002). Le Clus (2008) expands upon these challenges, noting that

> Today's workers [including RNs in the healthcare workplace] are constantly faced with challenges that affect both the way they perform their job and their participation in everyday workplace activities. They are expected to continually modify and update their work practices in order to sustain competitive advantage, remain employable, and perform well. For this reason, the workplace is increasing recognized as a legitimate environment for learning new skills and knowledge that . . . [are] crucial in supporting, valuing, and developing opportunities for learning (p. 1).

It is within this challenging work environment that informal learning using mobile devices in the healthcare workplace was investigated, including the strategies and processes RNs use to construct knowledge and meaning for their professional development and continuing competency.

The Canadian healthcare workplace.

The social changes driven by demographics, technologies, social-cultural issues, and economics have had an impact on the Canadian healthcare workplace. Population aging, technological advancement, healthcare-specific inflation, and changes in gender, cultural, and generational diversity are challenging the healthcare workplace (Carstairs & Keon, 2009; Spinks & Moore, 2006).

Canada leads the industrialized world in the rate at which the labour force over 45 years of age is increasing: projections suggest that by 2041, the 45+ year-old cohort will represent 41% of the Canadian labour force (Spinks & Moore, 2006). In

2006, the Canadian healthcare workforce consisted of just over 1 million people, or more than 6% of the total Canadian workforce (Canadian Institute of Health Information (CIHI), 2007). The nursing and physician professions combined represented approximately half of this paid workforce. According to the CIHI, the healthcare workforce in 2005 was slightly older than the general working population, with an average age of 41.9 years, compared to the Canadian average of 39.6 years. Challenges associated with retirement of the older members of the workforce are becoming acute. Spinks and Moore (2006) note that the exodus of healthcare providers from the workplace is projected to be critical by 2016. They claim that within the nursing profession alone, where nearly one-third of the nursing force is currently over 50 years of age, more than 70,000 nurses will need to be replaced by 2016.

As technology advances, new and innovative technologies are being used in the healthcare workplace for specialized kinds of medical treatment and diagnostic testing, as well as for communication and information management (Romanow, 2002). Healthcare professionals need to keep pace with technological advancement, as those "who do not or cannot continue to upgrade their skills, run the risk of becoming obsolete" (Canadian Council on Learning, 2009, p. 55).

Although approximately 80% of the healthcare workforce is female, occupations such as medicine and information technology are starting to show more gender diversification (CIHI, 2007). Spinks and Moore (2006) identify the following generational characteristics affecting the healthcare workplace:

- younger generations are very proficient in the use of technologies;

- 20 - 30 year olds are family-centric or dual work/family-centric, with more value on work–life balance in comparison with older generations who are more work-centric;
- 50 - 60 year olds are preparing for retirement.

There is also a greater demand for human capital, which includes skills and knowledge that are valued in the healthcare workplace, as well as national and global competition from other public and private employment sectors (Spinks & Moore, 2006). The years of cost-cutting, downsizing, and restructuring of the healthcare workforce have caused demoralization, overwork, and difficulty coping with working conditions, all of which decrease the quality of work life and organizational performance (Lowe, 2002). As Lowe argues, all of these factors make recruitment and retention of the healthcare workforce problematic and affect its capacity for responding to the healthcare needs of Canadians now and in the future.

In the commissioned report, *Building on Values: The Future of Health Care in Canada*, Romanow (2002) notes that "for the past two decades, continuing changes in how health care services are delivered combined with efforts to contain costs in every province and territory have taken their toll on Canada's health workforce" (p. 91) and identifies the following issues that have arisen from these changes:

- lack of nurses in rural and Aboriginal communities;
- changing skills and roles of health providers in terms of what they are trained to do and the scope of practice as part of their professional roles;
- changing patterns of practice related to the delivery of services occurring within the healthcare workplace. Significant changes have occurred for nurses

with downsizing of administrators and administrative support, and "shifting in and out of their areas of expertise from emergency rooms and intensive care to pediatrics and geriatrics, or from practice in teams in hospitals to individual practice in home care" (p. 94);

- declining quality of working life and morale, impacting the quality of patient care and causing a significant numbers of nurses to leave their profession;
- international mobility of healthcare providers, resulting in healthcare professionals leaving Canada to work in other countries, particularly the United States.

These issues remain valid today. Nurses still have to cope with considerable dissonance between what they desire in a job and maintaining a work-life balance. Part of what they value most in a job is "respect, interesting work, good communication, a sense of accomplishment, work-life balance and opportunities for skill development" (Lowe, 2002, p. 50). The latter characteristic, RNs' opportunities for skill development, was explored in this study on informal learning using mobile devices in the healthcare workplace.

Related to the changes in the healthcare workplace, Aiken et al. (2001) surveyed 43,000 RNs from more than 700 hospitals in the United States, Canada, England, Scotland, and Germany in order to gather their perceptions associated with quality of nursing care delivered, job satisfaction, career plans, and feelings of job burnout. A limitation of this study was that it only sampled RNs in hospital settings. The findings indicated that RNs in all five countries had similar concerns related to increased job dissatisfaction, burnout, and intent to leave the healthcare workplace,

and that nurses in the U.S. and Canada were "more likely to be dissatisfied with working conditions than with their wages" (p. 48). The results of this study show that the problems of RNs in healthcare workplaces are not a uniquely Canadian phenomenon. Aiken et al. (2001) advised that, in a competitive labor market, workplace changes must be made that promote "opportunities for career advancement, lifelong learning, flexible work schedules, and policies that promote institutional loyalty and retention" (p. 51).

The effects of healthcare workplace changes on nurses were examined in an extensive study conducted by Shields and Wilkins (2006). A stratified sample of nearly 19,000 Canadian registered nurses, registered psychiatric nurses, and licensed practical nurses were surveyed on the conditions and challenges in the workplaces related to their physical and mental well-being. The response rate was 80%. Multivariate analysis was used to examine the associations between work conditions and health, with the potentially confounding effects of gender, age, type of nurse, province/territory, household income, smoking and obesity taken into account. Findings revealed that more than 60% of the nurses felt that their workplaces presented high demands resulting in physical and mental health problems. Nurses who worked shift work had a higher likelihood of physical and mental health problems. Although the study was based on self-reported data and was not validated using other measures or direct observation, it illustrates the significant impact of the healthcare workplace on nurses' health and well-being.

At the forefront of the priorities and on the agendas of governments and many employers are "healthy workplaces that improve recruitment and retention, workers'

health and well-being, quality of care and patient safety, organizational performance and societal outcomes" (Shamian & El-Jardali, 2007, p. 7). Lowe (2002) advises that providing healthcare professionals, such as RNs, in the Canadian healthcare workplace with the opportunity to be

> innovative in terms of the quality of what they do and to encourage continuous learning… may be the surest way to create a better quality of work life and enhance the overall performance of the healthcare system well into the future (p. 55).

Canadian regulated nurses.

An estimated 348,499 regulated nurses are employed in the Canadian healthcare workforce (CIHI, 2010). Professional nurses in Canada are regulated at the provincial or territorial level (Nelson & Purkis, 2004). Each health profession has been delegated the authority and responsibility to self-regulate its professional members (The Conference Board of Canada, 2007).

There are four categories of Canadian regulated nurses: registered nurses; registered psychiatric nurses; licensed practical nurses; and nurse practitioners. While there are differences in entry-to-practice requirements for nurses, there is only one discipline of nursing (White et al., 2008). Registered nurses and registered psychiatric nurses may either be diploma- or degree- prepared, licensed practical nurses are diploma-prepared, and nurse practitioners are mainly degree-prepared. The CIHI (2010) reported the following for Canadian regulated nurses in 2009:

- Of the 348,499 regulated nurses working in nursing in Canada, 76.4% were RNs, 22.1% were licensed practical nurses, and 1.5% was registered psychiatric nurses.
- The majority of regulated nurses worked in the Canadian hospital sector including 62.6% of RNs, 45.6% of licensed practical nurses, and 44.0% of registered psychiatric nurses.
- The average age of regulated nurses was 44.9.

The CIHI also stated that as of 2009 there were 284,690 Canadian registered nurses (including nurse practitioners) with the following demographic characteristics:

- average age of 45.2 years;
- 93.8% were female and 6.2% were male;
- 60.1% were diploma-prepared, 36.7% were baccalaureate-prepared, and 3% were masters-prepared and 0.2% doctorate-prepared;
- 87.9 % worked in direct patient care, 6.4% worked in administration, 3.4% worked in education, and 0.7% worked in research;
- 58.6% worked full-time, 30.6% worked part time, and 10.7% worked casual hours.

Within Canada, multiple generations of RNs work in the healthcare workplace (Canadian Federation of Nurses Unions, 2009). There are four distinct age-generational categories: Veterans (born 1925 - 1945), Baby Boomers (born 1946 - 1964), Generation X (born 1965 - 1980), and Generation Y (born 1981 - 2000). According to the Canadian Nurses Association (2010), the age-generational

distribution of RNs in 2008 was as follows: Veterans - 2.7%, Baby Boomers - 51.5%, Generation X - 34.4%, and Generation Y - 11.4%.

Reflective practice.

With the restructuring of the Canadian healthcare workplace, Nelson and Purkis (2004) observed that regulators introduced competencies in the nursing profession "that *purport* [italics in original] to demonstrate and provide a public accounting of this professional group's competence to practice" (p. 248). Most nursing jurisdictions across Canada have undertaken the creation of Continuing Competence Programs (CCPs); whereby, RNs use a professional portfolio to collect, synthesize, and analyze professional experiences, and develop an individualized learning plan (Bassendowski & Petrucka, 2009). In the learning plans, RNs identify learning outcomes to be met for maintaining competency for the upcoming year from reflections on their personal strengths and weaknesses in professional practice (Bassendowski & Petrucka, 2009).

For RNs, these competencies include the "ability to integrate and apply knowledge, skills, and attributes required to practice safely and ethically in a designated role or setting" (Canadian Nurses Association, 2000, p. 6). Nelson and Purkis (2004) contend that competencies are considered within a reflective context to "articulate a discourse of clinical expertise in nursing and to distinguish between levels of experience and skill in practitioners" (p. 251). As self-regulated practitioners, RNs are required to evaluate their individual skill sets honestly and frequently, and then work to resolve any deficits (Nelson & Purkis, 2004).

These reflection-in-action activities arise out of Schön's (1987) studies on reflective practitioners where individuals self-evaluated during their experiences. Often an unexpected event triggers the reflect-in-action. The practitioner learns as action is implemented becoming aware of the complexities of the situation and assumptions for judging the new challenge (Marsick, Watkins, & Lovin, 2011).

Reflective practice also includes reflection-on-action which occurs after the encounter (Schön, 1987). This reflective exploration focuses on re-examining ideas, observations, and actions from past events in order to develop more effective ways of action for future practice. As discussed by Rodgers (2002), reflective practice is based on Dewey's criteria of reflection and includes the principles listed below.

1. Reflection as a meaning-making process that moves the learner from one experience into the next with deeper understanding of its relationships with and its connection to other experiences and ideas. It is the thread that makes continuity of learning possible, and ensures the progress of the individual and ultimately society. It is the means to a moral end.
2. Reflection as a systematic, rigorous, disciplined way of inquiry, with its roots in scientific inquiry.
3. Reflection needs to happen in a community, in interaction with others.
4. Reflection requires attitudes that value the personal and intellectual growth of oneself and others (Rodgers, 2002, p. 845).

Another concept of reflection described by Merriam (2004) involves Mezirow's critical reflection and rational/reflective discourse that are integral to transformational

learning where "one's values, beliefs, and assumptions compose the lens through which personal experience is mediated and made sense of" (p. 61).

In addition to mandating reflective exercises for competency, mandatory continuing education is also required by legislative bodies and professional associations in Canadian provinces and territories for maintaining competence, licensure, and/or certification for employment beyond the entry-level requirements. In a study of the continuing professional education (CPE) systems of 12 major health professions including Canadian registered nurses and licensed practical nurses, Curran, Kirby, and Fleet (2006) noted that "mandatory continuing education includes CPE that encompasses all of the formal, informal, and non-formal learning activities that are intended to enhance and maintain the competencies of professionals" (p. 50). Their study found that specific aspects of CPE systems for nursing professions varied across the provinces, but that most were based on mandatory requirements for continuing competency including "the fundamental principles of which are self-directedness and autonomy in the identification of personal learning needs and participation in selective educational activities to address those needs" (p. 57). Curran et al. contended that nursing had moved from clocking hours for CPE participation towards continuing competency programs where nurses had the autonomy and flexibility to identify individual learning needs and select appropriate continuing professional education activities to meet those needs, often in the form of required personal learning plans. They noted that "the use of distance learning technologies and the design of self-directed learning systems for mandatory CPE are examples of best practices for enhancing access to CPE activities" (p. 71), although

this may not be well known by nurses. These findings lend support to the use of informal learning for continuing professional education, as explored in this study on informal learning of RNs using mobile devices in the healthcare workplace.

As regulated professionals in the challenging healthcare environment, RNs must "obtain, maintain, and continue to enhance their competence through continuous learning" (Canadian Nurses Association & Canadian Association of Schools of Nursing, 2004, p. 2). Continuous learning requires RNs to reflect on their competencies related to changes in society and in the healthcare workplace, and then to take action as a result of this reflection (Canadian Nurses Association & Canadian Association of Schools of Nursing, 2004). With the ongoing challenges in the healthcare workplace, it may be necessary to move from traditional models of teaching and learning and consider other pedagogical practices and learning models, including informal learning, which "draws on previous experiences and encourages critical reflection and transfer of knowledge" (Le Clus, 2008, p. 21).

Adult Informal Learning

The origins of informal learning are unclear. According to Sawchuk (2008), the conceptualization of informal learning may have originated in the distant past, from the epistemologies and philosophies of ancient Greece. However, more conservative thinkers place its beginnings in the post-World War II era where non-formal education was considered a means of "establishing capitalist economic development, liberal democracies, a modern state and higher standards of living. . . flexible and responsive to the population, integrating local/indigenous knowledge forms" (Sawchuk, 2008, p. 4).

Despite the efforts of many researchers, there is no agreed upon or clear definition of informal learning (Colley, Hodkinson, & Malcolm, 2003; Wihak et al., 2010). As Sefton-Green (2004) explains, informal learning is conceptually difficult to define as there "is no one simple science of learning, no one set of shared rules to which all researchers in the field would point to begin to describe how informal learning might take place" (Sefton-Green, 2004, p. 8).

Informal learning is often referred to as learning that occurs somewhere other than in a classroom or training venue and that does not follow a prescribed framework of formally constituted educational institutions (Hager & Halliday, 2009; Wihak et al., 2010). Thomas and Moisey (2006) explain that informal learning "can be undertaken individually or collectively, in face-to-face or online settings . . . [and occurs] in the absence of an instructor" (p. 185). Informal learning differs from non-formal learning, which includes organized education programs that are usually short-term, voluntary, and take place outside of formal education settings (Schugurensky, 2000). However, other theorists, such as Malcolm et al. (2003), argue that the terms "informal" and "non-formal" are often interchangeable as they are defined in opposition to formal education.

Billett (2002) claims that using the term "informal learning" in the context of the workplace can be perceived as derogatory or implying a second-class quality of education compared to learning in educational institutions. However, Billett also asserts that informal learning is not unstructured, as it has "norms, values and practices [which] shape and sustain activities and interactions [that are often inherently pedagogical] within workplaces" (p. 4). Lastly, Billett posits that

discussing the learning process as either formal or informal implies a form of "situational determinism," where the circumstances determine the kind of learning to occur, either formally or informally, removing human agency in the creation and development of knowledge. In contrast to this view, Sawchuk (2008) argues that

> equally important is the concept of mediated practice. . . and its recognition plays an important role in helping to overcome the classic structure/agency dichotomy of learning analysis. However, does this necessarily mean the demise of the concepts of formality/informality? Clearly, if we are to take seriously the inherent role of social context then there are different social arrangements within organized instructional and non-taught learning situations that must be considered (p. 9).

According to Rubenson (2007), informal learning focuses on the practical and everyday knowledge from the ubiquitous experiences of daily life, including work, family, and leisure. Schugurensky (2000) proposes the following three main forms of informal learning:

1. Self-directed, undertaken by individuals either alone or as a part of a group, that is intentional as there is a purpose to learning that is known before the learning process begins. After the experience, the learner is conscious that something has been learned.
2. Incidental, as unintentional or unplanned learning, from the experiences of other activities (Watkins & Marsick, 1992). Following this experience, the learner is conscious that something has been learned "through a process of

retrospective recognition that is either internally generated or externally led" (Schugurensky, 2000, p. 6).

3. Social or tacit learning, which is neither intentional nor conscious. This includes the internalization of values, attitudes, behaviors, and skills that occur in our daily lives.

Informal learning is rooted in Dewey's (1938) theory of experiential learning, which asserts that as learners interact with their experiences, the effects of these experiences create continuity for the future and each learner derives individual meaning from these experiences (Marsick, Watkins, Callahan, & Volpe 2006). Lewin's (1952) Field theory also informs the definition of informal learning as it links behavioural changes to the interaction of individuals within their environment.

The term "informal learning" was introduced into the field of adult education in the 1950s through the pioneering work of Malcolm Knowles. He described adult learning as a process of self-directedness where adults decide what they want to learn and become ready to learn when they experience a situation that creates the need to know something new (Knowles, 1970). Accordingly, Knowles advocated that every adult is involved in continual learning activities and that such activities, which are outside the control of educational institutions, are integral to the structure of society.

Within a collective of self-directed learners, adults may collaborate and co-learn to construct knowledge (Rutherford, 2009). Co-learning is "learning with and in communities; it is respectful of the other's place; it involves knowledge making as much or more than knowledge consumption; [and] it is done in informal settings" (Rutherford, 2009, p. 6). Curry and Cunningham (2000) suggest that co-learning

promotes equality and develops mutual learning that is respectful of the other's place and meaning making. With informal learning using mobile devices in the healthcare workplace, RNs may engage in co-learning that includes:

- learning with, from, and about each other;
- sharing the roles of expert and novice, teacher and learner;
- application and re-creation of knowledge;
- mutually beneficial processes for addressing issues of importance to all participants;
- active involvement in deciding what and how to learn (Rutherford, 2011, p. 353).

Informal learning has received limited exploration in the literature to date and "warrants much fuller attention from those interested in comprehending the nature and extent of adult learning" (Livingstone, 2001, p. 4). It is within the sphere of informal learning where most of the salient knowledge that people apply in their daily lives and workplaces is obtained. This scarcity of literature underscores the need for further investigation of informal learning, and prompted this study on informal learning of RNs using mobile devices in the healthcare workplace.

Informal learning in the workplace.

In their seminal work, Watkins and Marsick (1992) proposed the theory of informal and incidental learning in the workplace. The elements considered central to this theory are:

- Learning from experience is constructed based on situations and individual experience.

- Organizational context "influences the way in which people define the situation, select options for action, and interact with others with whom they work and learn" (Watkins & Marsick, 1992, p. 294).
- Focus on action, based on Argyris and Schön's (1978) theory of reflective practice, occurs when individuals learn from their critical reflection on unexpected circumstances that they could not plan for the situation because they did not know the underlying assumptions. For example, nurses focus on action when they have to think critically in new situations that are not governed by a known practice or heuristics.
- Non-routine versus routine conditions of learning suggests that informal learning takes place when people see a situation as non-routine, otherwise they will respond habitually or routinely and no new learning may occur.
- The tacit dimension of knowledge resides outside the main focus of attention and in the context that "is fertile ground for informal and incidental learning" (Watkins & Marsick, 1992, p. 296).
- Delimiters of learning depend on how an individual frames a problem based on reflection and work capacity. Work capacity varies widely among individuals "in their ability to conceive the scope of learning tasks over time" (Watkins & Marsick, 1992, p. 296).
- Enhancers of learning include proactivity or the "readiness to take initiative" (Watkins & Marsick, 1992, p. 297) that leads to a sense of autonomy and empowerment, critical reflectivity as discussed by Mezirow, and creativity to think "outside of the box".

Marsick, Watkins, Callahan and Volpe (2006) later updated their earlier theory of informal and incidental learning in the workplace and added the concepts of tacit/implicit knowledge, whole-person learning, and communities of practice.

- Tacit/implicit knowledge occurs without the conscious knowledge of the learner and is associated with incidental learning conditions, tends not to be expressed through free recall, promotes a sense of intuition, and is robust over time.
- Whole-person learning theory illustrates the role of affect related to an individual's feelings and emotions in informal and incidental learning.
- Community of practice provides insight into how "individuals interact around common interests, and hence can be used to better leverage informal and incidental learning by providing support, structure, and incentives for this kind of learning" (Marsick et al., 2006, p. 799).

Based on this re-conceptualization of their informal learning theory, these authors proposed the informal and incidental learning model, as displayed in Figure 1.

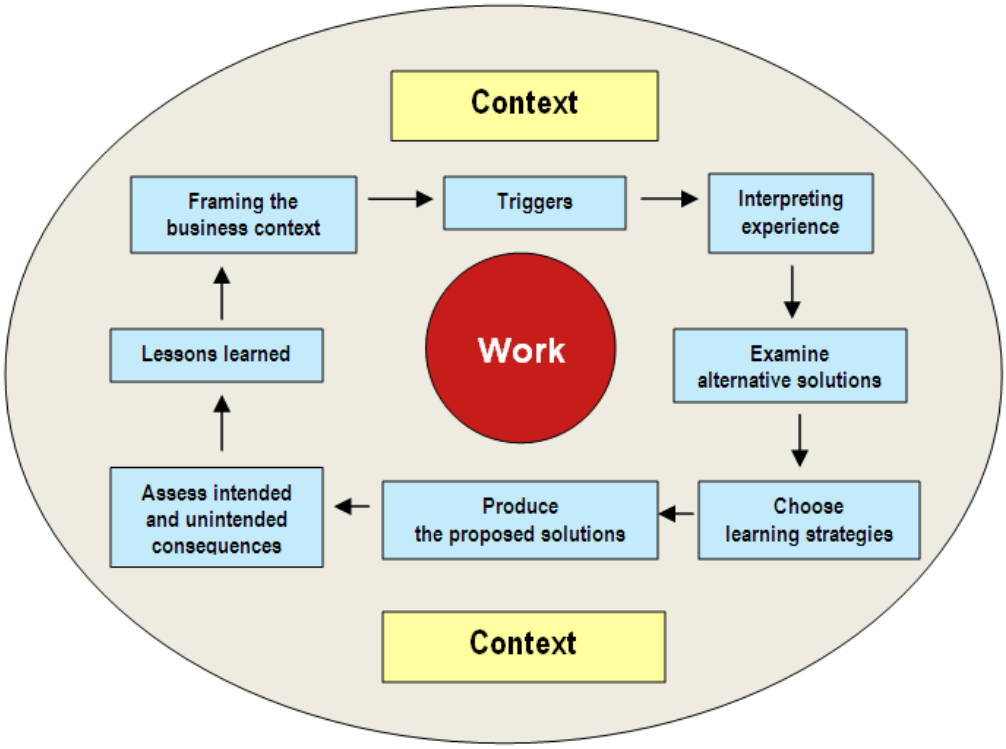

Figure 1. Re-conceptualized informal and incidental learning model. Adapted from "Reviewing Theory and Research on Informal and Incidental Learning" by V. J. Marsick, K. E. Watkins, M. W. Callahan, and M. Volpe, (2006), *Proceedings of the Academy of Human Resource Development International Conference (AHRD)* (p. 795).

This model of informal and incidental learning from and through experience in the workplace is based on problem solving through reflective thought (Marsick et al., 2011). The eight iterative steps in this model include:

1. responding to triggers for a potential learning experience;
2. interpreting the learning experience;
3. examining alternative solutions;
4. choosing learning strategies;
5. producing the proposed solutions;
6. assessing intended and unintended consequences;

7. evaluating the lesson that were learned;
8. framing the business context in which the learning takes place.

Unlike formal learning in the traditional educational context, workplace learning is often considered informal, as a normal by-product of the nature of the workplace (Eraut, 2004). Marsick and Watkins (2001) indicate that informal learning occurs when there is a "need, motivation, and opportunity for learning" (p. 28). Informal learning in the workplace may be facilitated by co-workers or the organization in some form of mentoring relationship or through "self-directed informal learning that includes intentional, job-specific and general employment-related learning done on your own, collective learning with colleagues of other employment-related knowledge and skills, and tacit learning by doing" (Livingstone, 2001, p. 3). As Marsick et al, (2000) explain, self-directed learning may occur as a timely response to strongly felt challenges that are situated within a highly relevant context.

In his benchmark study of the 1998 New Approaches to Lifelong Learning (NALL) survey, Livingstone (2000) compared the informal learning of adults to an iceberg that was "mostly invisible on the surface and immense" (p. 1). This national survey examined the informal learning of 1500 Canadian adults from the perspectives of employment, community volunteer work, household work, and general interest. Livingstone reported that more than 95% of participants were involved in some explicit informal learning that they considered significant, and that they devoted an average of 6 hours/week to informal learning within the workplace. Additionally, Livingstone's findings suggest that Canadians under the age of 24 years spent

significantly more time in informal learning activities while no differences were found with middle-aged adults or those adults approaching/entering retirement.

Building on the earlier study, Livingstone and Scholtz (2006) surveyed 9,063 adults in a 2004 Canada-wide survey of work and lifelong learning (WALL). They reported that more than 80% of the Canadian employed labour force was involved in some form of informal learning in the workplace and that the time spent in such activities averaged more than 5 hours/week. Livingstone, Mirchandi, and Sawchuk (2008) emphasized the need for further research on informal learning within all spheres of work in order to be more receptive to the needs of the workforce, noting that informal learning "may represent our most important learning for coping with our changing environment" (p. 4). In calling for further research, Erault (2004) explained that besides being under-researched, the workplace context can bring new perspectives to the investigation of informal learning.

Cheetman and Chivers (2001) conducted an empirical investigation of informal learning with 80 practitioners from 20 different professions. Surveys of six representative professions were conducted to examine the ways that professionals acquire knowledge for competence in the workplace. The results indicated that much of the learning for professional competence development occurs outside of formal learning, a finding that "highlights the critical importance of informal learning" (Cheetman & Chivers, 2001, p. 285). The researchers cautioned about overly prescriptive best practices for learning methods, explaining that learners find different kinds of learning experiences to be formative. They recommended that formal learning should concentrate on core knowledge and basic professional skills, which

develop learning skills that can be linked to informal learning, and advised that "developers should start by explicitly recognizing the key contribution of informal learning to the acquisition of full professional competence"(Cheetman & Chivers, 2001, p. 285). Noting the importance of reflection for constructing knowledge and meaning, Cheetman and Chivers recommended that further research was warranted into the ways of facilitating these learning skills.

A more recent study on factors affecting informal learning in the workplace including engagement, organizational characteristics, and perceived factors was conducted by Berg and Chyung (2008). The survey of 125 professionals revealed that the lack of a learning organizational culture did not inhibit informal learning in the workplace. The researchers stated, "if a worker needs to obtain specific information to complete a task, one might assume that the individual will find a way to learn that information regardless of whether the organization has a structure in place to make that effort easier" (Berg & Chyung, 2008, p. 237). The researchers also determined that gender and level of education did not influence engagement in informal learning, but that it did increase with age. Berg and Chyung found that intrinsically driven interest in the current field of the professional, followed by access to computer technology were the two factors that most positively affected the level of engagement in informal learning; whereas the least impacting factors were extrinsically driven monetary rewards and physical proximity to colleagues. Similarly, Marsick and Watkins (2001) contended that technology changed the face of organizations and affected informal learning, claiming that "given the distributed, asynchronous nature of technology-facilitated interactions, more may be learned

incidentally by learners reading between the lines. As we work to bring adult education to the Web, studies exploring how people learn in these settings are needed" (p. 32).

Constructivism and informal learning in the workplace.

Informal learning theories often relate to constructivism, which asserts that learners "construct meaning through their interpretive interactions with and experiences in their social environments" (Brown, 1998, p. 11). Kanselaar (2002) argues that this subjectivist epistemology of learning contrasts sharply with the objectivist view whereby learning is the passive reception of information transmitted from one individual to another. Constructivism is based on a relativist ontology where there can be multiple and diverse interpretations. Within this philosophy are clusters of constructivist epistemologies including cognitive and social constructivism (Davis & Sumara, 2003).

Cognitive constructivism asserts that human knowledge is constructed as learners actively build new knowledge upon the foundation of previous learning in the real world (Kanselaar, 2002). Cognitive constructivism is derived from the seminal work of Piaget, based on assimilation, accommodation, and learning as an individual activity (Laurillard, 2008). Piaget (1952) proposed that knowledge grows sequentially from simple to complex, building upon previous stages, and is based on schema building. Bruner (1979) elaborated upon Piaget's ideas, emphasizing "the importance of allowing a learner to be actively involved in 'discovering' new learning, which is constructed by active comparison of new information with existing knowledge" (Mohanna & Waters, 2008, p. 565).

Within the context of informal learning in the workplace, learners may individually or collaboratively set goals, either intentionally or unintentionally, through "surfacing or hiding of tacit dimensions of experience" (Watkins & Marsick, 1992, p. 298), and build on prior knowledge to construct new subjective knowledge and understanding. Within this uncertain milieu, learning is a complex, dynamic, and continuous process where the learner has control of the pace and adapts to the changing environment using meta-cognition and self-evaluation (Brown, 1998; Davis & Sumara, 2003).

Socio-cultural constructivism is based on Vygotsky's (1978) theory that knowledge is constructed through collaborative social discourse, rather than individually, and is influenced by the cultural context (Crawford, 1999). In this context, "learning must be 'situated,' in the sense that the learner is located in the situation. Therefore, what they know from that experience they know in relation to that particular context" (Laurillard, 2008, p. 13). Vygotsky (1978) proposed a "zone of proximal development," which represents the difference between the learning an individual can achieve alone, and the learning that is possible with appropriate guidance from a teacher or collaboration with more capable peers. From this socio-cultural constructivist view, learning is constructed when "individuals engage socially in talk and activity about shared problems or tasks. Making meaning is thus a dialogic process involving person-in-conversations, and learning is seen as a process by which individuals are introduced to a culture by more skilled members" (Driver, Asoko, Leach, Scott, & Mortimer, 1994, p. 7).

Billett (2009) suggests that in the authentic environment of the workplace, learning is situated and may be scaffolded through participation in the socio-cultural practices of the workplace community. This idea also reflects the view of a community of practice where individuals are engaged and meaning is constructed through participation in a sociocultural practice (Lave & Wenger, 1991). However, when socially constructed, extrinsic motivation is not present; learners have to be intrinsically motivated and challenged with a problem or task to use their skills and knowledge that goes beyond their current level of development (Laurillard, 2008).

The constructivist epistemology is not prescriptive. Rather, constructivism supports informal learning in the workplace for the creation of knowledge that is most meaningful to the learner. From this perspective, mobile devices can be learning tools that "provide access to rich sources of information, encourage meaningful interactions with content, and bring people together [synchronously or asynchronously] to challenge, support, or respond to each other" (Wilson & Lowry, 2000, p. 3). According to Hutchinson, Tin, and Cao (2008), mobile technologies are "ubiquitous in today's business and social environments; they are shaping the way that individuals learn, communicate, and share information" (p. 201). Mobile devices can play a role in the way people learn and build meaning from their experiences (Patten et al., 2006; Sharples, Taylor, & Vavoula, 2010). However, the use of mobile devices as learning tools should not stem from a technical determinist viewpoint motivated by cost, adaptability, and/or scalability (Patten, Arnedillo Sánchez, & Tangney, 2006). Rather, their use should be guided by constructivist learning principles, such as scaffolding, interactivity, and reflective practice; social interaction

and collaboration; and learner-centered knowledge construction and meaning-making. In the healthcare workplace, mobile devices can be learning tools that assist RNs to construct knowledge and meaning from reflections using real-time or recorded experiences, thoughts, and ideas (Clough et al., 2009), either individually as per the perspectives of cognitive constructivism or collaboratively as in socio-constructivism.

Informal learning using mobile devices in the workplace.

As previously discussed, workplace learning and informal learning are not new to adult education and pedagogy. However, the use of mobile devices as learning tools is a new and understudied area of research, and their use for informal learning in the healthcare workplace is a relatively unexplored area altogether. As Kukulska-Hulme and Pettit (2009) note, "mobile devices have become commonplace tools, yet little is known about how individuals use them in their teaching, learning, work, and leisure" (p. 135).

Ahonen (2010) estimated that the mobile industry has 4.6 billion active subscriptions. Included in these mobile technologies are personal digital assistants (PDAs), mobile phones, notebooks, tablets, and other portable wireless devices that enable learners to interact, maximize ideas, and expand the boundaries for just-in-time learning (McGreal, 2005). Due to their convenience, portability, and multimedia capabilities including text, audio, and video, mobile devices can take learning out of classrooms and into the authentic context of the workplace for both formal and informal learning. Clough, Jones, McAndrew, and Scanlon (2008) predict that as technologies become more mobile and increasingly ubiquitous, more mobile

devices will be used as learning tools. Wihak and Hall (2011) suggest that mobile devices have the potential to rapidly accelerate participation in informal learning. In addition, when linked with the Web, mobile devices can provide global access to information allowing us to

> learn across space as we take ideas and learning resources gained in one location and apply or develop them in another. We learn across time, by revisiting [and building on] knowledge that was gained earlier in a different context, and more broadly, through ideas and strategies gained in early years providing a framework for a lifetime of learning. We [interact] and move from topic to topic, managing a range of personal learning projects, rather than following a single curriculum. . . since some aspects of informal and workplace learning are fundamentally mobile
>
> (Sharples et al., 2010, p. 2).

In this context, mobile devices provide learners with the choice about whether to engage in learning individually or collaboratively, as well as with the potential for learner-centered control over the social and physical context where learning occurs (Clough et al., 2008).

In the healthcare workplace, the use of mobile devices by physicians, residents, and medical students is well recognized for portability, time savings, medical error reduction, and timely access to information (Di Pietro et al., 2008; Thede & Sewell, 2010). However, the use of these devices to provide access to current and reliable information remains a challenge for nurses, especially at point-of-care (Di Pietro et al., 2008).

In a study by Clough, Jones, McAndrew, and Scanlon (2008), mobile devices were investigated as potential learning tools. A web-based survey examined the use of PDAs and smartphones for supporting and enhancing the informal learning experience. In order to minimize anxiety and usability problems, the study targeted 100 experienced and enthusiastic mobile device users. Their professions were not specified. The findings suggested that participants adapted the mobile device features to suit their learning needs, and that informal learning was an outcome of owning a mobile device. Clough et al. classified the use of the mobile devices for learning activities as:

- referential -- such as ”office style” tools including dictionaries, translators, and e-books to allow access to content at the place where learning activities occurred;
- constructive -- to create knowledge either alone or with others;
- reflective -- including individual, collaborative/distributed, or interactive;
- administrative -- focusing on scheduling and maintaining a calendar.

The researchers concluded that the mobile devices were used extensively in an informal learning context in ways that corresponded to the “collaborative, contextual and constructivist learning philosophies” (Clough et al., 2008, p. 370). Due to the paucity of research on informal learning and use of mobile devices by RNs in the healthcare workplace, the Clough et al. (2008) study was relevant and underpinned this dissertation research study of mobile devices as tools for informal learning in nurses’ construction of knowledge and meaning in the workplace.

Doran, Haynes, Kushniruk, et al. (2010) suggest that the use of mobile devices in nursing practice is a relatively new innovation and the value unrecognized. The receptiveness of RNs to adopt and use mobile devices in the healthcare workplace varies. As Rogers (2003) states, "individuals in a social system do not all adopt an innovation at the same time. Rather, they adopt in an over-time sequence" (p. 267). Rogers classifies potential adopters of an innovation into five normally distributed categories, as illustrated in Figure 2 below, including (1) innovators, (2) early adopters, (3) early majority, (4) late majority, and (5) laggards based on receptivity to innovation.

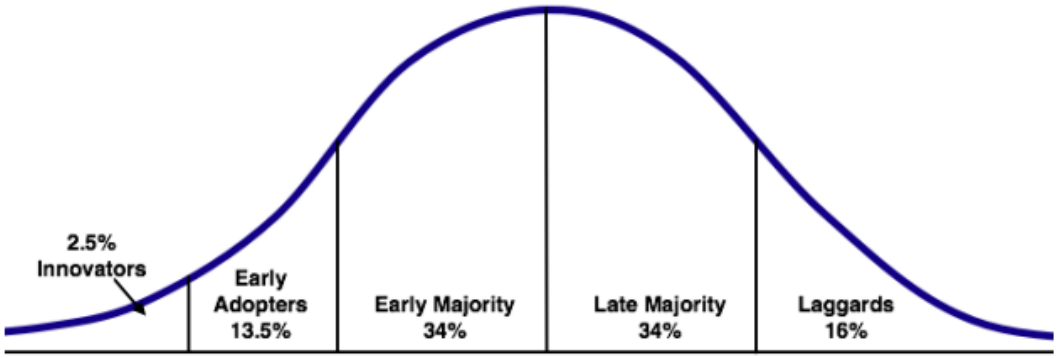

Figure 2. Distribution of Rogers' adopter categorization. Adoption categories based on the estimates of individuals' receptiveness to an innovation. Adapted from *Diffusion of Innovations* (p. 281), by E. M. Rogers, 2003, New York, NY: Simon and Schuster. Copyright 2003 by Everett M. Rogers.

For the adoption of a technological innovation in the healthcare workplace, Kaminski (2011) provides the following examples of each of the adopter categories with nurses:

1. Innovators -- technology enthusiasts who are venturesome and risk takers;
2. Early adopters -- visionaries who are trend setters and willing to trial the technology;
3. Early majority -- pragmatics who want to avoid any risks with technology;

4. Late majority -- conservatives who are sceptical, cautious, and technologically shy;
5. Laggards -- resistors who want to maintain the status quo and think of technology as a hindrance.

As such, it can be argued that RNs who are enthusiastic and willing adopters of technological innovations (i.e., those in the innovator and early adopter categories) may use mobile devices in the healthcare workplace more readily and earlier than others.

Garrett and Klien (2008) note that the literature related to use of mobile devices in the healthcare workplace has mainly focused on equipment, software, and development. However, a recent Ontario study examined the potential of mobile devices, including PDAs and tablet personal computers, for enhancing the access of nurses to information resources in order to support quality patient care (Doran, Haynes, Kushniruk, et al., 2010). In this study, a total of 488 front-line registered nurses and registered psychiatric nurses located in 29 acute care hospitals, long-term care, home care, and primary care settings in Ontario were provided with mobile devices to use over a 12-month period. The nurses were given several online text-based resources that could be accessed using mobile devices, but were not restricted to these resources. Pre and post surveys investigated the impact of providing nurses with mobile devices and resources to access information. Findings revealed that the mobile devices provided access to information resources that assisted in clinical practice, positively impacted care, and supported the learning needs of the nurses. The mobile devices were also considered to "have the potential to improve research

utilization in nursing practice leading to improvements in the quality of patient care and nurses' job satisfaction" (Doran, Haynes, Kushniruk, et al., 2010, p. 14). This study illustrated the utility of mobile devices as a tool for information acquisition and informal learning in the healthcare workplace that can lead to improved nursing practice and quality of patient care. As such, it served to motivate the dissertation research reported herein.

Another recent Canadian study examined the use of PDAs and tablet personal computers for nurses as a means to access evidence-based resources at the point-of-care (Doran, Haynes, Estabrooks et al., 2010). Data collection took place in 24 hospitals, long-term care (LTC) facilities, and community organizations (public health units and home care nursing providers) in Ontario and included 728 respondents to a baseline questionnaire and 504 participants in follow-up questionnaires and interviews or reviews of reflective journals. The majority of the participants (60%) were diploma-prepared nurses. Major findings included that "almost 53% of the nurses used a PDA or tablet at least once every few days or more often, with nurses in community (64.8%) and hospital (54.5%) using the devices more frequently than nurses in LTC (36%)" (p. 4). The researchers concluded that the use of mobile devices for accessing information resources supported the learning needs of the nurses and improved job satisfaction significantly over time. The results of this study bode well for further investigation of informal learning of RNs with mobile devices in the healthcare workplace.

Summary

The theoretical framework of this dissertation research study is eclectic drawing on selected theories of informal learning and workplace learning in addition to aligning with the constructivist lens. Workplace learning was described in terms of continuing professional education and human resource development; informal learning in terms of learning occurring outside of the classroom or training venue which does not follow the prescribed framework of a formally constituted educational program. Informal learning also includes self-directed, incidental, and tacit forms of learning. Using mobile devices as learning tools, knowledge may be constructed individually as in cognitive constructivism or collaboratively as per the perspectives of socio-constructivism.

In Canada, the healthcare workplace has undergone continuous restructuring, creating challenges for those who work within it. For RNs, as members of a self-regulated profession, the healthcare workplace often presents difficulties and constraints for accessing learning opportunities for professional development and maintaining competency.

Most learning in the workplace is informal learning (Cross, 2007). This mode of learning offers a promising alternative to formal education and training in the work environment. However, there is a paucity of literature on informal learning in the workplace. More specifically, there are gaps and limitations in the literature on informal learning of RNs using mobile devices in the healthcare workplace.

In this context, mobile devices can enhance the timely access to information resources for construction of knowledge and meaning making. The use of mobile

devices can support and enhance informal learning in the workplace now and into the future. When used for informal learning, mobile devices provide RNs with another means to meet their ongoing needs for continuing professional education, professional development, and continuing competence in the complex healthcare workplace.

CHAPTER 3

METHODOLOGY

This chapter discusses the methodology for the mixed methods study of informal learning of RNs using mobile devices in the healthcare workplace including the rationale for the selection of the sequential explanatory research design. The chapter reviews the purpose and study questions, and then provides an overview of the population and sampling, instrumentation, and methods of data collection and analysis. A discussion of ethical considerations concludes the chapter.

Study Purpose and Research Questions

As set out in Chapter 1, the purpose of this research study was to contribute to the body of research on how RNs engage in informal learning using mobile devices in the healthcare workplace. The study relates to unstudied and understudied areas; therefore, the research was considered exploratory in nature. As Mauch and Park (2003) suggest, exploratory research attempts to investigate "new or relatively unknown territory for the purpose of searching out and closely scrutinizing objects or phenomena to lead to a better understanding of them" (p. 129). Based on the purpose of this study, the main research questions were as follows:

1. What informal learning strategies or processes do RNs engage in when using mobile devices in the healthcare workplace?
2. For what purposes do RNs employ informal learning strategies or processes using mobile devices in the healthcare workplace?
3. Are there differences between how RNs use individual and collaborative modes of informal learning with mobile devices in the healthcare workplace?

4. Is there a relationship between the age of RNs and their use of mobile devices for informal learning in the healthcare workplace?

The research questions were drawn from the theory on informal learning. Informal learning can be intentional and conscious in nature where the learner engages in strategies that lead to "self-directed learning, networking, coaching, mentoring, and performance planning that includes opportunities to review learning need" (Marsick & Watkins, 2001, pp. 25–26). Informal learning also includes incidental learning that is unintentional, where the learner becomes conscious that something has been learned "through a process of retrospective recognition that is either internally generated or externally led" (Schugurensky, 2000, p. 6). Incidental learning may occur from learning from mistakes, or the unsystematic process of trial and error (Marsick & Watkins, 2001). Hence, the first research question explored these learning strategies or processes that RNs engage in when using mobile devices in the healthcare workplace.

The second research question explored the purposes for or reasons why RNs employ informal learning strategies using mobile devices in the healthcare workplace. Marsick and Volpe (1999) describe informal learning as integrated with work and daily routines and involving an inductive process of reflection and action that is often linked to the learning of others; informal learning may be driven internally or triggered externally from the environment. As Marsick and Watkins (2001) indicate "informal and incidental learning occurs wherever people have the motivation, need, and opportunity for learning" (p. 28).

The third research question addressed the independent variables of mode of learning (individual versus collaborative) in relation to the strategies or processes, and purposes of informal learning of RNs using their mobile devices in the healthcare workplace. Informal learning can be at the individual level that involves only one person, or connected to others as in communities of practice where several individuals interact around common interests and provide support, structure, and incentives (Marsick & Volpe, 1999).

The last research question considered the demographic characteristic of age in relation to the use of mobile devices by RNs for informal learning in the healthcare workplace. Lohman (2009) states that "the importance of informal learning in cultivating professional expertise focuses greater attention on the interplay between informal learning activities, the environment where they occur, and characteristics of those engaged in them" (p. 44). As discussed in the literature review, the age of the learner may have an influence on informal learning (Berg & Chyung, 2008; Livingstone, 2000).

Research Design

To answer the research questions, a mixed methods approach was selected combining quantitative and qualitative methods focusing on the depth and breadth of the data (Teddlie & Tashakkori, 2009). In mixed methods research "the investigator collects and analyses data, integrates the findings and draws inferences using both qualitative and quantitative approaches or methods in a single study" (Tashakkori & Creswell, 2007, p. 4). As Greene (2007) argues, a mixed methods approach aims for better understanding as it capitalizes on the inherent methods' strengths. Furthermore,

Sale, Lohfed, and Brazil (2002) indicate that mixed methods approaches are useful in research areas investigating complex phenomena such as informal learning and mobile devices that requires data from a range of approaches.

In mixed methods research, the philosophical underpinning is pragmatism that "opens the door to multiple methods, different world views, and different assumptions, as well as different forms of data collection and analysis" (Creswell, 2009, p. 11). Pragmatism is not based on a particular ontological or epistemological stance; rather, it focuses on finding the most appropriate methods to answer the research questions and derive knowledge about a specific problem (Creswell, 2009; Doyle, Brady, & Byrne, 2009). As Creswell notes, pragmatism is not committed to a predetermined view of what reality or knowledge is. Consequently, the researcher may, as appropriate, draw from both quantitative and qualitative assumptions and is free to choose the methods that best meet the research purpose for the investigation. Therefore, this mixed methods inquiry is a single exploratory study that was conceptualized as a continuum using quantitative and qualitative strategies where the data converses with each other rather than two segregated research projects.

Based on the main benefits of mixed methods approaches discussed by Doyle et al. (2009) , the rationales for undertaking this mixed methods study were as follows:

- to employ a greater repertoire of tools for answering the research questions and meeting the purpose of the study;
- to combine quantitative and qualitative approaches for a more complete and comprehensive picture of the study phenomenon;

- to enhance explanation of the findings generated from one research approach using another research approach i.e., quantitative findings being further explained with qualitative findings;
- to illustrate the quantitative findings using a qualitative approach to help portray the study phenomena under investigation;
- to support stronger inferences and greater validity building on the complementary strengths of a mixed methods approach thereby offsetting the weaknesses specific to either quantitative or qualitative approaches alone.

Sequential explanatory design.

The methodological approach of a research study shapes the design of the investigation (Creswell, 2007). For the mixed methods study on the informal learning of RNs using mobile devices in the healthcare workplace, a sequential explanatory design was selected. This design incorporates two distinct sequential phases: quantitative followed by qualitative (Ivankova, Creswell, & Stick, 2006). Sequential phases are used in mixed methods research when the investigator "seeks to elaborate on or expand the findings of one method with another method" (Creswell, 2009, p. 14).

In this study, the sequential explanatory strategy began with the quantitative phase where numeric data were collected and analyzed first, followed by the collection and analysis of text data in the qualitative phase. Based on the research questions, the quantitative data from an online survey identified demographic information, as well as strategies, processes, purposes, and individual/collaborative modes of informal learning of RNs who used mobile devices in the healthcare

workplace. Based on the online survey responses, purposive sampling for the qualitative phase occurred. The qualitative phase gathered data from interviewees for further explanation of the quantitative findings. Doyle et al. (2009) suggest that this sequential strategy is "particularly useful when unanticipated or unusual findings emerge. For example, findings from a quantitative survey can be followed up and explained by conducting interviews with a sample of those surveyed to gain an understanding of the findings obtained" (p. 179).

Integration of the quantitative and qualitative findings occurred during the last phase of analyses in this study. As suggested by Teddlie and Tashakkori (2009), qualitative data obtained from the semi-structured interviews can either confirm or disconfirm the quantitative findings and provide further explanations of the results.

Furthermore, in the sequential explanatory process, the quantitative and qualitative phases are connected and results integrated (Ivankova et al., 2006). In this mixed methods research study, the quantitative and qualitative phases were connected and results integrated in the following stages:

- design stage --the four research questions were devised to collect both quantitative and qualitative data;
- intermediate stage -- the quantitative results informed the purposive sampling and interview questions;
- outcome stage -- quantitative and qualitative findings were integrated.

Although the phases were connected and results integrated, priority was given to the quantitative approach in this mixed methods study. As indicated by Ivankova et al., priority or more weighting is typically on the quantitative approach in the sequential

explanatory design as the numeric data is collected first representing the major aspect of the mixed methods data collection process. Bazeley (2004) states:

> with any research, validity stems more from the appropriateness, thoroughness and effectiveness with which those methods are applied and the care given to thoughtful weighing of the evidence than from the application of a particular set of rules or adherence to an established tradition (p. 154).

Moreover, this mixed, sequential explanatory research design combined methodological breadth informed by theoretical rigour for constructing understanding and meaning of the study phenomena.

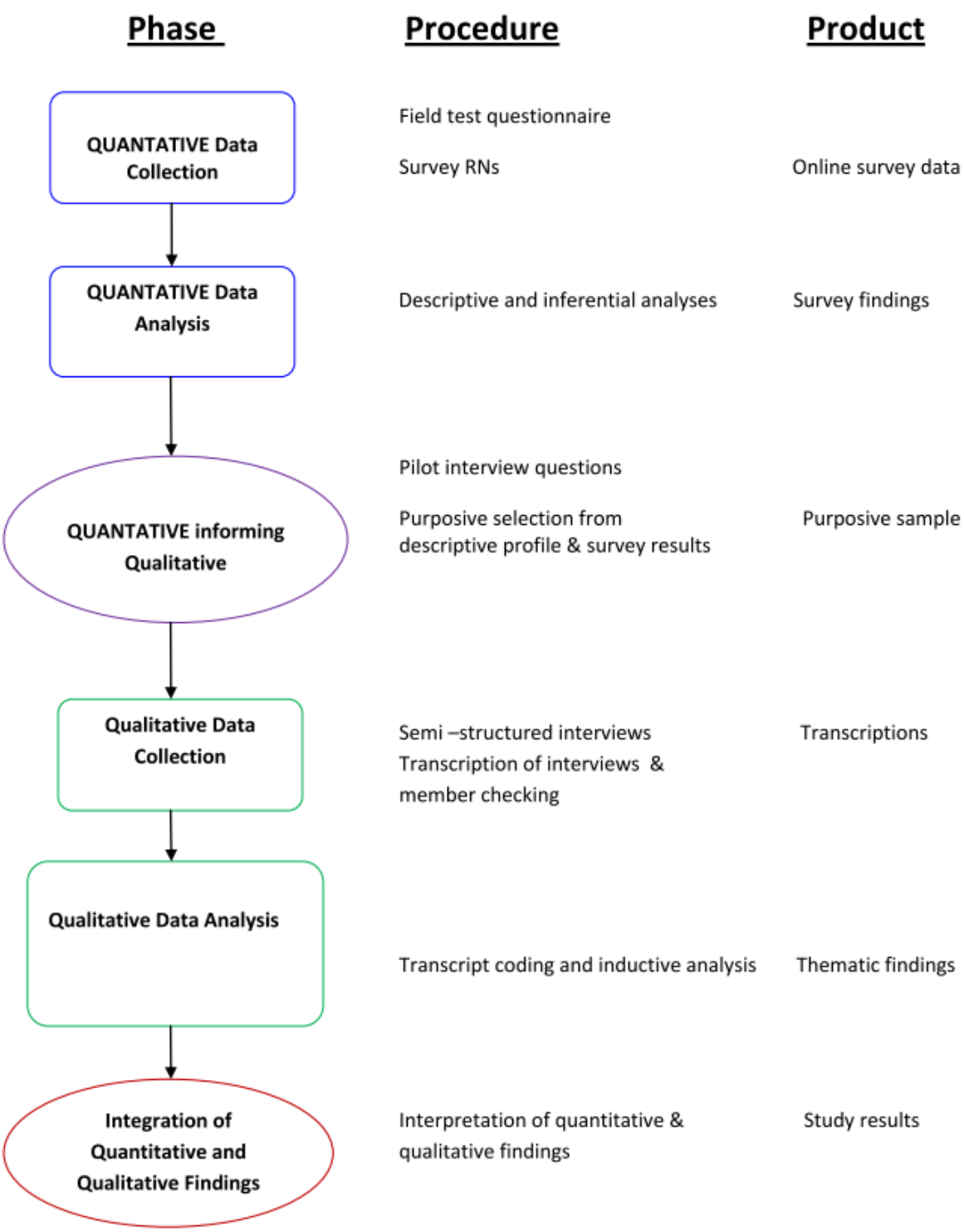

Figure 3. Study phases, procedures, and products.

Research Population and Sampling

The population for this mixed methods study was composed of practicing and regulated RNs who used mobile devices in their healthcare workplaces. Additionally, these diploma-prepared RNs were enrolled in a Bachelor of Nursing program at a single-mode distance university in Western Canada. Approximately 1450 RNs were registered in this program at the time of the study. The nursing program did not require RNs to use mobile devices in any of the courses.

Sampling strategy for survey.

Practicing RNs, who were also registered in the Bachelor of Nursing program, were recruited to participate in the online survey on informal learning for RNs using mobile devices in the healthcare workplace (see Appendix A). In order to improve response rates with online surveys, Solomon (2001) advocates using personalized emails and follow-up emails with recruitment. Following these recommendations, an email was sent to 1453 RNs in this program inviting those who used mobile devices in their healthcare work settings to complete the online survey (see Appendix B). A follow-up reminder for participation in the study was emailed three weeks later (see Appendix C). There were no returned emails from either of these mail-outs.

Quota sampling.

Quota sampling was used to ensure sufficient numbers of participants to address each of the research questions. As the proportions of RNs using mobile devices for informal learning in the wider population were unknown, the quota sampling scheme was non-proportional. This sampling strategy does not produce a

representative sample; rather, the goal is to conduct a detailed analysis of small groups (Daniel, 2011).

Prior to the survey data collection, the minimum sample size for the online survey was calculated to be 53 participants. Due to a lack of literature on informal learning of RNs using mobile devices in the healthcare workplace for comparison, the minimum sample size was based on the following assumptions:

- enrollment of approximately 1,000 RNs in the online Bachelor of Nursing program;
- estimated maximum sample size of 530 respondents (based on the findings of Doran, Haynes, Estabrooks, et al. (2010) that approximately 53% of the Canadian nurses in their study used a mobile device at least once every few days in the healthcare workplace);
- 50% of the potential participants would access the online survey;
- 20% online survey response rate.

Given the above assumptions, the calculation of the minimum sample size for the online survey was as follows: 1000 x 53% = 530; 530 x 50% = 265; 265 x 20% = 53 participants.

A quota sample of at least 15 participants self-reporting that they used collaborative modes of informal learning (e.g., talk with or e-mail others, interact in online community of practice) was also set. Cohen et al.(2007) advocate that a sample size of 30 is the minimum number of cases required for statistical analysis. Therefore, for the modes of informal learning, the quota sample of at least 15 participants using collaborative modes of informal learning, combined with the

respondents using individual modes would yield a number of cases surpassing 30 for statistical analysis.

Quota sampling was also used to obtain at least 15 respondents for each of the age-generational categories of Generation Y, Generation X, and Baby Boomers. Once again, the number of cases determined for the combined age-generational categories was set to exceed 30 to allow a sufficient number for statistical analysis. All of the quotas were met for the collaborative modes and age-generational categories. The rationale for the selection of variables requiring a quota sampling strategy is provided below.

Quota sampling was not used for educational level, gender, or occupational classification. As the population for this mixed methods research study was composed of diploma-prepared RNs, there was little variation in education levels for comparison. Furthermore, previous studies have found that highest level of education attained does not affect engagement in informal learning in the workplace (Berg & Chyung, 2008; Livingstone, 2000); these studies also found the same lack of effect for gender. In addition, Livingstone and Scholtz (2006) found relatively high participation rates with informal learning across all occupation levels, but slightly less participation with informal learning in lower occupational classes. Therefore, quota sampling was not considered necessary to ensure representation of these three variables.

On the other hand, the Clough et al. (2008) study found that 28% of students engaged in informal learning used mobile devices for collaborative knowledge construction and knowledge transformation. Therefore, to address the research

question on collaborative and individual modes of informal learning, a minimum quota of 15 respondents using collaborative modes of informal learning with mobile devices was set.

As discussed in Chapter 2, Livingstone (2000) conducted the Canada-wide survey of New Approaches to Lifelong Learning (NALL). The findings of this study indicated that Canadian adults under the age of 24 years spent significantly more time in informal learning activities than older adults, but that no differences were found between adults approaching/entering retirement and middle-aged adults. Subsequently, it was believed that age may have an influence on informal learning using mobile devices. Therefore, to address the research question on relationship between the age of RNs and their use of mobile devices for informal learning, a minimum quota of 15 respondents from each age-generational category was set.

Selection strategy for interviews.

For the semi-structured interviews, a multi-stage purposive sampling scheme was used to obtain a highly diverse set of participants. This purposive selection was "based on the assumption that the investigator wants to discover, understand, and gain insight and therefore must select a sample from which the most can be learned" (Merriam, 2004, p. 77).

The purposive sampling strategy was not rigid. Rather, as Reviere (1996) recommends, the sampling design provided "the flexibility to develop more refined sampling criteria as the study progresses . . . as long as such changes can be justified in relation to an unfolding understanding of the important characteristics or dimensions of the situation (p. 57). To form the qualitative sample, criterion

sampling first sought participants who self-reported on the online survey frequent use of their mobile devices for the individual and collaborative strategies/processes and purposes of informal learning in the healthcare workplace. From this criterion sample, participants were then selected using maximum variation sampling from the different age-generation categories (Generation Y, Generation X, and Baby Boomers), gender, location (population centre versus rural area and province/territory), work setting, occupational position, years employed as a RN, type of mobile device used, and length of mobile device usage. Furthermore, an outlier case from the quantitative findings was also included in order to obtain as diverse a sample as possible "to ensure strength and richness to the data, their applicability and their interpretation" (Cohen et al., 2007, p. 115) .

In qualitative research, there are no rules or specific criteria for sample sizes (Polit & Beck, 2004). Initially, a minimum of six (6) participants was sought for the purposive sample of this mixed methods study. However, in order to obtain rich data and achieve maximum variation, ten (10) participants were purposively sampled and interviewed.

Instrumentation

Data were collected from the participants using an online survey and semi-structured interview questions. Both of these data collection methods operationalized the research questions.

Online survey.

The online survey collected cross-sectional data at one point in time to gain understanding on informal learning of RNs using mobile devices in the healthcare

workplace. A search of the literature revealed no validated questionnaires or potential combination of validated questionnaires that specifically addressed each of the four dissertation research study questions. Consequently, a survey was developed for this dissertation research study (see Appendix A). The specific questions on informal learning strategies and processes in this questionnaire were created based on the Lohman (2005) and the Berg and Chyung (2008) studies.

The questionnaire had three sections for gathering data: demographic information of the respondents, mobile device usage, and modes of learning. Based on the recommendations of Cohen et al. (2007), the sections in this questionnaire were sequenced from general questions that established the mind set to more specific questions, and from objective facts to more subjective impressions or opinions.

The first section on demographic characteristics gathered data to obtain a descriptive profile of the participating RNs, including age, gender, education, location, work setting, length of employment, and occupational role/position. This section incorporated fill-in-the-blank and multiple-choice questions that prescribed a range of responses of demographic data within the sample. The demographics data operationalized the research question on age.

The second section of the questionnaire included fill-in-the-blank and multiple-choice questions to gather data on the different types of mobile devices used in the healthcare workplace, length of this use, and mobile device activities. With the mobile device activities, selections not related to informal learning were included in order to obtain the breadth of use of the devices. The last question on the usual reaction to new technologies collected data on the study participants' perceptions of

their technological receptiveness in the healthcare workplace for ascertaining possible limitations in this dissertation study.

The final section on modes of learning gathered data on strategies and processes for formal learning, informal learning, and informal learning using mobile devices. This section incorporated a four-point Likert rating scale providing a range of responses, i.e., never, sometimes, often, and always. Cohen et al. (2007) indicate that rating scales are more sensitive and have greater differentiation than closed and multiple-choice questions.

The questions on modes of learning were sequenced from formal learning modes to informal learning, and then more specifically to informal learning using mobile devices. The increasingly narrow streaming was used to reduce potential ambiguities by differentiating the modes of learning.

The last part of the section on modes of learning related to informal learning and the use of mobile devices operationalized the following research questions:

1. What informal learning strategies or processes do RNs engage in when using mobile devices in the healthcare workplace?
2. For what purposes do RNs employ informal learning strategies or processes using mobile devices in the healthcare workplace?
3. Are there differences between how RNs use individual and collaborative modes of informal learning with mobile devices in the healthcare workplace?

This part of the questionnaire explored the informal learning strategies or processes that RNs engage in when using mobile devices in the healthcare workplace. It also collected data on individual and collaborative modes of informal learning. The last

question in this section captured data on the specific purposes for which RNs employed informal learning strategies or processes using mobile devices in the healthcare workplace.

In questionnaires, self-reported data is subject to the risk of response biases (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). Study participants may under-report behaviors that might be considered inappropriate by a researcher or over-report behaviors that would be viewed as appropriate (Donaldson & Grant-Vallone, 2002). As suggested by Podsakoff et al. (2003), the participants in this dissertation study were informed that their participation in the online survey was anonymous and confidential to reduce potential response biases (see Appendix D).

Prior to use with the research participants, the questionnaire was field tested for content and face validity with a group of four RNs who used mobile devices regularly for informal learning in their healthcare workplaces in order to obtain feedback on the following:

- clarity, errors, readability, impartiality, appropriateness of the type and format of questions;
- operationalization of the research questions; and
- time required to complete the questionnaire.

Revisions to the questionnaire were made based on feedback from field testing. The online survey tool LimeSurvey© was used to convert the questionnaire into an online survey. Additionally, an online voluntary consent was built into the survey (see Appendix D). As a token of appreciation for completing the online survey, respondents had the option of participating in a draw for an iPad®. Additionally, the

participants in the semi-structured interviews were offered a $40 retailer gift certificate to honor their time and effort as well as the value they lent to the study. According to Cohen et al. (2007), "incentives may be useful in reducing dropouts, ensuring that respondents continue an online survey to completion (up to twice as likely to ensure completion) and… that they may be useful if intrinsic motivation is insufficient to guarantee completion" (p. 239). As discussed in the literature review in Chapter 2, the demanding healthcare workplace creates challenges for RNs for work-life balance. Hence, the tokens of appreciation showed the participants that their time participating in this study was valued.

Semi-structured interviews.

The data obtained from the online survey informed the questions of the semi-structured interviews. The semi-structured interview questions operationalized the research questions by providing additional data from the participants for further understanding of the phenomena (see Appendix E). The series of open-ended questions allowed for further probing for more depth and greater clarity of understanding.

To ensure clarity, appropriateness, and operationalization of the research questions, the semi-structured interview questions were piloted by four RNs who used mobile devices regularly for informal learning in the healthcare workplace. Revisions were made accordingly, based on their feedback.

The semi-structured interviews were conducted over the telephone at no cost to the interviewee and digitally recorded for later transcription. Prior consent for digital recording and transcription was obtained (see Appendix F). Interview

recordings were transcribed by the researcher and the informant's identifying information was removed. Using member checking, the interviewees were sent a written copy of their respective recording transcription for respondent feedback, validation, and to verify accuracy of the content prior to analysis. All interviewees confirmed accuracy of the transcripts; one interviewee added additional comments to the transcript.

Data Analysis

In this study, the data obtained from the quantitative online surveys and qualitative semi-structured interviews were analyzed in three steps.

First, descriptive and non-parametric statistics were obtained from the data gathered from the online surveys. Descriptive analysis does not make any predictions or inferences, but rather describes and synthesizes the data to provide organization and give meaning (Cohen et al., 2007). Inferential statistical analysis was performed on the non-parametric or distribution-free nominal and ordinal data collected in the online surveys (Munro, 2005; Cohen et al., 2007). SPSS® statistical data and predictive analytics software reduced the survey data into manageable proportions for summarization and description of characteristics to gain understanding of the study variables (LoBiondo-Wood & Haber, 2005). The findings of the descriptive and inferential analysis are included in the quantitative results in Chapter 4.

Second, analysis of the transcripts from the semi-structured interviews reduced the data into codes to determine emerging themes for further interpretation and explanation of the study phenomena based on the research questions. This

inductive analysis was performed using ATLAS.ti®. Details of the analysis are provided in qualitative results in Chapter 5.

Third, the findings from the quantitative and qualitative analyses were inductively integrated. Quantitative data from the online survey were integrated with the data from the qualitative semi-structured interviews in order to obtain greater depth and breadth of understanding of the study phenomena. Findings of the integrated analysis are included in Chapter 6.

Ensuring Trustworthiness

With quantitative research, validity and reliability are improved by careful sampling, appropriate instrumentation and statistical treatment of the data, and replication of the same methods and sampling (Cohen et al., 2007). Although the concepts of validity and reliability cannot be addressed in the same way in qualitative research, measures can be taken to ensure trustworthiness of the qualitative findings (Shenton, 2004).

In both quantitative and qualitative research, rigor is associated with truth value, applicability, consistency, and neutrality (Guba, 1981). Guba posits that these four factors align with the four criteria of trustworthiness of qualitative research: credibility, transferability, dependability, and confirmability. Each criterion was considered in this mixed methods study on informal learning of RN using mobile devices in the healthcare workplace for demonstrating rigor and ensuring trustworthiness of the qualitative findings. As Morse, Barrett, Mayan, Olson, and Spiers (2002) argue, "without rigor, research is worthless, becomes fiction, and loses its utility" (p. 14).

Credibility.

Credibility refers to adequate representation of the phenomenon under study so that there is confidence that the findings and conclusions are truthful (Lincoln & Guba, 1985). Guba (1981) equates the significance of credibility to the positivist's scientific equivalent of internal validity where the test measures what is actually intended. In this study on the informal learning of RNs using mobile devices in the healthcare workplace, the following strategies promoted the credibility of the findings and conclusions:

- Triangulation of the data sources included the sampling of a diverse range of informants who used mobile devices for informal learning in their work settings and also an outlier. This individual used a mobile device in the healthcare workplace, but not for informal learning. Negative cases "that disconfirmed the researcher's expectations and tentative explanation" (Johnson, 1997, p. 283) of the study phenomena were not explored. The sequential explanatory research design of this mixed methods study sought RNs who used their mobile devices frequently for informal learning in their work settings to provide confirming rather than disconfirming evidence.
- Member checking of the transcripts by the respondents for feedback, validation, and verification of accuracy of the content prior to analysis.
- Scrutiny of the research through peer debriefing and challenges to the researcher's assumptions by colleagues, peers, and academic faculty.
- Incorporation of strategies to promote honesty and reduce bias. These strategies included informing participants that all information would be kept

strictly confidential, identifying information would be removed, and pseudonyms would be used. Participants could refuse to answer any questions and/or withdraw from the interviews at any time without prejudice or academic penalty and their collected interview data would be removed from the study. Additionally, to avoid selection bias, entire transcripts from all of the informants were included in the qualitative analysis rather than selections of a portion of the transcripts.

- As advised by Shenton (2004), the researcher frequently consulted her doctoral committee in order to widen the vision of the investigator, discuss alternative approaches, test developing ideas and interpretations, recognize researchers' biases and preferences, and bring attention to potential flaws in the study.
- Thick descriptions of the phenomenon were provided, which contained the voices of the respondents and actual situations. As Shenton (2004) states, the reader is then able to assess the extent to which the overall findings "ring true."
- The researcher carefully monitored the effectiveness of the research study and discussed her critical reflections regularly with her supervisor.

Transferability.

Transferability refers to the extent to which a working hypothesis may be applied from one context to another (Guba, 1981). According to Guba, the researcher is not attempting to form generalizations, but rather to collect thick descriptions of the data that permit comparison from one context to another. In this study, background

information established the context of study and detailed descriptions of the phenomena were obtained to allow for comparisons.

Dependability and confirmability.

Dependability relates to the consistency between the data and the findings; whereas, confirmability relates to the results of the research being verified by others (Guba, 1981). Strategies used for dependability and confirmability in this dissertation research study included digital recording of the interviews, data analysis using ATLAS.ti®, memos, and methodological description including diagrams to demonstrate an "audit trail."

Ethical Considerations

Research participants in this dissertation study participated on a voluntary basis and were free to withdraw at any time with no negative consequences. All participants were required to provide consents in order to participate in the online survey and semi-structured interviews as explained on the consent forms (see Appendix D and Appendix F). Provisions around confidentiality and anonymity of the research participants were taken into account as stated on the consent forms.

All identifying information on the online surveys was removed by a research assistant to ensure that the personal identity of the respondents was not revealed. An optional, separate segment of the survey was used by the respondents for their names and e-mail addresses to volunteer for the interviews and/or to participate in the draw for the iPad®.

For the purposive sampling associated with the semi-structured interviews, only the participants who consented to the semi-structured interviews were

considered. Pseudonyms were used for the interviewees so their names were not associated with the responses. The interviews were transcribed by the researcher and the interviewees' identifying information was removed.

In addition to the security measures for maintaining privacy of the research participants, the Athabasca University server hosted the licensed version of LimeSurvey© thereby increasing security of data storage. The contact information of the researcher and research supervisor was made available for any questions, concerns, or complaints about the research procedures.

Prior to beginning the study, the research study was reviewed and approved by the Athabasca University Research Ethics Board (see Appendix G).

Chapter Summary

This chapter began by reviewing the purpose and research questions that guided the selection of a mixed methods study with sequential explanatory research design for the investigation of informal learning of RNs using mobile devices in the healthcare workplace.

An online survey questionnaire (see Appendix A) was developed as no validated questionnaires relevant to the research questions were found in a review of the literature. Field-testing of the questionnaire occurred prior to administration for content and face validity.

Quota sampling was used in order to obtain the minimum of 15 participants reporting collaborative modes of informal learning as well as at least 15 participants in each of the age-generational categories of Generation Y, Generation X, and Baby Boomers.

The questions for the semi-structured interviews were piloted and revised (see Appendix E) prior to conducting the telephone interviews. Of the online survey respondent volunteers, participants for the semi-structured interviews were selected using maximum variation purposive sampling. Purposive sampling continued until data saturation was achieved when no new data emerged in the interviews. Ten (10) participants were interviewed. The semi-structured interviews were digitally recorded and transcribed. Each transcription was member checked and validated by the interviewee.

Analysis of the study data included descriptive and inferential statistical analysis of survey data, inductive analysis of the semi-structured interview data, and integrated analysis of both datasets in order to gain an in-depth understanding and explanation of the study phenomena. Ensuring trustworthiness and ethical considerations were also addressed.

CHAPTER 4

QUANTITATIVE RESULTS AND DISCUSSION

This chapter presents the findings from the quantitative analysis of the descriptive and inferential statistics from the online survey. The chapter begins with a discussion of the survey response rates and then proceeds to present the findings. A summary of the quantitative findings concludes the chapter.

Response Rates

A total of 270 participants completed the online survey. In order to obtain high quality data for this dissertation research study, surveys that were considered unusable were eliminated from the sample resulting in 170 usable surveys and a response rate of 11.7%. This rate was considered satisfactory, as Cohen, Manion, and Morrison (2007) state that response rates for online surveys are typically lower than paper-based surveys and can be as "low as 10 percent or even lower" (p. 238). Sampling quotas were also reached. The minimum requirement of 15 participants reporting collaborative modes of informal learning was surpassed; only 22 respondents self-reported never using mobile devices for any of the collaborative modes of informal learning while 144 participants indicated using at least one of the collaborative modes. The quota of at least 15 participants in each of the age-generational categories was obtained; Generation Y = 22 participants, Generation X = 105 participants, and Baby Boomers = 38 participants; five participants did not self-report their age.

Unusable surveys removed from the sample included:

- 37 surveys that did not indicate the use of any mobile device;

- 26 surveys reporting the use of technological devices other than handheld mobile devices or devices that did not provide access to the Internet, i.e., personal computers, computer-on-wheels, laptops, older cell phones with no Internet capabilities;
- 35 surveys where the participants did not complete the two respective questions on informal learning using mobile devices: question 15 on the frequency of mobile device use for the informal learning strategies or processes, and question 16 on the purposes of informal learning using mobile devices (see Appendix A);
- two surveys considered outliers where the study participants self-reported never using mobile devices for any of the informal learning strategies, processes, or purposes.

Descriptive analysis provided a profile of the 170 participants and their mobile device usage. Furthermore, descriptive and inferential analyses examined the research questions on strategies and processes, purposes, individual and collaborative differences, and the relationship of generational-age for informal learning of RNs using mobile devices in the healthcare workplace.

Descriptive Profile

Data collected from the first two sections of the online survey (see Appendix A) provided demographic information to develop a descriptive profile of the 170 participants. In the following descriptive profile, demographic characteristics on age-generational categories, gender, education, location, work settings, length of

employment, and occupational positions are presented and compared to statistics on the Canadian workforce of RNs.

Age-generational categories.

Study participants ranged in age from 24 to 63 years. This age range encapsulates the three generational categories: Baby Boomers (born 1946 - 1965), Generation X (born 1966 - 1980), and Generation Y (born 1981 - 2000). No participants were from the Veteran's generation (1945 and earlier). The numbers of participants (n=165) in each generational category were:

- Generation Y - 22;
- Generation X - 105;
- Baby Boomers - 38.

The distribution of the age-generational categories is illustrated in Figure 4.

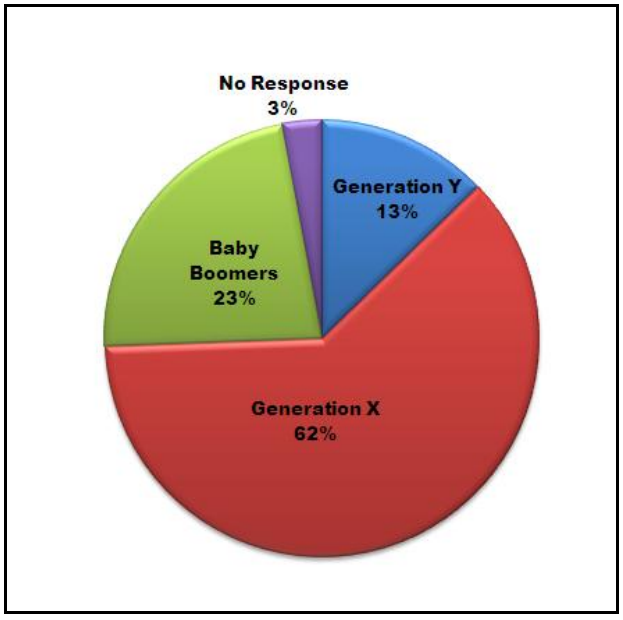

Figure 4. Distribution of age-generational categories.

As previously discussed in the literature review, the generational distribution of Canadian RNs in 2008 was Veterans - 2.7%; Baby Boomers - 51.5%; Generation X - 34.4%, and Generation Y - 11.4% (Canadian Nurses Association, 2010). Based on these statistics, the proportion of the study participants in Generation Y (13%) was similar to that of Canadian RNs (11.4%). However, the proportion of Generation X participants (62%) was higher than the Canadian RN average, and the proportion of Baby Boomer respondents (23%) was lower. As the population for this study was composed of RNs who were studying to obtain a bachelors degree, the distribution differences may be due to more RNs in Generation X undertaking formal education for career development, while the Baby Boomers may be focusing more on retirement (Canadian Federation of Nurses Unions, 2009).

Gender.

The participants in this study included 156 (91.8%) females and nine (5.2%) males with five (2.9%) participants not reporting their gender. This distribution is similar to the Canadian RN's gender distribution of 93.8% female and 6.2% males reported in 2009 (Canadian Federation of Nurses Unions, 2009).

Education.

As the sample for this investigation was composed of diploma-prepared RNs, there was minimal variation in education levels for comparison. For 148 participants (87.1%), the highest level of education was a nursing diploma. Twenty (11.8%) participants indicated the highest level of education as bachelor-prepared, and one (0.6%) respondent was master-prepared. One (0.6%) participant did not self-report on educational levels.

Employment location.

The province or territory where the study participants were employed as RNs is identified in the Table 1 below.

Table 1

Province or Territory of Employment

Province/Territory	Frequency	Percentage (n = 169)
British Columbia	9	5.3%
Alberta	40	23.5%
Saskatchewan	9	5.3%
Manitoba	12	7.1%
Ontario	57	33.5%
Quebec	15	8.8%
New Brunswick	5	2.9%
Nova Scotia	5	2.9%
Prince Edward Island	0	-
Newfoundland	9	5.3%
Northwest Territories	3	1.8%
Nunavut	2	1.2%
Yukon	0	-
Other	3	1.8%

Note. The category of "Other" includes respondents who work outside of Canada.

There were greater numbers of study participants from Alberta and Ontario with the lower numbers from Prince Edward Island and the territories. Similarly, at this university where the RNs were registered in the Bachelor of Nursing program,

there were more undergraduate students from Alberta and Ontario with the least number of students from Prince Edward Island and the Territories.

Only 37 (22%) of the participants reported working in rural locations, while 124 (73%) participants were employed in population centers, i.e., areas "with a population of at least 1,000 and a density of 400 or more people per square kilometre" (Statistics Canada, 2011). Nine participants (5%) did not self-report their workplace location as either rural or in a population centre. The proportion of respondents working in rural locations and population centres is illustrated in Figure 5 below.

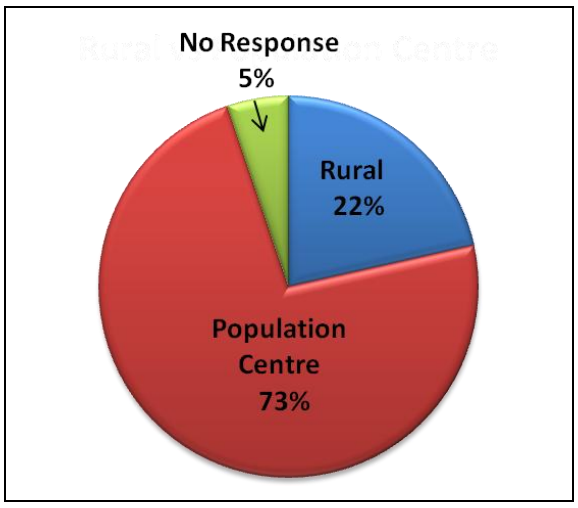

Figure 5. Distribution in rural and population centres.

The higher proportion of participants employed in population centres is reflective of the Canadian RN workforce. The CIHI (2010) reported that 89.3% of Canadian RNs were employed in urban communities while 10.7% were employed outside of urban areas in 2009.

Work settings.

In Canada, the work settings of RNs incorporate all publicly and privately funded sectors which have variable settings such as hospitals, long-term care facilities, community health settings, and other workplaces such as physicians' offices, private nursing agencies, educational institutions, governments, or associations where healthcare workers are employed or self-employed. Table 2 depicts the work settings profile of the participants in this dissertation study.

Table 2

Work Settings of Study Participants

Work Setting	Frequency	Percentage (n=170)
Hospital	103	60.6%
Public Health	7	4.1%
Community Health Agency	8	4.8%
Community Nursing Clinic	2	1.2%
Home Care Agency	10	5.9%
Education Institution	4	2.4%
Private Nursing Agency	1	0.6%
Business/Industry/Occupational Health	7	4.1%
Nursing Home/Long Term Care	7	4.1%
Mental Health Center	5	2.9%
Association/Government/Regional Office	9	5.3%
Primary Care	1	0.6%
Other	6	3.4%

Note. The category of "Other" included the following work settings: community hospice, provincial office, infection control, isolated mining camp, outpatient surgical clinic, and private infusion clinic.

In 2009, 62.6% of RNs in Canada worked in a hospital setting (CIHI, 2010). This proportion was comparable to that of participants (61%) working in hospitals (see Figure 6). There were also similarities between the percentages of Canadian RNs working in community health and the study participants. The CIHI (2010) defines community health to include "community health centre, home care agency,

nursing station (outpost or clinic) and public health department/unit" (p. 20). Based on this definition, the distribution of participants working in community health was 16% (combination of public health, community health agency, community nursing clinic, and home care agency categories). In 2009, the distribution for Canadian RNs working in community health was 14.2% (CIHI, 2010).

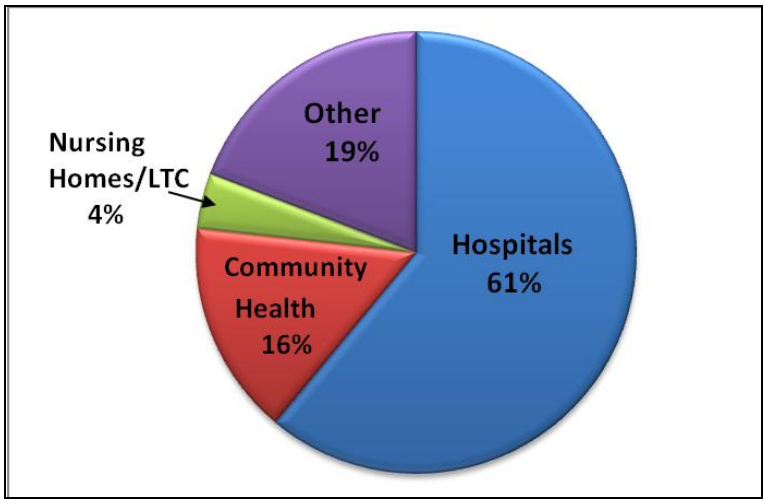

Figure 6. Work settings.

Length of employment.

For the year 2009, the CIHI (2010) reported the distribution of RNs' length of employment in the Canadian workforce as follows: 0 - 10 years - 25.1%; 11 - 20 years - 24.4%; 21 - 30 years - 24%; and 30+ years - 26.5%. Figure 7 displays the length of employment as RNs for the study participants.

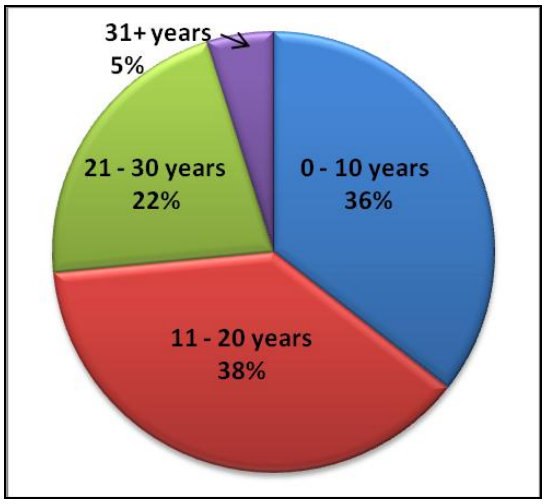

Figure 7. Years working as a RN.

Although there was little difference in the distribution of years of employment as Canadian RNs (each category had approximately one-quarter of the distribution), there was greater variability in the distribution within the study's sample including a lower proportion of study participants who had worked 31+ years as an RN.

Occupational position.

According to the Canadian Nurses Association (2011b), the two occupational positions in which the majority of Canadian RNs were employed in 2009 were staff/community health nurses (77.0%) and managers/assistant managers (5.2%). Similarly, in this dissertation research study, the two occupational positions with the largest number of participants were staff /community health nurses (55.3%) and managers/assistant managers (19.4%). The greater percentage of study participants in the positions of managers/assistant managers may be attributed to employers requiring RNs in managerial positions to obtain a baccalaureate degree. The occupational positions of the study participants are displayed in Table 3.

Table 3

Occupational Positions

Position	Frequency	Percentage (n = 169)
Staff/Community Health Nurse	94	55.31%
Manager/Assistant Manager	33	19.4%
Nurse Practitioner	1	0.6%
Clinical Nurse Specialist	3	1.8%
Chief Nursing Officer/Chief Executive Officer	2	1.2%
Consultant	4	2.4%
Director/Assistant Director	2	1.2%
Instructor/Professor/Educator	8	4.7%
Other	22	12.9%

Note. The category of "Other" includes positions such as clinic resource nurse, clinical coordinator, discharge planner, team leader, and care facilitator.

Mobile Device Usage

As the use of mobile devices in nursing practice in Canada is a relatively new phenomenon (Doran, Haynes, Kushniruk, et al., 2010), there is a lack of information on the types of mobile devices used, length of mobile device usage, and mobile activities of RNs in the Canadian healthcare workplace.

The participants in this dissertation research study used several different types of mobile devices, including PDAs, iPods, Smartphones, and iPad/tablets. Each of these mobile devices has different features, as shown in Table 4.

Table 4

Features of Different Mobile Devices

Features	PDA	iPod	Smartphone	iPad/Tablet
Email	√	iPod Touch only	√	√
SMS	√	iPod Touch only	√	-
Phone	-	-	√	-
MP3	√	iPods Touch only uses video	√	√
WiFi enabled	√	iPod Touch only	√	√
Camera	√	iPod Touch only	√	√
Bluetooth	√	iPod Touch only	√	√
Capacity	64 -128 MB	2-160 GB	1-64 GB	16-64 GB
Screen size	2.8 – 4 in	1.54 - 3.5 in	3.6 - 4.7 in	7 - 10.1 in
Weight	.33 - .41 lbs	.04 - .30 lbs	.25 - .41 lbs	0.9 - 1.6 lbs
Battery Life	4 - 6 hours	4 - 40 hours	5.5 - 10 hours	8-10 hours
Price	$100 & up + data plan	$150 & up + data plan	$0 & up + data plan	$500 & up + data plan
Sample Brands	Palm, HP	Nano iPod, Classic iPod, & iPod Touch	iPhone, Blackberry, & others	iPad, Playbook, TouchPad, Zoom & others

Note. Adapted from: Consumer Search (2012). *Compare PDAs.* Retrieved January 17,2012, from http://www.consumersearch.com/pda-reviews/compare
About com. (2012). *iPod Comparison Chart*. Retrieved January 17, 2012, from http://ipod.about.com/od/ipodcomparisonchart/a/ipod_comparison.htm
Smartphones: The Ultimate Comparison Chart (n.d.). Retrieved January 17, 2012, http://gpo.st/phones
Peirce, D. (2011, February). *Top tablet comparison: iPad vs. Xoom vs. Touchpad vs. Playbook.* Retrieved January 17, 2012, from http://www.pcmag.com/article2/0,2817,2380049,00.asp

The most common types of mobile devices used by the study participants were Smartphones, followed by PDAs, iPods, iPads, and other tablets (see Figure 8). The wide array of Smartphone features combined with its comparatively lower cost may have increased the popularity of this tool for informal learning amongst the participants in this dissertation research study.

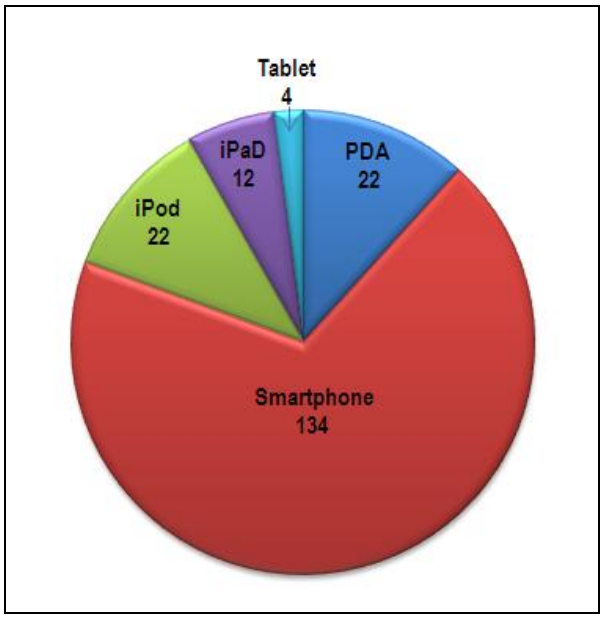

Figure 8. Types and number of mobile devices used.
Note: Some participants used more than one mobile device.

The largest proportion of study participants started using mobile devices in the past year, with progressively smaller proportions using them for longer periods. More than half of the participants (85 out 167) had used their mobile devices for less than two years. Figure 9 displays the length of time that participants used mobile devices in the healthcare workplace. The "newness" of mobile devices coupled with their emerging presence in nursing practice may attest to the increasing adoption of mobile devices in healthcare workplace over the past five years.

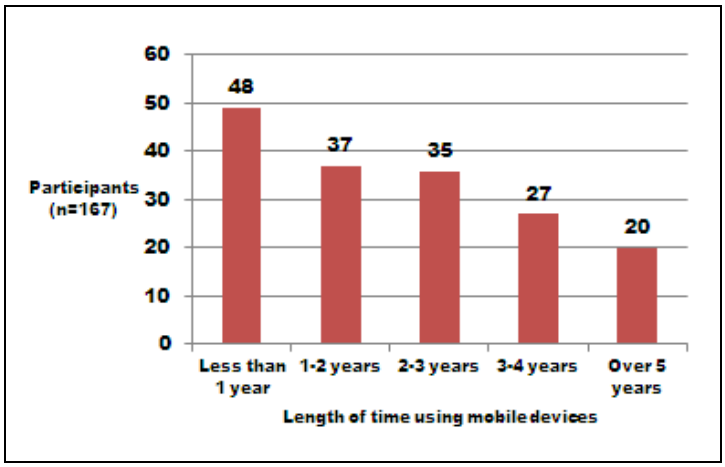

Figure 9. Length of mobile device use in the healthcare workplace.

Table 5 displays the participants' self-reported activities with their mobile device in the healthcare workplace. These activities do not include strategies or processes for informal learning using mobile devices; rather they represent the breadth of use of the devices.

Table 5

Mobile Device Activities

Activity	Frequency (n=170)
Making calculations	105
Documenting clinical practice	24
Accessing nursing support software	62
Downloading clinical reference materials	90
Email	119
Texting or Short Message Service (SMS)	89
Taking photos or videos	44
Instant Messaging	44
Other	20

Note. The category of "Other" includes activities such as calendar, translation, and phone calls.

Reaction to a new technology.

In order to determine the participants' receptiveness to innovations, respondents were asked to indicate their usual reaction to a new technology in the healthcare workplace. The distribution of responses (n = 168) was as follows:

- 74. 7% -- usually one of the first few nurses at work to try out a new technology;
- 21. 8% -- usually try out a new technology once they have seen other nurses at work use it successfully;
- 0. 6% -- will only use a new technology at work once they have seen many other nurses successfully use it;

- 1.8% -- usually one of the last nurses at work to use new technologies.

Based on Rogers' (2003) adoption categories, nearly 97% of the study participants perceived themselves to be innovators or early adopters in terms of their uptake of technologies in the healthcare workplace. As Kaminski (2011) described, these study participants could be considered the innovators and early adopters who are adventuresome, risk takers, visionaries, and/or trend setters in the diffusion of new technologies in the healthcare workplace. However, this finding also suggested that the study participants may be more receptive to new technological innovations including mobile devices than the general population of RNs, which was previously identified as a limitation of this dissertation study.

Strategies or Processes for Informal Learning using Mobile Devices

In the online survey, study participants were asked to rate the frequency of various strategies or processes used for informal learning using a four-point Likert rating scale ranging from never (1), sometimes (2), often (3), and always (4) for two data sets, when not using a mobile device and also when using a mobile device. In order to determine if there were statistically significant differences between the two data sets on strategies or processes used for informal learning, a Wilcoxon Signed-Ranks test was performed. A Wilcoxon Signed-Ranks is a non-parametric test designed to evaluate the differences between two related samples from the same population (Cohen et al., 2007). The Wilcoxon Signed-Ranks tested the differences between the mean rating of frequencies for the strategies and processes of informal learning using a mobile device (M = 22.21, SD = 6.49) and without using a mobile device (M = 31.37, SD = 5.15). The Wilcoxon Signed-Ranks analysis revealed

statistically significant differences at the 5% level (Z = -11.312, N = 170, p = .000) indicating that more study participants used the strategies and processes for informal learning without using a mobile device in the healthcare workplace. Such a finding is not surprising considering the uptake of mobile devices in nursing practice is still relatively new (Doran, Haynes, Kushniruk, et al., 2010), as previously discussed in the Chapter 2 literature review.

For informal learning of RNs using mobile devices in the healthcare workplace, Table 6 reports the frequency of use of the various strategies and processes.

Table 6

Frequency of Strategies/Processes of Informal Learning using a Mobile Device

Strategy/Process	M	n	SD	Median
Reflect on previous action and knowledge using notes, diary, or some other method using my mobile device	1.99	170	.926	2.00
Learn by trial and error	1.90	167	.896	2.00
View a video, webcast or podcast	2.15	163	.931	2.00
Search the Web (including the Intranet)	2.88	169	.867	3.00
Search an online database (e.g., Medline)	2.56	169	.956	3.00
Read books, magazines, and/or journals	2.18	168	.999	2.00
Observe others on the job such as photos	1.99	165	1.036	2.00
Talk on the phone with others	2.42	166	1.080	2.00
Interact with other people via e-mail	2.69	167	1.069	3.00
Ask questions in a professional listserv or online community	1.87	164	1.022	2.00

Note. Never = 1, Sometimes = 2, Often = 3, Always = 4. Analysis of the open ended question on strategies and processes for informal learning using mobile devices yielded no additional strategies or processes.

The most frequently self-reported used strategies or processes for informal learning using a mobile device were *searching the Web (including the Intranet), interacting with other people via e-mail,* and *searching an online database (e.g.*

Medline). The frequency of use for these strategies or processes was higher than the mid-way point of 2.5 between the ratings of "sometimes" and "often."

The least frequently self-reported used strategies or processes were *talking on the phone with others, viewing a video, webcast or podcast,* and *reading books, magazines, and/or journals.* These activities had a rating between 2.0 and 2.5. The least used strategy or process was *asking questions in a professional listserv or online community*.

Purposes of Informal Learning using Mobile Devices

In the online survey, the study participants were also asked to indicate the purposes for informal learning using a mobile device in the healthcare workplace. Table 7 reports the mean rating of the frequency of the purposes.

Table 7

Frequency of Purposes of Informal Learning using a Mobile Device

Purpose	M	SD	(N = 170)
New procedure/treatment	.48	.501	
Accessing resources for evidence based support	.62	.486	
Patient/client teaching	.44	.498	
Professional development	.61	.490	
Maintaining competency	.39	.490	

The most frequently selected purposes or reasons for engaging in informal learning using a mobile device were *accessing resources for evidence-based support* and

professional development, as seen in Table 7. The least frequent purpose for using a mobile device for informal learning was *maintaining competence.*

In order to investigate the differences in the purposes of informal learning using mobile devices in the healthcare workplace, a chi-square test was performed. A chi-square test "measures the difference between a statistically generated expected result and an actual result to see if there is any statistical difference" (Cohen et al., 2007, p. 525).

Chi-square analysis revealed statistically significant differences at the 5% level for the following purposes for the use of mobile devices for informal learning:

- accessing resources for evidence-based support (X^2 (1, N = 170) = 10.376, p = 0.001);
- professional development (X^2 (1, N = 170) = 7.624, p = 0.006);
- maintaining competency (X^2 (1, N = 170) =7.624, p = 0.006).

For the purposes of *accessing resources for evidence-based support* and *professional development*, significantly more participants than expected self-reported they were using mobile devices for informal learning in the healthcare workplace, as depicted in Table 8. Conversely, for the purpose of *maintaining competency*, significantly fewer participants than expected were using mobile devices for informal learning.

Table 8

Purposes of Informal Learning using Mobile Devices: Observed/Expected Findings

Purposes	Observed	Expected	(n=170)
Accessing resources for evidence-based support	106	85	
Professional development	103	85	
New procedure/treatment	81	85	
Patient/client teaching	75	85	
Maintaining competency	67	85	

Note. The open-ended question on purposes of informal learning using mobile devices yielded no additional reasons.

Individual and Collaborative Modes of Informal Learning using Mobile Devices

In order to determine if there were differences between individual and collaborative modes of informal learning using mobile devices in the healthcare workplace, the strategies or processes were separated into two categories. The following strategies or processes were considered to be individual modes of informal learning, whereby only one person participates in the activity:

- reflect on previous action and knowledge using notes, diary, or some other method using my mobile device;
- learn by trial and error;
- view a video, webcast or podcast;
- search the Web (including the Intranet);
- search an online database (e.g., Medline);
- read books, magazines, and/or journals;

- observe others on the job such as photos.

The remaining three processes were considered potentially collaborative modes of informal learning using mobile devices whereby interaction may occur with two or more persons participating in the activity:

- talking on the phone with others;
- interacting with others via emails;
- asking questions in a professional listserv or online community.

Study participants rated the frequency of use for each of the individual and colloborative strategies or processes using a four-point Likert rating scale ranging from never (1), sometimes (2), often (3), and always (4).

To investigate the differences among the distribution of responses (never, sometimes, often, and always) for the modes of informal learning, a Kruskal-Wallis test was used. The Kruskal-Wallis is a non-parametric test that measures the difference in three or more independent groups (Cohen et al., 2007). This test compared the mean ranks of the four groups of responses for the modes of informal learning. At the 5% significance level, the Kruskal-Wallis analysis revealed statistically significant differences for the distributions of responses (X^2 (3, N = 150) = 27.314, p = 0.000), and mean ranks: never = 59.52, often = 69.54, sometimes = 90.11, and always = 123.88.

On a scale of one to four, where one (1) was never and four (4) was always, on average, the collaborative modes (M = 2.33, SD = .885) were used slightly more frequently than the individual modes (M = 2.21, SD = .696) for informal learning

with mobile devices in the healthcare workplace. The distribution of responses is displayed in Table 9 below.

Table 9

Distribution of Responses for Individual and Collaborative Modes of Informal Learning using Mobile Devices

Responses	Individual Modes (n = 170)	Collaborative Modes (n = 169)
Never	28.3 %	30.8%
Sometimes	32.5%	25.2%
Often	26.6%	24.5%
Always	12.6%	19.5%

Reviewing the distribution, slightly more (59.1%) of the participants self-reported "sometimes" or "often" for the individual modes of informal learning using a mobile device, while the distribution of responses for the collaborative modes was somewhat more evenly distributed (as shown in Figure 10 and Figure 11).

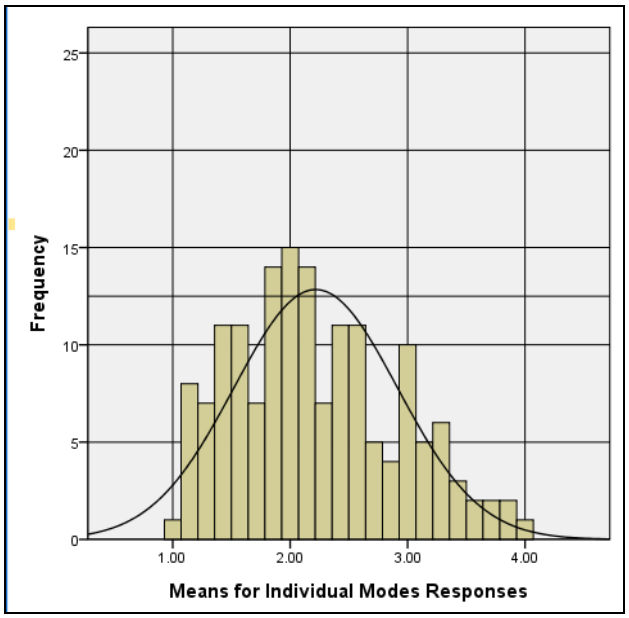

Figure 10. Histogram of means for individual mode responses. Never = 1.00, Sometimes = 2.00, Often = 3.00, Always = 4.00

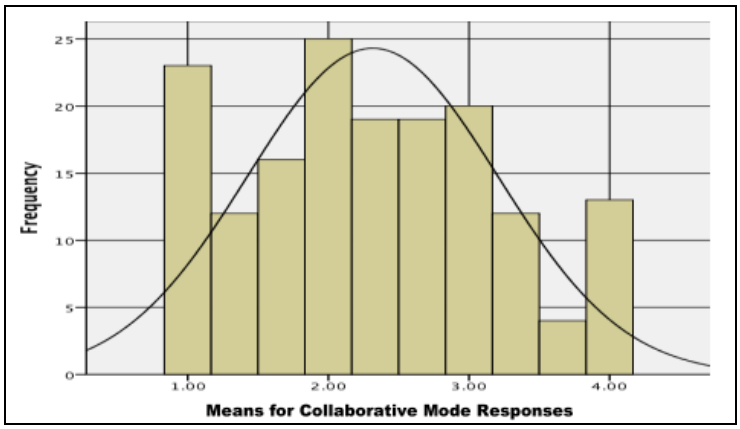

Figure 11. Histogram of means for collaborative mode responses. Never = 1.00, Sometimes = 2.00, Often = 3.00, Always = 4.00

In order to determine the differences between the individual or collaborative modes of informal learning and purposes, a Mann-Whitney U-test was used. This non-parametric test evaluates the differences between two independent samples (Cohen et al., 2007). As the study participants selected the purposes (nominal data) separately in the online survey, repeated Mann-Whitney U-tests measured the

differences in the individual modes with each of the purposes and also the colloborative modes with each of the purposes.

The Mann-Whitney U-tests revealed that only the purpose of professional development was not significantly different at the 5% significance level when the individual modes were used with mobile devices, as displayed in Table 10 below.

Table 10

Responses for Individual Modes and Purposes of Informal Learning using Mobile Devices

Purpose	Mann-Whitney U	Asymp. Sig (2-tailed)	Mean Ranks			
			Selected	n	Not selected	n
New procedure/ treatment	2264.5	.004	89.70	76	68.96	81
Accessing resources for evidence-based support	2154.5	.009	86.24	99	66.65	58
Patient/client teaching	2046.5	.000	92.97	73	66.86	84
Professional development	2365.5	.056	84.36	98	70.09	59
Maintaining competency	2112.0	.003	92.44	62	70.23	95

There were no significant differences for the purposes of informal learning at the 5% significance level when the colloborative modes were used with mobile devices, as illustrated in Table 11 below.

Table 11

Responses for Collaborative Modes and Purposes of Informal Learning using Mobile Devices

Purposes	Mann-Whitney U	Asymp. Sig (2-tailed)	Mean Ranks			
			Selected	n	Not selected	n
New procedure/ treatment	3204.50	.920	81.38	77	80.65	84
Accessing resources for evidence-based support	2826.50	.519	79.21	102	84.09	59
Patient/client teaching	2952.00	.388	77.50	72	83.83	89
Professional development	2625.50	.121	85.48	99	73.85	62
Maintaining competency	3045.00	.795	79.85	65	81.78	96

Age Generations and Use of Mobile Devices for Informal Learning

The data were analyzed to determine if there were differences among the three age-generation categories with regard to the strategies or processes of informal learning using mobile devices. A Kruskal-Wallis test revealed a statistically significant difference in the age - generational categories at the 5% significance level for the process of *interacting with other people via email* (X^2 (2, N = 162) = 7.689, p = 0.021) and mean ranks: Generation Y = 57.18 (n = 22), Generation X = 84.05 (n = 104), and Baby Boomers = 89.00 (n = 36). Generation Y participants tended to interact with other people via email significantly less often than Generation X and Baby Boomer participants.

For the purposes of informal learning using mobile devices, a Kruskal-Wallis test found significant differences in age-generational categories at the 5% significance level for the purpose of *professional development* (X^2 (2, N = 165) = 6.108, p = .047), which had the following mean ranks: Generation Y = 67.25 (n = 22), Generation X = 88.50 (n = 105), and Baby Boomers = 76.92 (n = 38). For the purpose of professional development, Generation Y participants used mobile devices for informal learning less than the Generation X or Baby Boomer participants.

Analysis of use of individual and collaborative modes of informal learning with a mobile device revealed opposite, but non-significant, findings for the age-generational categories. For the individual modes of informal learning using mobile devices, Generation Y had the highest usage, followed by Generation X, then Baby Boomers. Conversely, for collaborative modes of informal learning using mobile devices, Baby Boomers used the collaborative modes the most, then Generation X, and least by Generation Y, as seen in Table 12.

Table 12

Responses for Age Generations for Individual and Collaborative Modes of Informal Learning using Mobile Devices

Age Generation	Individual Modes		Collaborative Modes	
	Mean Rank	n	Mean Rank	n
Generation Y (30 years and below)	84.21	21	59.58	20
Generation X (31 – 46 years)	78.94	97	80.27	101
Baby Boomers (47 - 65 years)	67.30	35	84.20	35

A Kruskal-Wallis test revealed no statistically significant differences at the 5% significance level for the individual modes (X^2 (2, N = 153) = 2.431, p = .297) or collaborative modes (X^2 (2, N = 156) = 4.280, p = .118) among the three age-generational categories.

The age-generational categories and location (rural versus population centres) were also analyzed using a Kruskal-Wallis test. There was no statistical significant differences found at the 5% significance level for the age-generational categories and location (X^2 (2, N = 157) = 2.496, p = .287).

Chapter Summary

The quantitative findings from the descriptive and inferential analyses of the data from the online survey are summarized below.

- Based on the descriptive profile, the majority of RNs in this dissertation research study were females from Generation X who had been employed for more than 10 years as staff nurses in urban Canadian hospitals. This is similar

to the national norms of RNs reported in 2009 (Canadian Nurses Association, 2011b; CIHI, 2010). The RNs primarily used Smartphones in their workplaces, for less than two years. Nearly 97% of the RNs perceived themselves as being innovators or early adopters in terms of their mobile device use for informal learning in the healthcare workplace; a possible limitation of this mixed methods study.

- More study participants engaged in informal learning strategies or processes not involving mobile devices than strategies or processes using mobile devices.
- The strategy or process used most often for informal learning using a mobile device was *searching the Web (including the Intranet),* followed by *interacting with other people via e-mail*, and then *searching an online database (e.g. Medline).* The least frequently used process of the selections on the survey was *asking questions in a professional listserv or online community.*
- The most frequently reported purposes for engaging in informal learning using a mobile device were *accessing resources for evidence-based support* and *professional development.* The least frequently reported purpose was *maintaining competence*. These differences were statistically significant.
- Collaborative modes were used slightly more frequently than individual modes for informal learning with mobile devices in the healthcare workplace. For the individual modes, only the purpose of *professional development* was

not statistically significant. None of the purposes for the collaborative modes were statistically significant.

- For the age-generational categories, there were no statistically significant differences for informal learning using a mobile device except for the process of *interacting with other people via email* and the purpose of *professional development*. Generation Y participants self-reported using this process and purpose in the healthcare workplace significantly less than the Generation X and Baby Boomer participants.
- Generation Y participants used individual modes more frequently for informal learning, while Baby Boomer participants used more collaborative modes in the healthcare workplace; however, these differences were not statistically significant.
- The differences among the age-generational categories were not statistically significant for the use of individual and collaborative modes of informal learning or for location (rural areas vs. population centres).

CHAPTER 5

QUALITATIVE RESULTS AND DISCUSSION

The first part of this chapter describes the purposive selection of the interviewees and presents an overview of the qualitative sample. Next, the findings of the inductive analysis of the qualitative data corpus are presented and discussed. A summary of findings concludes the chapter.

Purposive Selection

Ten (10) participants for the semi-structured interviews were selected from the online survey responses using a multi-stage purposive sampling scheme. This approach enriched the investigation by simultaneously paralleling the quantitative effort while inviting and exploring diversity.

In the first stage, criterion sampling sought participants who self-reported using mobile devices frequently in their healthcare workplaces for the individual and collaborative informal learning strategies /processes and informal learning purposes. As shown in Table 13, the selected interviewees used a wide variety of strategies or processes for informal learning with their mobile devices. When asked to identify the strategies or processes they used for informal learning with their mobile device, their responses were more frequently in the "often" or "always" categories (59 responses) than in the "never" or "sometimes" categories (30 responses).

Table 13

Interviewees' Informal Learning Strategies or Processes

	Informal Learning Strategies or Processes										
	Reflect (n=9)	Trial & error (n=9)	View video (n=9)	Search Web (n=8)	Search database (n=9)	Read (n=9)	Observe (n=9)	Phone (n=9)	Email (n=9)	Online Comm. (n=9)	Total
Never	2	1	0	0	0	0	2	2	0	2	9
Sometimes	2	4	2	1	0	3	2	3	2	2	21
Often	5	3	5	6	7	5	4	2	4	4	45
Always	0	1	2	1	2	1	1	2	3	1	14

Note. Data from the outlier case is not included in this table.

However, the number of participants using a mobile device for each purpose of informal learning in the healthcare workplace was fairly evenly distributed in this sample.

Next, participants from the criterion sample were selected using a maximum variation approach in order to attain a diverse range of perspectives for the investigation related to age-generational category, gender, location (i.e., population centre versus rural, province or territory), work setting, occupational position, years employed as a RN, type and length mobile device use). Participant selection continued simultaneously with interviewing until no new information was obtained from the informants related to the research questions.

Lastly, an outlier from the quantitative sample was also purposively selected for the interviews in order to add strength and richness to the data. This particular RN self-reported on the online survey that she used a mobile device in her healthcare

workplace for only administrative purposes such as medication calculations, but did not use any of the strategies, processes, or purposes for informal learning using a mobile device.

The demographic profiles and mobile device use of the ten (10) interviewees purposively selected for this mixed methods study are displayed in Table 14.

Table 14

Interviewees' Demographic Profiles and Mobile Device Use

Name	Age Generation	Gender	Location	Work Setting	Occupation Position	Years as a RN	Mobile Device	Length of Use
Iris	Gen Y	Female	Population Centre Alberta	Long Term Care	Staff Nurse	6	Smart phone	1-2 years
Fay	Gen Y	Female	Population Centre Quebec	Private Clinic	Staff Nurse	3	Smart phone	4-12 months
Haley	Gen Y	Female	Population Centre Alberta	Hospital	Staff Nurse	8	Smart phone	4-12 months
Barb	Gen X	Female	Rural Manitoba	Hospital	Educator	14	iPod	2-3 years
David	Gen X	Male	Population Centre Ontario	Home Care	Community Nurse	-	Smart phone	over 5 years
Gail	Gen X	Female	Rural Northwest Territories	Hospital	Assistant Manager	20	Smart phone	less than 3 months
Jill*	Gen X	Female	Population Centre Saskatchewan	Hospital	Staff Nurse	17	Smart phone	4-12 months
Chuck	Baby Boomer	Male	Population Centre Ontario	Hospital	Staff Nurse	18	Smart phone & Tablet	1-2 years
Alice	Baby Boomer	Female	Rural Nunavut	Comm. Nursing Clinic	Manager	8	PDA	over 5 years
Emily	Baby Boomer	Female	Population Centre Alberta	Hospital	Staff Nurse	7	Smart Phone & iPad	3-5 years

Note. Pseudonyms were used to protect the participants' identity and maintain confidentiality. * Denotes the outlier case. Comm. = Community.

Qualitative Findings from Inductive Analysis

A total of ten (10) interviews were conducted by telephone and digitally recorded. The interviews ranged in length from 38 minutes to approximately one hour with the average length of time being approximately 46 minutes. The interview recordings were transcribed and identifying information was removed prior to inductive analysis.

The inductive analysis of the transcripts used ATLAS.ti® and involved an iterative process moving from general to more specific observations in the textual interview. This process condensed raw data and used inductive reasoning, by which categories and themes emerged from the data through careful examination and constant comparison (Zhang & Wildemuth, 2009). The steps involved to inductively analyze the qualitative data corpus were as follows:

1. As suggested by Creswell (2007), each interviewee's transcript was read multiple times to acquire a sense of the whole interview before breaking it into segments.
2. Codes were assigned from direct interpretation of the transcript sentences or phrases. The units of data were pulled apart and coded as topics, and checked "to prevent drifting into an idiosyncratic sense of what the codes mean" (Schilling, 2006, p. 33) prior to re-coding in more meaningful ways. After coding the entire data set, the coding consistency was re-checked. A total of 78 codes were generated based on the transcripts (see Appendix H).

3. Similarly coded data were aggregated into categories for the emergence of issue-relevant meanings based on the research questions. This process resulted in 26 categories (see Appendix I).
4. Patterns were established where there were similarities and consistency in two or more categories. Categories were re-grouped for consolidation of meaning into themes for further interpretation and explanation of the study phenomena.

As an outcome of the coding, categorization, and analytical reflection, five themes (termed "code families" in ATLAS.ti®) emerged:

1. self-directed informal learning using mobile devices;
2. individual and collaborative informal learning strategies or processes using mobile devices;
3. purposes of informal learning using mobile devices;
4. healthcare workplace-related influences on informal learning using mobile devices;
5. perceptions of informal learning using mobile devices (see Appendix J).

Theme 1: Self-directed informal learning using mobile devices.

Interviewees described their use of self-directed informal learning using their mobile devices in their healthcare workplaces in terms of the categories illustrated in Figure 12. The number of interviewees self-reporting data in each category is depicted in the parentheses, e.g., eight interviewees discussed new situations in which they used self-directed informal learning with their mobile devices.

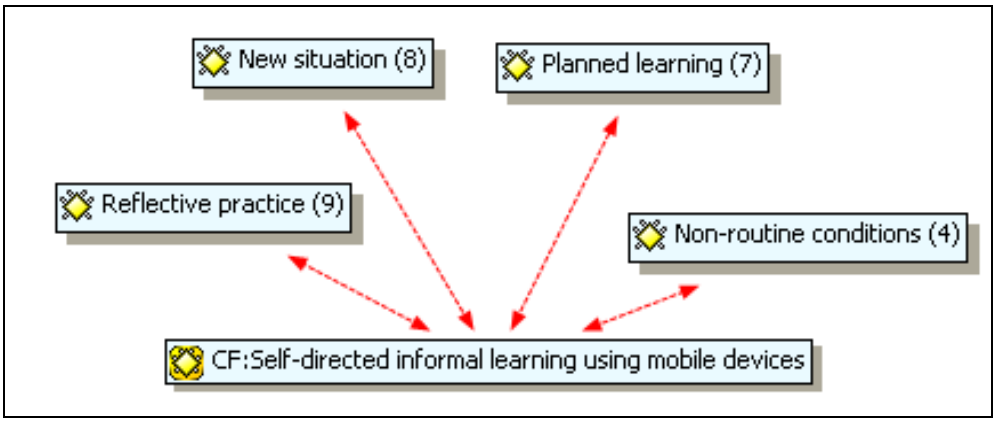

Figure 12. Self-directed informal learning using mobile devices. The number of interviewees reporting data in each category is displayed in the parentheses. CF = Code family or theme.

As discussed in Chapter 2, self-directed learning is a type of informal learning; it is intentional and conscious, whereby the learner has a purpose in learning something even before the process begins and is aware that learning has occurred after the learning process has been completed (Schugurensky, 2000). Self-directed learning is widespread learning "that occurs as part of adults' everyday life [including the workplace], and that is systematic yet does not depend on an instructor or a classroom" (Merriam, 2001, p. 8).

A new situation in the healthcare workplace was the trigger for eight of the 10 interviewees' conscious and intentional informal learning using mobile devices. As Chuck expressed:

> I am beginning to find that if I encounter something new, the first thing that I do is I grab my handheld and look it up . . . in the emergency department you'll encounter a million different things. For instance, if somebody comes in with Steven Johnson's syndrome and we are not quite sure exactly what it is or if we haven't encountered it before, the epidemiology of it is easily accessed using a handheld and then we can teach ourselves with

> that. You can do anything. You can even look at scope of practice, what we are allowed to do.

Haley shared how a new situation in her workplace prompted her self-directed informal learning with her Smartphone:

> We get unusual cases. Babies with unusual syndromes so I will use it to look up in my textbook [on my Blackberry] for that particular syndrome so that I can know what some of the risk factors with that syndrome are. Like some babies are more prone to having necrotizing enterocolitis. Or they can have like a blockage in their bowel. That may not be something that we have discussed on rounds. So if it is a syndrome that you only see like once every 10 years then you might not know that. So it's nice to look up what the risks can be and that is what we do.

Four interviewees spoke to ongoing changes in their workplace creating non-routine conditions that influenced their need to engage in self-directed informal learning using mobile devices. Gail, an assistant manager, stated that "the only constant in healthcare is change. The minute that I think I have got it, it has changed. I want to go back and refresh [by looking up information on my Blackberry] to make sure that I have got the most current information available to me." Chuck commented on how the changes in his work setting influenced his informal learning:

> I think that's the nature of nursing, isn't it? That they are always changing; policies and procedures and through research-based learning, how we wash our hands, how we do dressings, everything changes. I think it is keeping yourself informally educated as well as formally educated that makes you a better nurse.

Seven interviewees conveyed that their informal learning involved a planned learning episode. These RNs purposefully used their handheld devices in new situations or non-routine conditions to obtain information for constructing new knowledge. Alice referred to engaging in informal learning to gain knowledge about

an unfamiliar client diagnosis while working at a remote northern community nursing clinic:

> If somebody comes, if a child comes back with Legg-Calve-Perthes disease, [then I am] looking it up [on my mobile device], finding out what tests are required, what follow-up we need to do in the community, what specialists they need to be referred to, [and] what expected outcomes there are so that we can provide education to the family. I also use it for looking up lab results because in the situation that I work, we order, the nurses' order, can order and do order the blood tests. So if I order a C4 complement, I need to know what I am ordering, what it is going to diagnose, and what the abnormal results mean because then I am going to have to either refer to a doctor with a recommendation to refer to a specialist or do further testing to find out what else is going.

Some of the RNs also planned to use their mobile devices during breaks or downtime at work in order to acquire information for informal learning. Iris stated that she often researched information on her Smartphone during her breaks and Chuck stated:

> If I have some downtime, which these days are few and far between, often it is good to be able to look up things. I am always searching or surfing something at work. I am often on the machine just looking up something related to nursing.

The interviewees in this mixed methods study made a conscious, intentional, and learner-centered choice to use their mobile devices to access information for planned, self-directed informal learning. Alice provided the following example.

> What the PDA does for me is allow me to have resources that I prefer to have, the information that I prefer, in a format that I prefer, rather than leaving it up to somebody else to tell me what I should be using in terms of say a reference.

Barb expressed similar sentiments about informal learning using her iPod stating, "I can access resources anytime and anywhere. I can also learn anytime and anywhere. The learning is personalized for my learning needs."

As part of their nursing practice, nine interviewees gave accounts of incorporating reflection in their self-directed informal learning using mobile devices in their healthcare workplaces. Emily mentioned using a "notepad on the mobile device . . . that you can just type in what you can do differently next time and stuff like that. So if I have to, I can just go back and look at that real quick." Alice spoke about reflective practice using her PDA for self-directed informal learning, as follows:

> I mean by using my mobile device and other electronic means to gather information, it determines, going back and looking what I have looked up, looking at what I have book marked, looking at what questions I marked, [and] looking at what I have added comments to. It allows me to say "I really need to do more research on gall bladders or I really need to do more research on, you know congestive or chronic obstructive pulmonary diseases". I need to take a look at this area because this has come up a lot as I've often looked it up, and so I need to be well-versed in this area.

David provided the following insights on his reflection with his informal learning using a Smartphone:

> So I would go back and reflect on what I had done and taken a look at what the best practices were and what other people might be doing. It might just sort of been bothering me and I am that personality where I will be sitting there and I wonder if what I did if there was another product that I could have used. Or maybe next time, I could use something else so that I don't have to use that particular one. So that's what I mean by reflective. I would sort of go back and see how I performed in my practice could be modified or changed or if it was ok the way it was.

Fay also spoke about the importance of reflective practice with her self-directed informal learning using her mobile device for improving her nursing practice and professional development:

> As nurses, we are always trying to improve our nursing capabilities through learning so if anything of interest pops up through the daily work . . . it may not reflect a certain patient that we are seeing but I may look it up later on [my Smartphone], just for my own personal knowledge to better my practice.

Theme 2: Individual and collaborative informal learning strategies and processes.

Interviewees used a total of eight types of strategies or processes for informal learning with their handheld mobile devices when they had to learn something new in the workplace. All of the interviewees (except the outlier RN) used individual-based strategies or processes (i.e., they did it on their own) for informal learning in their work settings. As depicted in Figure 13, the following five strategies were included in this category: *searching an online database (e.g. Medline); reading books, magazines, or journals; searching the Web (including the Intranet); viewing a video, webcast or podcast*; and the process of *reflecting on action by making notes*. In addition, one interviewee provided an example of incidental learning involving the use of the individual process of *trial and error* using a mobile device.

Two interviewees used collaborative modes for informal learning; these uses involved *interacting with other people using email* or *asking questions in professional listservs or online communities*.

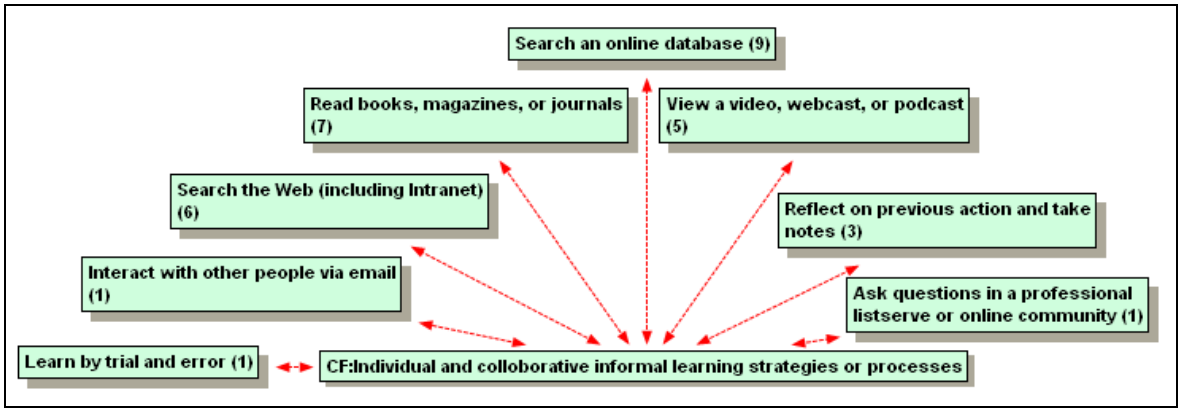

Figure 13. Individual and collaborative informal strategies/processes using mobile devices. The number of interviewees reporting data in each category is displayed in the parentheses. CF = Code family or theme.

Nine interviewees individually searched an online database for information using their mobile devices. They looked for information related to disease diagnosis, medications, and other information related to their clinical practice. Alice provided an example of downloading "immunization schedules for different provinces and territories, and . . . differences in standard treatments." In addition to accessing databases, eight of the interviewees regularly used medical programs such as Pepid, Skyscape, Medscape, Lexicomp, and Epocrates for searching out information for medical, clinical, and pharmacological data at point-of-care. Chuck gave the following account of how he used databases for informal learning:

> We have resource books on the units, but we find that often these resources aren't up-to-date. So about maybe 2 years ago, I got a subscription for a program called Epocrates that I used on my first handheld. I started using that as a drug resource and it also had calculation features. Or if I just wanted look up a disease or something that someone came into the department with, I had a quick resource to research that at my fingertips without leaving the bedside.

Reading online books, magazines, and journals for informal learning was done individually by seven of the interviewees using their mobile devices. Gail stated that she used her mobile device to "search for the subject that I am looking for. I have used articles from all over Canada and the U.S., both in my workplace and for my personal learning as well." David pointed out that he used his Smartphone to read online resources for informal learning in his clinical practice, stating "In some cases, I might not know all the signs and symptoms of a particular illness . . . I might look up a current paper or something like that and do a quick review [or] get an abstract."

Alice commented that she downloaded textbooks onto her mobile device for informal learning, stating the following:

> For instance, I've got on my Palm a book on, besides nursing theories, I've got one on wound care, I've got one on trauma nursing, I've got one on fractures. So because we have be able to describe a fracture, knowing what I might need to do, dictates what resources I feel I am going to have to download and know what I have got. So I just don't download a reference book. I also have to kind of flip through to see the format of it, see what it's about, make sure that it is current, and that it is pertinent to what I am doing because otherwise I have just taken up disk space.

Haley also downloaded textbooks onto her handheld device, indicating "My iPhone is mobile, it is light, and I don't have to carry textbooks around. They don't clutter up my house . . . I have three textbooks essentially in my reach. It's always at my hand."

Searching the Web for information using a mobile device was another individual strategy employed by six interviewees for informal learning in their workplaces. Emily mentioned that "lot of times, I use Google. Just go on and Google it to see what comes up." Gail said that she often searched the Web for information for her informal learning:

> I tend to choose the big three of the registration bodies in Canada. I consider the big three relative to us to be BC, Alberta, and Ontario. Of the three registering bodies, they have the most information that is accessible online. Very often I would seek that out. If I can't find anything relevant to Canada on the subject that I am searching, I will go into the US and search it out there. Often times that will lead me to pare down the search terms that I am looking for and maybe find the wording. Sometimes I will get a hit in Canada as well.

Besides text- or print-based strategies for informal learning, five of the interviewees remarked that they incorporated multi-media learning tools including online videos, webcasts, or podcasts for informal learning with their mobile devices.

Chuck accessed YouTube videos as a "just-in-time" visual learning tool for engaging in informal learning in his clinical practice:

> So if you have any suspicions until it is actually diagnosed by the doctor, whether you can put somebody in isolation or not, [for example] if you think it is shingles. You have a YouTube video right in front of your face that shows exactly what shingles looks like.

Three interviewees used mobile devices for the informal learning process of reflecting on previous action by taking notes. For self-reflection, Emily made use of her Smartphone as "it has a notepad on the mobile device as well that you can just type in what you can do differently next time and stuff like that. So if I have to, I can just go back and look at that real quick." Alice also stated that she benefitted from using her PDA for reflective activities for informal learning:

> So if I tried to remember or write down everything that pops into my head in a day I wouldn't have time. However, if I look it up, I download it and it's there and you know I will go back and I will look at it. And it always there and it's always there for reflection and to take notes on . . . I'll annotate what I am doing [be]cause I have the little wireless keyboard so I will sit there and I'll type out little notes and I'll say we should look at this or we should look at that.

During the interviews, seven participants mentioned that they accessed online forums, listservs, or blogs to read postings; however, only one interviewee (Alice) reported interacting collaboratively by asking questions in the online communities. David explained that he found it difficult to contribute to forums, but appreciated the information he obtained from [reading] them. Iris echoed David's sentiments, stating that she read blogs, but did not feel comfortable posting to them. Alice discussed that she belonged to a variety of online nursing groups and noted the following:

> Where I [have] never posted a thing but I've got a lot out of it. But it's because, I'm either very new at it or I am very much a beginner and the

> subject matter being discussed is at a more advanced level so that I don't feel that I have something [to offer].

However, she had also asked questions in the nursing online communities:

> I might ask a question, "Hi I am a newbie, you know I have not done this before, would someone please explain this, this, or this". So I have used it to receive [informal] education or receive advice. And then there are other forums that I am on where I can, because I've got the experience, say northern nursing, and somebody says "well has anybody ever nursed up in northern Ontario, what's it like, what do I need? Well then, that's an area expertise that I have, so that I can say "well, you'll have this or you won't have this, be prepared to pay eight dollars for a loaf of bread."

Only one interviewee interacted with other people using email for informal learning. Gail offered the following on how she used email for interacting with other healthcare professionals for her informal learning:

> I guess one of the more recent things that we have done is implementing what we call a hot stroke protocol. It's TPA [administration of tissue plasminogen activator] for a stroke. It started out in the beginning as a discussion via email in terms of what we can do here for treating stroke patients who present within four hours of their initial symptom. . . This is a multifaceted thing, it's just not an in- hospital thing. You are involving people who do medical transport so that you are involving air ambulance, road ambulance, and coordinating with southern facilities having access to neurology, having access to people who can read complicated head CTs [Computed Tomography Scan]. There is a whole raft of learning involved in that [done by email] because one nurse can't be expected to know what's required in band width to relay one CT image.

Although Gail was the only interviewee who spoke about using email for interacting with others for informal learning, five of the RNs stated that they sent emails via their mobile devices for communicating with patients/clients and nursing colleagues in their workplaces. Fay worked in a private clinic and often used her Smartphone for emailing as she received "a lot of questions from patients via email. So it was a quicker way of checking your email, always having it [Smartphone] on

you." Haley gave the following example of how she used email for communicating with her fellow staff members:

> If we have moved equipment in the room because we need to know exactly where it is for resuscitation, right? You want to know exactly where it is. So if we moved something around the room, we just send each other an email to say "hey, it is now located over here so if you need it", so that we are not scrambling for stuff when something is going wrong . . . Basically everything we communicate on the team is through this.

While two interviewees interacted collaboratively in the online environment, four of the interviewees described how they used their handheld devices in face-to-face situations in the workplace for collaborative informal learning while accessing their respective online communities of practice. Haley described a situation where she and two fellow RNs used Haley's iPhone to engage in collaborative informal learning regarding the condition of a newborn baby:

> She was having a lot of tummy issues. So we did a little bit of research between us nurses because it was during the middle of the night [in the hallway, using my iPhone with the other two RNs reading over my shoulder]. We thought she might have an ileus which is like a blockage in her tummy . . . She actually did end up having an ileus. I guess we kind of solved that one . . . [We felt good as we] caught something that might have been disastrous and it turned out to be relatively minor.

Chuck provided another instance of engaging in informal learning with his co-workers while using his Smartphone:

> I am beginning to find that if I encounter something new, the first thing that I do is I grab my handheld and look it up. And then I might ask somebody, have you ever seen this before and what do you know about it? And then, if everybody is in agreement with what they have seen then we go from there.

In this mixed methods study, only one participant resorted to the process of trial and error with a mobile device for informal learning in the healthcare workplace. As noted in chapter 2, the non-systematic process of trial and error leads to unintentional or unplanned learning as a result of seeking information with the mobile

device. Incidental learning may occur from this experience (Watkins & Marsick, 1992). Alice, who worked in a northern nursing clinic, had an increased scope of practice as an RN. Alice commented on how she used an informal learning process of trial and error using her mobile device to come up with a client's differential diagnosis based on clinical findings.

> [I use my PDA] when I am presented with a group of symptoms and observations in a client and I have no clue what is going on with the person . . . So for instance, when the person's got a fever. He's got, you know, some crackles in his chest but he's also got abdominal pain and complains that his foot hurts. So [I am] trying to put all those things together. I am looking up [information on my PDA] and trying to say, ok what if it's this and then doing more research . . . [such as learning] it wasn't crackles that I was hearing per se and trying to track down what system I am dealing with. For instance, looking up kidney stones, [and finding] what other weird things will come up with kidney stones. Ok, that's not it. So what other weird things will come up with a gallbladder . . . or what about a blocked common bile duct? What about, you know cholangina or cholangitis? You know, like going through all these different things, so that I have learned about these things. The next time I can apply them without having to go back and relearn them. I have expanded on my knowledge of right upper quadrant pain. And you know, I've also learned at that time, what I can use to rule out one thing or another. So while he had this, but he didn't have this, so he doesn't have this. But that being said, once you have gone through all that and you kind of resolved your problem, you've accumulated all this extra information. And as you are going along, you can highlight it, you can bookmark it, and you can go back at a later time and you can do more research on it.

Except for this one instance of incidental learning using a mobile device, all of the strategies and processes employed by the participants interviewed were for self-directed informal learning. More strategies and processes were used for engaging in informal learning on an individual basis than collaboratively.

Theme 3: Purposes of informal learning using mobile devices.

The third theme identified in the qualitative analysis pertained to the reasons why the interviewees used their mobile devices for informal learning. As shown in Figure 14, five purposes were identified.

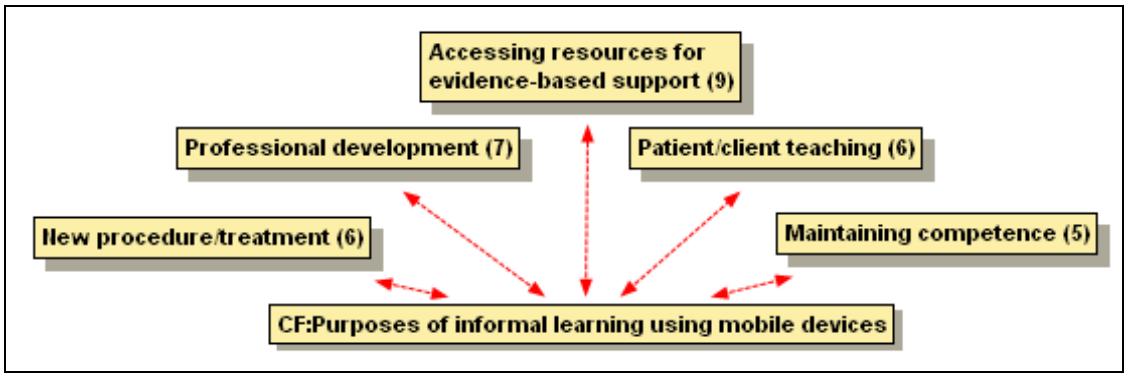

Figure 14. Purposes of informal learning using mobile devices.
The number of interviewees reporting data in each category is displayed in the parentheses. CF = Code family or theme.

All of the interviewees, except the RN considered the outlier, accessed resources for evidence-based practice with their mobile device. Gail referred to her need for timely access to evidence-based resources in her work as an assistant manager:

> Because I am not involved in day-to-day ongoing active clinical practice, I want to make sure that the information that I am giving to my staff members is current, accurate and relevant, and based on evidence-based practice. I want to make sure that they have up-to-date information available to them when they need it to do their jobs.

Barb, as a nursing educator, conveyed that she didn't need to waste her time "looking for paper resources on the ward. I feel good that I am able to get evidence-based information in the palm of my hand [with my iPod]. I feel good that I can provide clients and students with the right information."

Seven of the interviewees cited professional development as their reason for using their mobile devices to engage in informal learning in their workplaces. These RNs intentionally engaged in informal learning for constructing knowledge and seeking skills for informing their professional development. Fay's clinical practice involved working with clients traveling to different global regions; she noted the following about using her mobile device to access information:

> I am also learning regarding the vaccinations, and certain diseases and sicknesses that are in that region. I am always building on my knowledge regarding the different regions because people travel to many different places. It's not always just like Mexico or Cuba. You know I have people that are going to Vietnam and so I am learning about the certain things and conditions that are in Vietnam. . . So I am always building on that knowledge so that I am always able to better process things.

Chuck had been using his Smartphone for informal learning related to continuing professional development for furthering his advanced cardiac life support (ACLS) skills:

> We actually have one little app that we loaded and we have the ACLS simulator that you can buy for 99 cents and you have different situations. You can actually run through the current ACLS model. You can run little mega codes through your handheld. It almost becomes a game because if you are gathered with three or four other people, you can look through it, and it will ask what to do next and then you do it. It sort of keeps you current with the protocol between courses.

David used his Blackberry for informal learning leading to personal and professional development as a RN in his community setting:

> In one case in particular, I had never seen this type of insulin needle device before, so I actually went out to my car and I went onto my Blackberry, and I looked up the company and found a video actually. It showed me how to use it, so more like personal educational tutorial type of stuff.
> Six interviewees used their mobile devices for patient and client teaching.

Fay accessed information online using her Smartphone for teaching patients: "I

would think that is probably the most beneficial thing that you can use it for, is teaching a patient. So say as nurses, I mean we are teachers, outside from [being] caregivers." A number of the interviewees had also used their mobile devices to access visual tools to facilitate learning for their patients or clients. For example, David showed photos or diagrams on his mobile device to his clients to "help illustrate the question or a response to a question." Similarly, Chuck used online images to illustrate "what bone is affected if they have a fracture or things that like that. There is Google app called My body, I think. You can point that out to patients so that they can see it." Barb, a nurse educator, remarked that, in addition to patient teaching, she also used her mobile device for teaching students:

> I will use it for patient teaching, like if they are going over medications. I use it with students for drugs. Say they don't remember the side effects, so we will type in. I will get them to type it in, and then we will do the side effects and the dose. We make sure the dose is right to prevent any errors. What else? Teaching in general, teaching for the students, and for the client, and I guess for myself.

Jill, who was the outlier case, stated that if her employer allowed the use of mobile devices for accessing online resources for informal learning, she could foresee using her Blackberry for patient teaching as she would be able to "draw on information right then and there at the bedside . . . being able to share that knowledge with your patient so that we can make sure that they are getting the right treatments."

New procedures or treatments provided a rationale for using mobile devices for informal learning for six interviewees. They sought online resources about new procedures or treatments in order to be more knowledgeable in their clinical practice. Emily commented that she used her iPad to look up new or unfamiliar procedures. David used his mobile device for a new procedure, explaining that "before the

treatment began, I might have to review what was available for [online] files to make sure that I had the up-to-date information and make sure that I was asking the right questions. Just sort of refresh myself before I went in [to see the patient]." Chuck provided the following example of informal learning using his Smartphone to prepare for a new procedure:

> [We had a] CADD pump [Continuous Ambulatory Delivery Device for the delivery of medications] that a client came in with that we had to disengage or turn off. We didn't even know how to access it. The company webpage was available right in front of us and I accessed it. We were able to reprogram the machine and turn it off.

Also, Jill (the outlier case) described a situation where she used a personal computer to seek information for treatment options, but stated that she would have preferred to have used a mobile device in order to provide more immediate access to information at point-of-care. She elaborated as follows:

> If I am looking up, let's say, scleroderma or lupus, I would want to find out treatment options and what exactly I would have to do and what kind of medications would be applicable to help treat certain signs and symptoms that might be showing. [Having this information] then I can kind of converse with the doctors a little bit more knowledgably about [the treatment] and see what I can do to help that patient out more.

The final purpose for using a mobile device for informal learning discussed by the participants was maintaining competency. Five interviewees described instances where they had incorporated informal learning for competency in their clinical practice. Barb used her iPod to "review disease processes, drugs, nursing diagnosis-things related to nursing. I will educate myself on things that I don't know or things that I need to review again to remain competent." Chuck spoke about maintaining competency related to his nursing association as he will "look at their app if I have any questions about the policies and procedures. You know the standards of practice

and so on. Often just browsing, the same ways we used to when we had nursing magazines." Alice explained how she used her PDA for maintaining competency when she was lacking knowledge in an area of her practice:

> Because I am constantly looking it up then maybe I should do some more research, or I should look up more information or take a course, or something related to where I am noticing there is a deficit. It's like if you look up or use a search engine cookies, if you use cookies, you can find that you have gone to a site 900 out of a 1000 times. You are going to the same site to look up the same thing. Well, that would indicate that maybe you need more education in that area so that you are not constantly having to look it up.

Overall, the interviewees lacked knowledge about incorporating their informal learning into their mandatory competency requirements for professional practice and registration requirements. Only one interviewee indicated that she captured her informal learning using her mobile device on her self-directed learning plan for maintaining competency. Meanwhile, seven of the RNs interviewed stated that they were unaware or had not thought about using their informal learning with their handheld devices for the continuing competency requirements as a regulated nurse. Haley disclosed that "it didn't occur to me because it doesn't seem like it would fit into any of the indicators. . . I have always thought I had to do something formal. Like take an inservice or take a class." David had a similar perception:

> I haven't been keeping a record of it, unfortunately. . . Obviously, I have given you some examples of why I think it's important to have informal [learning], but the formal stuff is more like having hardware that you can see and touch where the informal stuff is things that you pick up along the way and fill in the gaps.

Theme 4: Healthcare workplace-related influences.

The fourth theme identified in the qualitative analysis involved workplace-related factors that affected the RNs' use of mobile devices for informal learning. Four types of influences were identified, as seen in Figure 15.

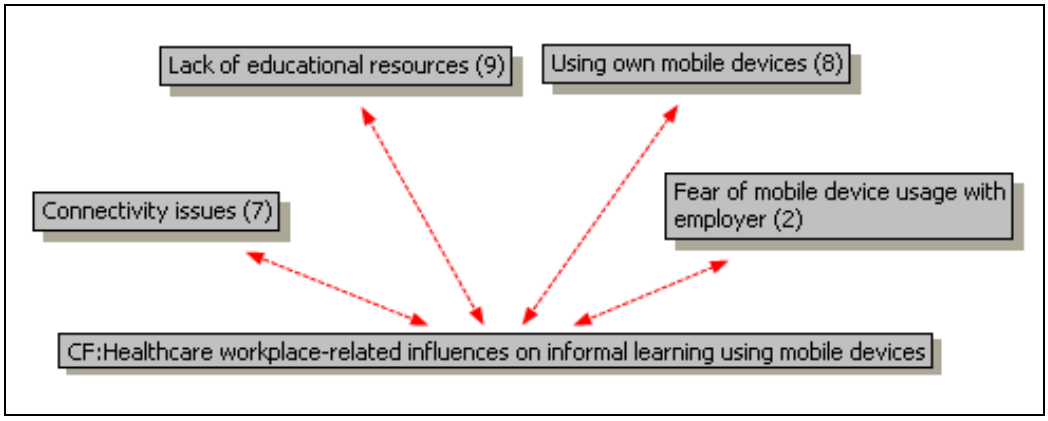

Figure 15. Healthcare workplace-related influences on informal learning using mobile devices. The number of interviewees reporting data in each category is displayed in the parentheses. CF = Code family or theme.

Lack of educational resources in the healthcare workplace was a common concern, voiced by all but one interviewee. These concerns included lack of access to educators, formal education and inservice training programs, and/or current educational resources for meeting their learning needs as RNs on a timely basis. David talked about the inaccessibility of inservice training:

> We had inservicing available, but it was going to be like on this date so it was almost impossible to make it. Or they would have a learning fair or something like that. But these types of formal learning situations, I found as thorough as they could be, and as good as far as socializing and speaking with your peers, that's fine. But they are really not that practical when it comes to having an immediate need. Having access to the information right in your hand when you need it or when it comes to mind is quite important.

Several of the interviewees remarked on the difficulties of accessing current resources in their workplace for evidence-based practice. David commented, "[We have] textbooks, policy and procedures that are outdated, you know from 1987 that they haven't updated them yet. Textbooks, lab resources, and some of that stuff are very old." He also expressed preference for his mobile device over using older hardcopy books as they are "not always a reliable resource to have on hand when we can have immediacy and accuracy." Alice referred to the convenience factor, stating that when she makes flights in her clinical practice "there are weight restrictions on flights so carrying around 50 books was a lot easier in digital format than in my suitcase." Emily commented on timely access, noting that if she needed to access information on her mobile device, she could do it almost immediately "instead of fumbling around trying to find a book. . . We've got some books but just because we are so diverse, it would take a lot of books to have a lot of resources [that I need]." Iris also mentioned that timeliness of accessing resources for her informal learning was important in her clinical practice, stating:

> I work evenings and we don't really have all inservice educators and managers available during evenings. And the next thing is that we do have some computers at our work but you have to turn them on and then you have to enter a password. The computer is kind of slow. So rather than taking 10-15 minutes just to get into the computer, I will just use my Blackberry . . .We do have a drug handbook and other books but sometimes we don't even have time to go to the books. It is much easier [to use my Blackberry].

Jill, the outlier case, cited the lack of computer resources on her busy surgical unit as a reason for wanting a mobile device to engage in informal learning at point-of-care:

> They [the employer] actually went from [providing] textbooks just to online resources . . . Like, we have really gone away from any kind of [hardcopy] manuals or anything there. In order to access any of the policy or procedures,

> we have to use the computer workstation to do that . . . [and we have only the one workstation for all staff to use on this unit].

The interviewees also voiced concerns related to the support of employers for using mobile devices for informal learning in their workplaces. Only two interviewees had mobile devices supplied by their employer; the remaining eight interviewees used their own personal mobile devices in their places of work. The lack of connectivity in the healthcare workplace was also an issue. Seven interviewees accessed the Internet for their informal learning in their work settings by way of their own personal mobile service providers and subsequently incurred the cost of the mobile data plans.

Furthermore, two of the three interviewees who worked in rural areas did not have Internet access or cell service at work. They downloaded resources from the Web onto their handheld devices at home, and then accessed these resources offline in their workplaces for engaging in informal learning. The third rural RN, Gail, reported having bandwidth issues at her hospital:

> As you can imagine, when you are dealing with a remote area . . . there is only so many pipes or lines that come into the [hospital]. So if we crowd up the system using bandwidth to access items that take up a lot of bandwidth-like applications then things like results of CAT [Computerized Axial Tomography] scans, patient care things actually cannot get through. So the priority has to be given to those types of services.

The use of cellular communications and the potential for interference with electronic equipment was also a factor that limited the use of certain mobile devices. Haley explained that Smartphones were not allowed in her nursing unit due to the employer's view that mobile technologies might interfere with medical equipment. She had to leave her nursing unit and move to an adjacent hallway when accessing

online resources with her iPhone; however, there were no similar restrictions on iPad use by physicians and other staff in the nursing unit. She said the following about the perceptions of cellular interference with medical equipment:

> I don't know who is saying it, if it is clinical engineering or what, but they [managers] are saying that it [cellular phone technology] interferes with the medical equipment. Even though, we [nurses] don't think that it does, because there have been a lot of studies that say it doesn't, they still err on the side of caution.

Also, the potential non-medical use of the mobile device also appeared to play a role and contributed to the employer's resistance to particular types of devices (i.e., those with communication capabilities). Haley expressed these concerns relating to the use of her iPhone on the unit:

> [An iPad] is not seen as something that you can text on or perform personal things. I think it is big enough that people can see what you are doing. I think that with an iPhone or any other cell phone, it's just automatically assumed that you are texting. It's ok for me to whip out my Kobo [e-Reader] and look up things on it, because it's like a textbook. That's why I actually bring that to work. An iPhone, I wouldn't even dream of [bringing it to the nursing unit] because if I brought it out in front of the wrong person, it might get me in trouble.

Jill voiced similar trepidations for not using a mobile device for informal learning in the workplace. She explained that an inquiry was underway at her place of work involving a nurse's alleged improper use of a mobile device and this investigation had deterred Jill from using her mobile device. Although Jill was not currently using her mobile device for her informal learning, she was hopeful that her employer would support its use for engaging in informal learning in her workplace in the near future.

Theme 5: Perceptions of informal learning using mobile devices.

The final theme identified in the qualitative analysis pertained to the benefits and consequences of the use of mobile devices for informal learning in the

workplace. As represented in Figure 16, interviewees' insights on their informal learning with their handheld mobile devices related to the following perceptions:

- increased efficiencies;
- increased self-confidence;
- increased patient/client safety;
- positive reactions from clients/patients;
- need for sanctioned resources.

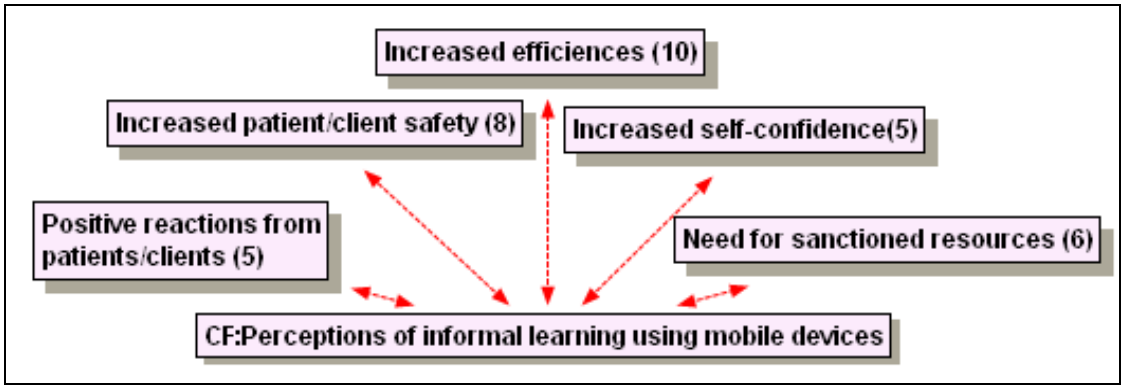

Figure 16. Perceptions of informal learning using mobile devices. The number of interviewees reporting data in each category is displayed in the parentheses. CF= Code family or theme.

With exception of the outlier case, the RNs alluded to the efficiencies afforded by the mobile devices for informal learning in their places of work throughout the interviews. Alice expressed "you are saving time and you're being more efficient, and that technically would leave more time for patient care and the interaction with patients as opposed to looking up stuff in paper." Haley stated that with a mobile device "you would spend less time messing around with the computer. You just pull it out of your pocket, plug it in, and then you are done." Barb indicated that she used her iPod because "it is convenient, resourceful, and I choose to use the device

because it has an incredible amount of information. I can learn anytime." Fay added that she used her Smartphone because "anywhere I am, I can research something. I don't have to be necessarily stuck down at a library or at a desktop computer. [If] something comes up, I pull out my Blackberry." David also testified to the efficiencies of using his Smartphone for informal learning in his community-based clinical practice:

> I think it saves me time by being rapidly available. And in particular with community [nursing], you want to go in and be quick. Basically, you are paid on a per-visit basis. So you want to be as efficient as you can be, in the short amount of period of time in that you are there, because most of your time is eaten up by driving back and forth. So you know, when you get there, you want to see what is needed, and do it quickly and properly, and go. So the efficiency [of informal learning using mobile devices] and then, of course, doing that sort of work; not having to carry around additional bulk, notes, papers, and those types of things. Being able to either look for it quickly or bring it up quickly.

Chuck acknowledged that his Smartphone was an invaluable resource that he relied upon everyday for its efficiencies to obtain timely up-to-date information in the work setting, stating "I could not see a day go by that I haven't consulted with it for at least one thing. I see, as our jobs become more complex, that we need information at our fingertips."

Five interviewees referred to the increased self-confidence that resulted from their informal learning using handheld technologies. Haley explained that being able to use her iPhone for informal learning gave her more self-confidence because she was able access "just-in-time" resources when there was uncertainty over a patient's condition. She said, "I am able to recognize when something is going wrong. I think if I am watching for something a little bit more closely, I might catch something a little bit faster. It just gives me a little bit more confidence." David also indicated that

the use of his Smartphone in his community care practice promoted his self-confidence:

> I don't like to demonstrate a lack of confidence. For me, not knowing or not being aware of all aspects before I go into situation is uncomfortable for me. I like to make sure that [I am] whatever is relevant as I don't like to be surprised by information. That is another reason that I like mobile devices, so that I can spontaneously use it to bone up on what it is that arises spontaneously. . . It's hard enough for them [clients], for somebody to come into their home and have all of these things happening to them, without wondering about whether or not the person who is working on them knows what they are doing.

Although Jill was not currently using a mobile device for informal learning in her work setting, she could foresee the effect it could have on her clinical practice and self-confidence:

> People are asking questions. People aren't sitting at home and not researching for themselves what kind of problems that they might have as a diagnosis when they are in the hospital. So they are asking for information. Let's say you come across a diagnosis that you are not really too sure about because you didn't really know about or study it in school. It would be nice to be able to appear knowledgeable for your patients.

Eight interviewees cited increased patient/client safety resulting from the use of mobile devices for informal learning. David described how he used his Smartphone for just-in-time informal learning when administrating medications at point-of-care:

> If I need to know something I can have it immediately. I can research information and if it's concerning a drug, I can look up different resources. Or I can even look at the manufacturer's website and learn about the drug before I administer it to a patient. I think it makes my work atmosphere safer. I can see it immediately, what interactions are involved, without always running back to the med room or without always pulling out the CPS [Compendium of Pharmaceuticals and Specialties]. Even the CPS has an app. Everything is right there as I need it at the bedside.

Barb also commented that timely access to information for informal learning using her mobile devices may mitigate some of the potential risks associated with the delivery of patient/client care:

> I am making sure of giving safe and competent care . . . I think more people are going to have them [mobile devices] because in the palm of your hand you have this resource. It would be nice if the hospital would purchase it for the staff, but they don't. Maybe they will with the cost of med errors and different errors to clients.

Five interviewees commented that patients/clients reacted positively to the use of mobile devices for informal learning. (No negative reactions were reported). Fay commented on the satisfaction voiced by her patients "because they are getting a quick response and they are getting accurate information as well." Alice provided an interesting example of how some of her clients responded to her PDA use:

> These days with the younger generation, if you pull out your iPad or Palm and you come up with the information, you are seen as competent. You are seen as having the advanced knowledge. If you say "well just a minute, I have to go find my book" and you are flipping through the book then you are seen as old fashioned and that you aren't as current as you should be. I don't know that if it is necessarily a competence thing, but a lot of young people these days aren't going to sit there and want to watch you look through a book.

In a similar vein, Fay articulated her insights regarding her patients' responses to technological innovations such as handheld devices in the healthcare context:

> I think the population, the society that is around us, we are an information society. We are a technology type of society. So if you are able to show them with modern technology as a way of learning, I think they are going to be more receptive to it.

From her experiences, Emily shared that not only have clients reacted positively to the handheld devices, but also the client's families:

> Families are very appreciative, as well. Say if you've got older clients and the families are asking a lot of questions and if you pull that [mobile device] out a lot of the time, the families bring out their mobile devices as well. They then

> look it [information] up at the same time so that they can see what you are looking at, as well.

Six of the RNs in the narrative accounts had a perceived need for sanctioned resources associated with the use of mobile devices for informal learning. These resources included access to approved websites and applications, as well as the use of employer-supplied mobile devices. For example, Chuck cited the need for the following:

> More official sanctioned websites that you know that you could trust from the Canadian Nursing Association or College of Nurses or the provincial association. If there are apps on the site to have them endorsed by these organizations, it would probably be useful.

Iris spoke about wanting to have access to workplace policies and procedures on her Smartphone "because first of all, it saves lots of time. The [mobile device] is so handy. Even if you are in the hallway or somewhere else, you can just browse through it. It's more flexible." Jill also expressed the need for employer-supplied mobile devices "to provide access to more timely interventions. It would be nice if I could have a PDA used more at work. But it would be nice if the hospital would supply one [and permitted access to Web resources]."

Chapter Summary

This section presented the key findings of the inductive analysis of the qualitative data from the interviews. This analysis augmented the quantitative findings from the online survey providing richer and deeper insights of the study phenomena. The interview data also added authenticity to the study of RNs use of mobile devices for informal learning in the healthcare workplace.

Ten (10) participants were purposively selected for the semi-structured interviews based on their online survey responses to obtain a maximum variation

sample. An outlier case was included in this sample. The five themes that emerged from the inductive analysis of the interview transcripts are summarized as follows:

- Self-directed informal learning using mobile devices was intentional and planned by the interviewees in response to new and changing situations in their healthcare workplaces. This experiential learning was usually evaluated through reflective practice.
- Interviewees stated they used most frequently the individual self-directed strategies of: *searching an online database (e.g. Medline), read online books, magazines, and/or journals*, and *searching the Web (including the Intranet)* for informal learning with their mobile devices. A minority of RNs participated in online collaborative processes for informal learning. However, some interviewees used their handheld devices in face-to-face situations for collaborative informal learning while accessing online communities of practice.
- The interviewees used their mobile devices for informal learning for the purposes of timely access to evidence-based resources, professional development, patient/client teaching, new procedures and treatments, and maintaining competency. Overall, there was a lack of awareness for the inclusion of informal learning using mobile devices to satisfy the requirements for maintaining competency for professional practice and licensure.
- The lack of educational resources in the healthcare workplaces influenced the use of mobile devices for informal learning. The majority of the interviewees

used their personal mobile devices and data service plans to engage in informal learning in their workplaces. The lack of Internet connectivity and/or lack of employer support may have influenced the interviewees' selection of informal learning strategies or processes. Interviewees cited positive perceptions of efficiencies, self-confidence, patient/client safety, and reactions by patients/clients. Also, the need for the sanctioned resources for using mobile technologies in the healthcare workplace was articulated.

CHAPTER 6

INTEGRATED RESULTS AND DISCUSSION

The previous two chapters in this dissertation reported the quantitative and qualitative results of the study. This chapter presents the analytical integration of the quantitative and qualitative findings that led to inductive inferences based on interpretation and explanation. An eight-stage model for informal learning of RNs using their mobile devices in the healthcare workplace for informing their professional practice is presented. In this chapter, attention is also drawn to how the integrated findings fit within body of existing literature. A summary of integrated findings concludes the chapter.

Integration of Quantitative and Qualitative Findings

Integration in mixed methods research refers to the point in the research process where the "investigator mixes or integrates the quantitative and qualitative data collection and analysis" (Creswell, Fetters, & Ivankova, 2004, p. 10). Integration in this dissertation research study occurred during the last phase of the analyses. As Wooley (2009) advocates, the mixing of the "quantitative and qualitative components effectively is the basis for producing integrated findings that are greater than the sum of their parts" (p. 23).

In this dissertation research study, the integration of the quantitative and qualitative findings was enabled by the research questions exploring how RNs engage in informal learning using mobile devices in the healthcare workplace. As such, the research questions were drawn from the theoretical framework and provided the

foundation for this mixed methods investigation. The research questions were as follows:

1. What informal learning strategies or processes do RNs engage in when using mobile devices in the healthcare workplace?
2. For what purposes do RNs employ informal learning strategies or processes using mobile devices in the healthcare workplace?
3. Are there differences between how RNs use individual and collaborative modes of informal learning with mobile devices in the healthcare workplace?
4. Is there a relationship between the age of RNs and their use of mobile devices for informal learning in the healthcare workplace?

Strategies and processes for informal learning using mobile devices.

From the quantitative findings, it was revealed that more study participants in this dissertation study engaged in the informal learning strategies or processes without using mobile devices in the healthcare workplace than did those using mobile devices. As previously discussed in the quantitative results in Chapter 4, this finding was not surprising, considering the newness of the use of mobile devices in the healthcare workplace. However, as discussed in the qualitative results in Chapter 5, when the study participants engaged in the informal learning strategies and processes using mobile devices, only self-directed informal learning that was planned, intentional, and conscious was readily apparent in this dissertation study.

From the quantitative findings on the use of mobile devices for informal learning, the survey respondents indicated a high frequency of use for these strategies, i.e., the mean rating was 2.85 (out of a score of 4) for *searching the Web*

(including the Intranet) (M = 2.88, *SD* = .867*)* and for *searching an online database (e.g. Medline)* (*M* = 2.56, *SD* = .956). The qualitative analysis yielded strong support for these findings. The interviewees reported frequently used their mobile devices for *searching an online database (e.g. Medline)* and *searching the Web (including the Intranet)* for their self-directed informal learning.

Conversely, the process that was selected the least frequently on the online survey was *asking questions in a professional listserv or online community* (*M* = 1.87, *SD* = 1.02). It was also the least commonly used strategy or process for self-directed informal learning using a mobile device stated by the interviewees. Berg and Chyung's (2008) study on professionals and informal learning strategies and processes obtained similar results; whereby, the study participants also used the process of *asking questions in a professional listserv* the least frequently for informal learning. Akin to Berg and Chyung's (2008) interpretations, the qualitative analysis showed that the participants in this dissertation research study may have "joined the listserv [or online] community to gain information that helps improve general knowledge about their profession, but they tend not to post questions specific to their job tasks" (p. 239)

Incidental learning was minimally reported in both the qualitative and qualitative findings. The process of *trial and error* for informal learning using a mobile device was infrequently selected (*M* = 1.90, *SD* = .89) on the online survey. In the semi-structured interviews, only one interviewee used the process of trial and error; this was the sole example of incidental learning.

The qualitative analysis revealed that the RNs in this dissertation research study purposefully selected self-directed informal learning strategies and processes using their mobile devices to respond to new situations in their places of work. These new situations included those reported in other studies. It is within this context where learners are said to "compare the new situation with prior experience, identify similarities or differences, and use their interpretation to make sense of the new challenge" (Marsick & Watkins, 2001, pp. 29-30). Changes in workplace routines also create a dysjuncture preventing the participants from responding routinely and habitually (Watkins & Marsick, 1992). This disjuncture triggered the RNs' self-directed informal learning using mobile devices for problem solving and planning for future action (Jarvis, 2004). As Wihak and Hall (2011) posit, "the best conditions for learning occur when harmony is disturbed and the resultant disjuncture makes unthinking action impossible" (p. 12).

Reflective practice identified in the narrative accounts focused on experiencing new and/or non-routine workplace events to determine the nature of the problem (Watkins & Marsick, 1992). As discussed in Chapter 2, reflective practice includes reflection-in-action, where individuals self-evaluate during their experience, and also reflection-on-action, where experiences are re-examined after the encounter in order to develop more effective ways of action for future practice (Schön, 1987). In this dissertation research study, the RNs incorporated reflection-in-action for solving problems using self-directed informal learning strategies and processes with mobile devices. Furthermore, reflection-on-action was noted where the RNs looked back at the effectiveness of what had been done.

The new situations and the non-routine conditions in the healthcare workplace were catalysts for construction of knowledge, understanding, and meaning for the RNs that focused on using mobile devices for self-directed informal learning from experience. This builds on Dewey's (1938) thinking that learning begins with an experience that is triggered by an unexpected event, and Lewin's (1952) work that behavior is based on the interaction of the individual and the environment as identified in the informal learning theory (Marsick et al., 2000; Watkins & Marsick, 1992).

Purposes of informal learning using mobile devices.

The quantitative analysis revealed two purposes to be statistically significant; *accessing resources for evidence-based support* (X^2 (1, N = 170) = 10.376, p = 0.001), and *professional development* (X^2 (1, N = 170) = 7.624, p = 0.006) for engaging in informal learning using mobile devices in their places of work. During the interviews, the purposes or reasons that RNs most frequently cited were also *accessing resources for evidence-based support* closely followed by *professional development*.

The qualitative analysis provided additional insights into these purposes. Similar to the findings of Doran et al. (2010), the handheld mobile technologies facilitated timely access to evidence-based resources to promote the delivery of patient and client care. In relation to professional development, the interviewees alluded to proactively engaging in informal learning using their mobile devices for knowledge and skills acquisition to inform their professional practice. As discussed in the findings of Berg and Chyung's (2008) study, participants may be more likely to

engage in informal learning strategies or processes for the purpose of gaining new knowledge that was necessary to perform at a higher level in their professional practice.

The quantitative analysis found significantly fewer study participants used their mobile devices for informal learning for maintaining competency (X^2 (1, N = 170) =7.624, p = 0.006). This result corresponds to the qualitative finding that the least reported purpose of informal learning using a mobile device was for *maintaining competency*.

Although the interviewees cited examples of how they applied their informal learning related to competency, there was a general unawareness of the potential contribution of informal learning using mobile devices for professional practice competency and registration requirements. This deficit may have influenced the responses related to the purpose of *maintaining competency*.

Individual and collaborative modes of informal learning using mobile devices.

The integration of the quantitative and qualitative findings may not always provide corroborative evidence, but "may well add depth or breadth to a study and perhaps even hold the key to understanding the processes which are occurring" (Bazeley, 2004, p. 144). The quantitative analysis revealed collaborative modes (M = 2.33, SD = .885) were used, on average, slightly more than individual modes (M = 2.21, SD = .696). All of the interviewees (except for the outlier case) reported using individual modes of strategies or processes for informal learning using their mobile devices in their work settings. However, only two interviewees acknowledged using

collaborative modes with their handheld devices for informal learning. These modes included *interacting with others via emails*, and *asking questions in a professional listserv or online community*.

In addition, the process of *interacting with other people via e-mail* was reported to be used frequently in the online survey (M = 2.69, SD = 1.069). However, when probed about this colloborative mode for informal learning, five interviewees stated that they emailed via their mobile devices for communication purposes only with patients/clients and peers (i.e., they did not use this process for informal learning). The Clough et al. (2009) study on the use of PDAs and Smartphones for supporting and enhancing the informal learning experience found that some participants used their devices to communicate, but lacked awareness as to their participation in collaborative informal learning. This finding is relevant to this dissertation study; when completing the online survey, some of the study participants may not have recognized a difference between using email for communication with others and using email for collaborative informal learning. The divergence of the integrated findings in this dissertation research suggests the need for further research on the use of collaborative modes of informal learning using mobile devices in the healthcare workplace.

For the purposes of informal learning using mobile devices in the healthcare workplaces, the quantitative analysis revealed four out of the five purposes were statistically significant (p = 0.000 - 0.009) at the 5% statistical significance level with the individual modes. Only the purpose of professional development was not statistically significant (p= .056) with the individual modes of informal learning

using mobile devices. The narratives accounts found that the interviewees used the individual modes for the all of the purposes of informal learning in the healthcare workplaces. Wihak and Hall (2011) assert that individual or solitary modes are the preferred form of self-directed informal learning in comparison with more social or interactive forms. The individual modes employed by the interviewees for self-directed informal learning using mobile devices reflect this assertion. Moreover, the narrative accounts of the individual modes of informal learning suggested that the RNs in this dissertation research study were constructing new knowledge and meaning-making from experience using primarily meta-cognitive abilities and reflection, as illustrated in the cognitive constructivism perspectives. The RNs engaged individually in authentic and meaningful learning using the informal learning strategies and processes with their mobile devices to construct new knowledge based on previous learning.

Although the quantitative findings revealed that respondents were not significantly utilizing the online collaborative modes for the purposes of informal learning, four interviewees provided examples of how they used their handheld devices for in-person collaborative informal learning in their community of practice. These RNs engaged in shared activities and interaction incorporating their mobile devices for socially reflective informal learning. This qualitative finding also suggests the need for further exploration of collaborative informal learning of RNs using mobile devices in the healthcare workplace that is socially situated and constructed within a community of learners (Lave & Wenger, 1991).

Age-generational categories and mobile devices for informal learning.

Integration of the qualitative and quantitative findings revealed that participants in all of the age-generational categories engaged in informal learning using their mobile devices in the healthcare workplace. Quantitative and qualitative data analyses revealed minimal differences among the age categories of Generation Y, Generation X, and Baby Boomers for informal learning by RNs using mobile devices in the healthcare workplace. The only statistically significant difference found was for the process of *interacting with other people via email.* Generation Y participants used this process significantly less frequently than participants in the Generation X or Baby Boomer age generation categories (X^2 (2, N = 162) = 7.689, p = 0.021) with the mean ratings of Generation Y = 57.18 (n = 22), Generation X = 84.05 (n = 104), and Baby Boomers = 89.00 (n = 36). No differences were found for the strategies or processes used for informal learning among the age-generational categories from the interviews.

These findings differ from those of the Berg and Chyung (2008) study, which found that as age increased, so did the tendency to learn by searching the Web and reading printed magazines and journals. These disparities in the relationship between age and informal learning strategies or processes may be explained by differences in the units of analysis. This dissertation study explored informal learning of RNs using mobile devices in the healthcare workplace; whereas, the Berg and Chyung (2008) study looked at informal learning of various professional disciplines in different workplaces and did not incorporate the use of mobile devices.

Livingstone's (2000) Canada-wide survey of New Approaches to Lifelong Learning may provide a better explanation of the age-related findings. The NALL study found that Canadian adults under the age of 24 years spent significantly more time in informal learning activities than older adults, but no differences were found between middle-aged adults or adults approaching or entering retirement. As there were no RNs under the age of 24 years in this dissertation study, the frequency of use of mobile devices for informal learning was similar to Livingstone's (2000) results.

For the purposes of informal learning using mobile devices, the only statistically significance difference among the age-generational categories was for the purpose of *professional development*. Significantly fewer Generation Y participants used informal learning with their mobile devices for professional development than did Generation X or Baby Boomer participants (X^2 (2, N = 165) = 6.108, p = .047), with mean ranks for Generation Y = 67.25 (n = 22), Generation X = 88.50 (n = 105), and Baby Boomers = 76.92 (n = 38). Qualitatively, only one interviewee from Generation Y indicated professional development as a purpose of informal learning using a mobile device compared to three participants in each of the Generation X and the Baby Boomer age-generational categories.

The quantitative analysis revealed no significant differences among the age generations in terms of the use of individual or collaborative strategies or processes. The qualitative analysis revealed that only two interviewees used colloborative strategies or processes for informal learning using mobile devices; and both were from the Baby Boomers age-generational category.

No significant differences were found between the age generations and location (rural and population centres) for informal learning using mobile devices in the healthcare workplace; the qualitative analysis revealed similar findings.

Healthcare workplace-related influences.

Informal learning is highly contextualized in nature and, thereby, the influences of the workplace affect learning choices and practices (Marsick, 2009) as were discussed in the interviews. When educational resources were not accessible or available in the healthcare workplaces for evidence-based practice, many of the interviewees used their ingenuity, personal mobile devices, and service/data plans to meet their informal learning needs for continuing professional practice. At the same time, the lack of Internet connectivity in the workplace and/or employer support may have also influenced the participants' strategies or processes for using mobile devices for informal learning. Lohman (2006) contends that professionals' selection of learning activities for engaging in informal learning is strongly influenced by the workplace. Similarly, Watkins and Marsick (1992) avow that the organizational context is a critical component of the conceptual understanding of informal learning theory in the workplace.

Perceptions of informal learning using mobile devices.

From the qualitative analysis, increased efficiencies, self-confidence, and patient/client safety, as well as positive patient/client reactions and the need for the sanctioned resources were perceived to influence the use of mobile devices for informal learning. Increased efficiencies in clinical practices were attributed to the proactive use of mobile devices to access timely up-to-date information for informal

learning. This finding is similar to that of Watkins and Marsick (1992), who suggested that proactivity may enhance a sense of autonomy and empowerment.

Participants had increased self-confidence from engaging in informal learning using their mobile device in their challenging work settings. Eraut (2004) argues that confidence affects self-efficacy and the ability to execute a particular task or successfully perform a role in the workplace. The proactive use of the strategies or processes for informal learning using mobile devices required the participants to have self-confidence. Reflection on the use of these strategies or processes may have led to new perceptions that challenged initial beliefs, behaviors, or feelings (Watkins & Marsick, 1992).

Increased perceptions of patient/client safety as well as positive reactions from patients/clients to the interviewees' use of mobile devices for informal learning are associated with the RNs' competencies for "integrating and applying knowledge, skills, and attributes required to practice safely and ethically in a designated role or setting" (Canadian Nurses Association, 2000, p. 6). In addition, the need for sanctioned resources including websites and applications, and employer-supplied mobile devices was voiced. These findings are similar to those proposed in Volpe's (1999) study of human resource professionals and informal learning, which stated that these "perceptions of the organizational environment, of management, and of their own professional competencies [may] influence their ability to serve their clients" (p. 22).

Informal Learning of RNs using Mobile Devices in the Healthcare Workplace Model

Within the context of the healthcare workplace, this exploratory dissertation study aimed to initiate and/or add to the body of research on how RNs engaged in informal learning using mobile devices. Reflecting on this purpose, the following eight-stage model (Figure 17) depicts the informal learning of RNs using their mobile devices for informing their professional practice based on the model of informal and incidental learning in the workplace (Marsick, Watkins, Callahan, & Volpe 2006), previously discussed in Chapter 2.

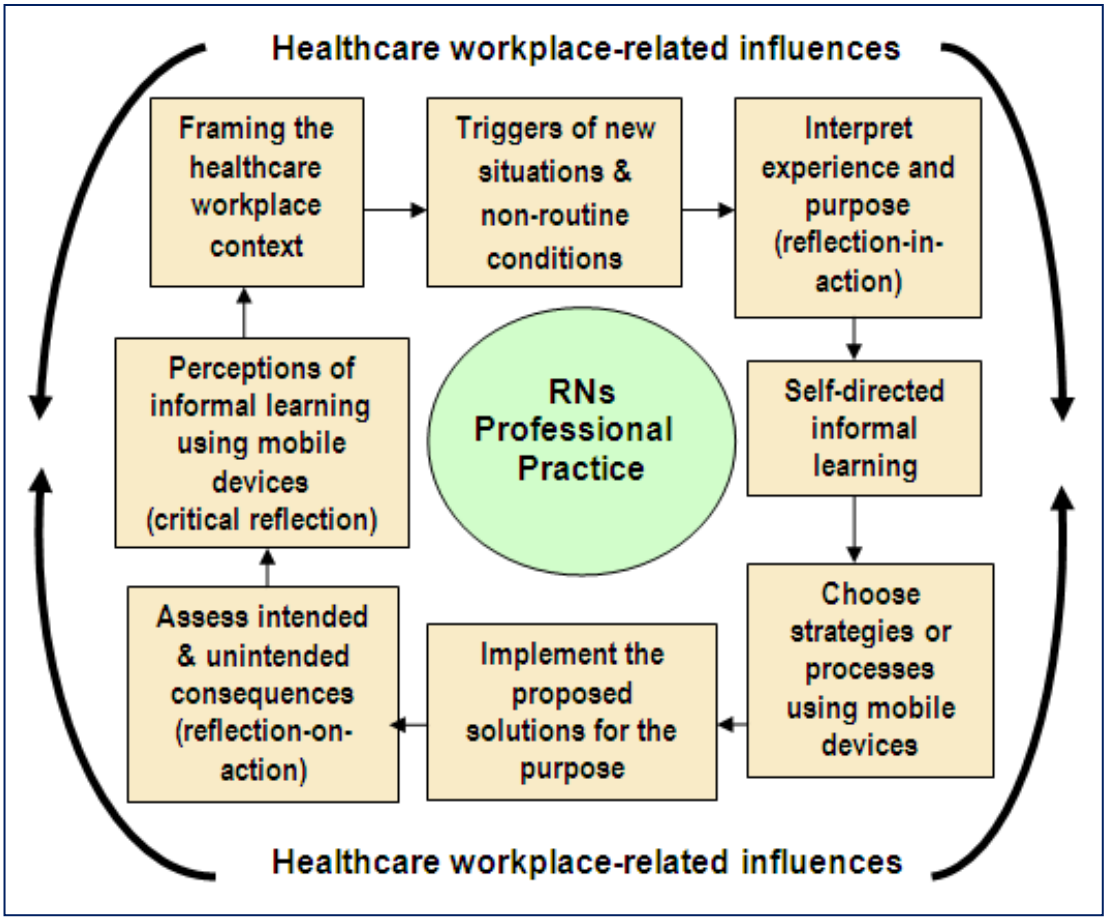

Figure 17. Informal learning of RNs using mobile devices in the healthcare workplace. Adapted from "Reviewing Theory and Research on Informal and Incidental Learning" by V. J. Marsick, K. E. Watkins, M. W. Callahan, and M. Volpe, (2006), *Proceedings of the Academy of Human Resource Development International Conference (AHRD)* (p. 795).

In their informal and incidental model, Marsick et al. (2006) proposed that informal learning may take place as a just-in-time response to strongly felt challenges (or triggers) that are situated within in a highly relevant context. Similarly, for the RNs in this mixed methods study, these challenges were **triggered by new situations and non-routine conditions** in the healthcare workplace. In their work settings, the RNs framed this new experience based on past experiences and interactions with their

patients and clients to make sense of the new situations and non-routine conditions they encountered.

As part of their reflective practice and focus on action, the RNs initiated reflection-in-action to **interpret experiences and purpose for the informal learning** related to the new or non-routine situations. The RNs in this dissertation study were primarily using their mobile devices for the purposes of *accessing resources for evidence-based support* and *professional* development. As Marsick, Watkins, and Lovin (2011) propose, reflection helps the individual to "become aware of the complexity of the situation and the assumptions used to judge the new challenge" (p. 65). This reflection-in-action led to **self-directed informal learning**. The action was an intentional, conscious, planned, and a job-specific reflective response to the new situations and non-routine conditions in the healthcare workplace.

Based on the research questions, integration of the quantitative and qualitative findings revealed that the RNs were primarily **choosing the strategies or processes** of *searching the Web (including the Intranet)* and *searching an online database* for their self-directed informal learning using their mobile devices. There was divergence in the integrated findings as to how frequently the RNs engaged in informal learning using collaborative modes. This divergence suggested that there may have been a lack of understanding of what constituted informal learning in a collaborative mode. However, the RNs primarily used the individual modes of strategies and processes for all the purposes of informal learning in the workplace.

Furthermore, it was discovered that some of the RNs were engaged in face-to-face shared activities and discussion using their mobile devices for informal learning.

Action was taken using the strategies and processes to **produce the proposed solutions** for the purposes. The RNs in this mixed methods study engaged in informal learning for all of the purposes of informal learning using the strategies or processes. Although RNs in the Generation Y age-generational category may have engaged less frequently than the older generations in informal learning for *professional development* purposes, there were minimal differences in the age-generational categories of Generation Y, Generation X, and Baby Boomers for informal learning using mobile devices. The RNs participated infrequently for the purpose of *maintaining competency.* However, this finding must be interpreted cautiously given that many participants appeared to be unaware or had not thought about using their informal learning for the continuing competency requirements as a regulated nurse.

Using reflection-on-action, the RNs **accessed the intended and unintended consequences** of their actions in order to determine whether the actions met their purposes of informal learning. From this reflections-on-action and also critical reflection, lessons were learned and **positive perceptions** of increased efficiencies for timely access to evidence-based resources, self-confidence, patient/client safety, reactions by patients/clients resources, and a perceived need for sanctioned resources were felt by the RNs. Critical reflexivity may have influenced these perceptions based on previously held beliefs, values, or routines (Marsick & Volpe, 1999) for **framing the healthcare workplace context** with new understandings.

In the complex healthcare workplace, "self-directed learning takes place in natural, everyday settings and . . . it is the individual's perceptions of, and interaction with, that environment which give meaning to the experience" (Watkins & Marsick, 1992, p. 294). With the individual modes of self-directed informal learning, the RNs constructed new knowledge and meaning from experience using meta-cognitive abilities and reflection based on the perspectives of cognitive constructivism. The RNs who participated collaboratively, either online or face-to-face, in informal learning using their mobile devices incorporated socio-constructivism for constructing knowledge and meaning-making from social discourse.

The lack of formal educational resources, lack of connectivity for accessing the Internet, and/or lack of employer support was relevant to the informal learning of the RNs using their mobile devices. Due to these **healthcare workplace-related influences**, RNs proactively used their ingenuity, as well as their own personal mobile devices and mobile services data plans to meet their informal learning needs. Csech, Watkins, and Marsick (1999) assert that the workplace context "permeates every phase of the learning process -- from how the learner will understand the situation, to what is learned, what solutions are available, and how the existing resources will be used" (as cited in Marsick et al., 2011, p. 67).

Within this informal learning process, the RNs used action and reflective practice for informal learning in order to integrate and apply new knowledge and skills for continuing professional education and professional development. Moreover, the informal learning process using mobile devices provided the RNs with

opportunities for maintaining and enhancing continuing competency, essential requirements for regulated professional nursing practice.

Chapter Summary

Guided by the research questions that were drawn from the study's theoretical framework of informal learning in the workplace, the quantitative and qualitative results on informal learning of RNs using mobile devices in the healthcare workplace were integrated in this chapter. From this integrative analysis, the findings revealed that the RNs employed self-directed informal learning that was planned and conscious, for the informal strategies or processes using mobile devices in their work settings. New situations and non-routine conditions were the triggers for self-directed learning using handheld devices for the purposes of informal learning. However, there was a lack of awareness for including informal learning using mobile devices as part of the requirements of maintaining competency for professional practice and registration. There was divergence in the integrated findings as to the frequency of use for collaborative modes, suggesting the need for further study. However, the analysis suggested that the RNs were using the individual modes for the most part, for the purposes of informal learning. Minimal differences were noted between the age-generational categories and their uses of mobile devices for informal learning in the workplace. The use of mobile devices for informal learning led to positive perceptions; however, these experiences were also influenced by the context of the healthcare workplace.

CHAPTER 7

CONCLUSIONS AND RECOMMENDATIONS

Continuous restructuring and reorganization of the Canadian healthcare workplace has created challenges for the delivery of formal work-based education and training programs. Opportunities for formal education and in-service training have declined, creating difficulties for RNs to meet their ongoing learning needs for continuing professional education, professional development, and continuing competence. As self-regulated professionals, RNs are seeking other means to meet their requirements for competency.

In the workplace, informal learning is the primary method for ongoing skill development and knowledge construction (Cross, 2007). Informal learning offers the flexibility to learn from workplace experiences and has become a recognized, accepted way of meeting regulated professional competence. The use of mobile devices in the healthcare workplace is becoming more common for accessing online information and provides a valuable tool for informal learning.

Informal learning in the healthcare workplace, particularly for the purpose of professional development and ongoing maintenance of competency, is an under-researched area. Additionally, there is a paucity of literature on the use of mobile devices as potential learning tools for informal learning. Therefore, the results of this dissertation study contribute to the body of research and provide a greater awareness of the potentials related to informal learning of RNs using mobile devices in the healthcare workplace.

Moreover, informal learning using mobile devices in the healthcare workplace has the potential to offer RNs flexibility and learner-centred control for meeting their continuous learning needs for professional development and maintaining competence. Therefore, the results of this dissertation research study support the use of mobile devices for just-in-time informal learning of RNs for knowledge construction and meaning-making for informing their professional practice.

Although this mixed methods research study was exploratory and no hypotheses were made, careful attention was paid to appropriate sampling, instrumentation, and statistical analysis of the quantitative data for validity and possible replication. For the qualitative data, as discussed in Chapter 3, trustworthiness strategies were woven into the data coding, analysis, and interpretation processes to reduce potential bias and contribute to the rigor of this dissertation research study. Strategies to limit potential biases included using an anonymous online survey, field testing of the online survey, piloting of the semi-structured interview questions, and member checking of the transcripts.

As discussed in Chapter 4, the major limitation inherent in this study was associated with the participants' enrollment in an online Bachelor of Nursing program and their perceptions of receptiveness to adopting new technologies in the healthcare workplace. These two aspects limit the generalizability and transferability of the study findings to other populations.

In the conclusions that follow, how RNs engaged in informal learning using mobile devices in the healthcare workplace will be addressed for each research question. Recommendations from the perspective of nursing professional practice

and suggestions for future research are then considered. The chapter concludes with closing thoughts from the author.

Conclusions from Research Questions

In this section, the conclusions for this dissertation research study are summarized in response to each of the four main research questions.

Strategies or processes for informal learning using mobile devices.

The first research question asked: What informal learning strategies or processes do RNs engage in when using mobile devices in the healthcare workplace? The integrated results demonstrated that participants in this mixed methods study purposively selected self-directed informal learning strategies and processes using their mobile devices to respond to new situations and non-routine conditions in their places of work. Participants used primarily the strategies of *searching the Web (including the Intranet)*, and *searching online databases* and used least frequently the process of *asking questions in a professional listserv or online community*. Participants indicated they were comfortable with searching for information for their informal learning on the Web or in online databases but were ill at ease with posting questions in a professional listserv or online community. This finding is in keeping with prior research results that suggest professionals may be reluctant to post specific questions related to their job tasks in an online community (Berg & Chyung, 2008).

The process of trial and error was minimally reported and no indications of tacit learning were found in this mixed methods study. Wihak and Hall (2011) speculate that tacit informal learning is often not articulated, as the learner is unaware that learning has occurred. Furthermore, these authors state that it is difficult to

assess this form of informal learning and that "methods other than surveys, interviews and questionnaires would need to be employed" (p. 8). Berg and Chyung (2008) propose that the challenge of studying tacit informal learning in the workplace may be better suited to ethnographic research methodology.

Rather, the study participants reported incorporating reflective practice with self-directed informal learning using mobile devices that led to construction of knowledge, understanding, and meaning-making required for continuing professional education and professional development. Reflection-in-action was used for problem solving that was triggered by a new situation or non-routine conditions; while reflection-on-action assessed the outcomes of using informal learning strategies or processes with mobile devices. As Marsick et al. (2011) state, "reflection is central to every phase of experiential learning" (p. 66) for understanding and addressing new challenges.

The context of the healthcare workplaces may have influenced the choice of strategies or processes employed for informal learning using the mobile devices. Marsick et al. (1999) posit that the context for learning is pervasive, influencing every step of informal learning and the resources used. In this dissertation study, participants were confronted with workplace-related influences including inaccessible and/or unavailable educational resources for evidence-based practice, lack of Internet connectivity, and/or lack of employer support for using mobile devices for informal learning in their work settings. Faced with these challenges, the participants proactively used informal learning strategies or processes using their mobile devices for meeting their learning needs for continuing professional education and

professional development, and continuing competence. Furthermore, in using the informal strategies or processes with mobile devices, the participants reported positive perceptions of increased efficiencies for obtaining timely up-to-date information, increased self-confidence, increased patient/client safety, and positive patient/client reactions. Additionally, they recognized the need for sanctioned resources including websites and applications, and employer-supplied mobile devices to facilitate using the strategies or processes for informal learning.

Purposes for informal learning using mobile devices.

The second research question asked: For what purposes do RNs employ informal learning strategies or processes using mobile devices in the healthcare workplace? Although the RNs in this dissertation study were employing the informal learning strategies or processes using mobile devices for all of the purposes, the most frequently reported purposes were *accessing resources for evidence-based support* and *professional development*. RNs were actively engaging in informal learning using their mobile devices for new knowledge and skills acquisition to inform their professional practice. This finding corresponded with Berg and Chyung's (2008) assertion that professionals engage in informal learning to improve professional practice performance.

The least frequently reported purpose or reason for employing informal learning strategies or processes using mobile devices was for *maintaining competency*. There was a general lack of awareness cited by the RNs as to the potential contribution of informal learning using mobile devices for professional practice competency and registration requirements.

Individual and colloborative modes of informal learning using mobile devices.

The third research question asked: Are there differences between how RNs use individual and collaborative modes of informal learning with mobile devices in the healthcare workplace? The frequency of collaborative mode use for informal learning using mobile devices reported in the online survey was slightly more than individual modes but this finding was not supported in the narrative accounts. The process of *interacting with other people via e-mail* using mobile devices was reported to be used frequently in the online survey. However, this finding was not corroborated qualitatively. The interviewees stated they were not interacting with other people via e-mail using their mobile devices for informal learning but rather using email for communication purposes only in their work settings. Similar to the results in the Clough et al. (2009) study on mobile devices and informal learning, a potential lack of awareness of the participant's participation in collaborative informal learning may have influenced the quantitative findings in this dissertation research study.

For the purposes of informal learning, the RNs used primarily the individual modes of informal learning using their mobile devices to construct new knowledge based on previous learning, as described in the perspectives of cognitive constructivism. This finding concurs with Wihak and Hall's (2011) claim that the individual modes of self-directed learning are the preferred mode for informal learning. However, some RNs engaged in collaborative face-to-face shared activities and social interaction for informal learning with their mobile devices. Further

exploration of the collaborative modes of informal learning using mobile devices is warranted.

Age and use of mobile devices for informal learning.

The fourth research question asked: Is there a relationship between the age of RNs and their use of mobile devices for informal learning in the healthcare workplace? RNs in the three age-generational categories of Generation Y, Generation X, and Baby Boomers engaged in informal learning using mobile devices in the healthcare workplace. The only differences found with age were with the frequencies for the process of *interacting with other people via email* and the purpose of *professional development*, where Generation Y participants used this process and purpose less than the other age generations. No differences among the age generations in terms of the use of individual or collaborative strategies or processes, or location (rural and population centres) for informal learning using mobile devices in the healthcare workplace were found.

The minimal differences associated with age in this dissertation research study were similar to Livingstone's (2000) findings in the Canada-wide NALL survey. Livingstone's study suggested there were no differences related to age and informal learning activities found between middle-aged adults or adults approaching or entering retirement.

Recommendations

Drawing from the results of this dissertation research study, this section discusses recommendations for informal learning of RNs using mobile devices in

their healthcare workplaces related to nursing professional practice and also future research.

Nursing professional practice.

The findings of this study give rise to the following three recommendations for nursing professional practice:

1. RNs require more information and/or education on self-directed informal learning. Regulatory bodies, employers, and educators have an important role to play in raising RNs' awareness and recognition of informal learning in the workplace for contributing to continuing professional education, professional development, and continuing competency.
2. Healthcare organizations should recognize and support the informal learning that RNs are already engaged in using their mobile devices in their workplaces. Employers must review any restrictions and/or areas related to lack of support for RNs using their mobile devices that inhibit informal learning for professional practice. Mobile device guidelines, policy statements, and procedures are required for RNs to maximize their informal learning opportunities in their work settings.
3. The expressed need for sanctioned resources for informal learning of RNs using mobile devices in the healthcare workplace, including approved websites and applications, and employer-supplied handheld devices calls for further exploration by healthcare organizations and regulatory bodies.

Future research.

Stemming from the findings of this study, the following six recommendations are proposed for future research:

1. Due to the exploratory nature of this dissertation research study, additional studies (including longitudinal studies) are needed to assess and provide further breadth and depth on the strategies, processes, and purposes used for informal learning of RNs using mobile devices in the healthcare workplace.
2. Further exploration of individual and colloborative modes of informal learning using mobile devices is advised for understanding how social processes may influence informal learning and inform professional nursing practice.
3. Additional investigations are required into how workplace influences affect the informal learning processes of RNs for meeting their learning needs for continuing education, professional development, and continuing competency.
4. Research into the reasons why RNs are using mobile devices in their workplaces may provide greater understanding of the motivations for engaging in informal learning in nursing practice.
5. Exploration into the adoption of mobile devices by nurses as a new technological innovation is needed to determine the receptiveness for use in the healthcare workplace.
6. Additional investigations of other professions related to informal learning using handheld devices may add to the theory base of informal learning and to the body of knowledge on workplace learning.

Concluding Thoughts

Changing demographics, technological advances, socio-cultural issues, and economic concerns are affecting work-life and learning globally, creating a fruitful climate for the exploration of new pedagogical practices and models of work and learning for professions (Marsick et al., 2011). In this context, RNs are proactively seeking means, other than formal education activities, for meeting their learning needs for continuing professional education, professional development, and continuing competence.

Throughout this exploratory dissertation research study, RNs expressed the importance of informal learning in the healthcare workplace using mobile devices for acquiring knowledge and developing skills as a means for improving professional nursing practice and quality of patient care. RNs are using this self-directed, learner-centered mode to engage in informal learning regardless of whether their workplaces had structures in place to support their learning. Furthermore, as the use of mobile devices becomes more ubiquitous, there is the potential for this powerful tool to rapidly accelerate participation in informal learning in the challenging milieu of nursing professional practice.

The findings from this dissertation research study point to the significance of informal learning using mobile devices as learning tools for RNs' construction of knowledge and meaning-making to inform professional development and continuing competence. As the need for learning in the healthcare workplace continues to grow, further empirical inquiry on informal learning using mobile devices is needed to obtain an in-depth understanding of the intertwined processes of work and learning.

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Appendix A: Survey Questionnaire

Informal Learning in the Healthcare Workplace and Mobile Device Usage Survey

The purpose of this online questionnaire is to examine Registered Nurses' informal learning using mobile devices in the healthcare workplace. **Only one survey is to be completed per student.**

Your accurate and honest opinions are highly valued and deeply appreciated. The information collected in this questionnaire is **confidential.**

Part 1 - Background Information – Please answer all the questions by entering a √ in the circle.

1. In what province/territory are you working as a Registered Nurse?

   ○ British Columbia ○ Alberta ○ Saskatchewan ○ Manitoba ○ Ontario ○ Quebec

   ○ New Brunswick ○ Nova Scotia ○PEI ○ Newfoundland ○ Northwest Territories

   ○ Yukon ○ Nunavut ○ Other (please specify) _____

2. What is the location of your job as a Registered Nurse? ○ Rural ○ Population centre (minimum population over 1,000 and a population density of 400 people per square kilometer).

3. What is your work setting for your job as a Registered Nurse?

   ○ Hospital ○ Public Health ○ Community Health Agency ○ Education Institution
   ○ Private Nursing Agency ○ Rehabilitation Hospital ○ Community Nursing Clinic
   ○ Physician/ Dentist/ Family Practice Unit ○ Business/ Industry/ Occupational Health
   ○ Nursing Home/ Long- term Care ○ Home Care Agency ○ Mental Health Centre
   ○ Association/ Govt/ Regional Office ○Primary Care ○Other (please specify) _____

4. What is your position title?

   ○ Staff/Community Health Nurse ○ Manager/Assistant Manager ○ Nurse Practitioner
   ○ Clinical Nurse Specialist ○ Chief Nursing Officer/Chief Executive Officer
   ○ Consultant ○ Director/Assistant Director ○ Instructor/Professor/Educator
   ○ Researcher ○ Other (please specify) _____

5. How many years have you been employed as a Registered Nurse? _____
6. What is your gender? ○ Female ○ Male
7. What is the highest level of education that you have completed?

   ○ Diploma ○ Bachelor degree ○ Masters' degree ○ PhD/Doctorate

8. What is your age?_____

Part 2 – Mobile Devices: A handheld device such as a Smartphone, personal digital assistant (PDA), tablet, or other portable device that provides access to the Internet, e-mail, telephone, or other form of communication.

Please answer all the questions by entering a √ in the circle.

9. What types of mobile device(s) do you use in your job in the healthcare workplace?

○Personal Digital Assistant (PDA) ○Smartphone ○ iPod ○iPad ○Other (please specify)_____

10. How long have you been using mobile devices in your job in the healthcare workplace?

○ Less than 3 months ○4 to 12 months ○1 to 2 years ○ 2-3 years ○3-5 years ○ over 5 years

11. For what kinds of activities do you use mobile devices in your job in the healthcare workplace?

○ Making calculations ○ Documenting clinical practice ○ Accessing nursing support software

○ Downloading clinical reference materials ○ Email ○ Texting ○ Taking photos or videos

○ Instant Messaging ○Other (please specify)_____

12. Please enter a √ **in the circle** beside the statement below that best describes your usual reaction to a new technology:

○ I am usually one of the first few nurses at work to try out a new technology.

○ I usually try out a new technology once I have seen other nurses at work use it successfully.

○ I will only use a new technology at work once I have seen many other nurses successfully use it.

○ I am usually one of the last nurses at work to use new technologies.

Part 3 - Modes of Learning

A. Formal learning: Any learning taking place within a formal educational/training setting in which you seek understanding, knowledge, or skills pertaining to your job in the healthcare workplace.

Please enter your level of agreement by clicking on a circle in each of the following questions:

13. How frequently do you use the following formal learning strategies when you need to learn something new in order to perform your job in the healthcare workplace?

	Never	Sometimes	Often	Always
• Take a course	○	○	○	○
• Attend an in-service training session	○	○	○	○
• Attend a workshop or conference	○	○	○	○
• Take an online course	○	○	○	○
• Attend an online training session	○	○	○	○
• Attend an online workshop/conference	○	○	○	○

- If you use other formal learning strategies, please indicate the type of strategy and frequency (either sometimes, often, or always) in this space_____

B. Informal learning: any activity taking place outside of a formal educational/training setting in which you seek understanding, knowledge, or skills pertaining to your job in the healthcare workplace. Please enter your level of agreement by clicking on the circle:

14. How frequently do you use the following informal strategies or processes when you need to learn something new in order to perform your job in the healthcare workplace?

	Never	Sometimes	Often	Always
• Reflect on my previous actions and prior knowledge	○	○	○	○
• Learn by trial and error	○	○	○	○
• View a video, webcast, or podcast	○	○	○	○
• Search the web (including the Intranet)	○	○	○	○
• Search an online database (e.g., Medline)	○	○	○	○
• Read books, magazines, and/or journals	○	○	○	○
• Observe others on the job	○	○	○	○
• Talk with people at work	○	○	○	○
• Talk on the phone with others	○	○	○	○
• Interact with other people via e-mail	○	○	○	○
• Ask questions in a professional listserv or online community	○	○	○	○

- If you use other informal strategies or processes, please indicate the type of strategy or process and frequency (either sometimes, often, or always) in this space

_____

15. How frequently do you use a **mobile device** for the following informal strategies or processes when you have to learn something new in order to perform your job in the healthcare workplace?

	Never	Sometimes	Often	Always
• Reflect on my previous action and knowledge using notes, diary, or some other method using my mobile device	○	○	○	○
• Learn by trial and error	○	○	○	○
• View a video, webcast or podcast	○	○	○	○
• Search the web (including the Intranet)	○	○	○	○
• Search an online database (e.g., Medline)	○	○	○	○
• Read books, magazines, and/or journals	○	○	○	○
• Observe others on the job such as photos	○	○	○	○
• Talk on the phone with others	○	○	○	○
• Interact with other people via e-mail	○	○	○	○

- Ask questions in a professional listserv or online community ○ ○ ○ ○
- If you use other informal strategies or processes with a mobile device, please indicate the type of strategy or process and frequency (either sometimes, often, or always) in this space

  _____

16. For the informal strategies or processes identified in the last question above, what were the main reasons that you used a **mobile device** to learn something new in order to perform your job in the healthcare workplace?

○New procedure/treatment ○Accessing resources for evidence based support

○Patient/client teaching ○Professional development ○Maintaining competency

○Other (please specify) _____

Thank you for taking the time to complete this survey. Your effort is very much appreciated.

Optional Information

As a thank you for your time, you have the opportunity to enter your name into a random draw for an iPad to be held on October 21, 2011. In this draw, **one iPad** will be awarded to a participant who completes the survey.

Only one survey is to be completed per participant.

Additionally, you may volunteer to participate in a follow-up interview on informal learning using mobile devices in the healthcare workplace. This interview will be about one hour in length. As a thank you for participating in this interview, a **$40 gift certificate** for Tim Hortons will be given to each interview participant. The researcher will use the survey results and identifying information in the selection process for the follow-up interview.

Please indicate your choice(s) for participating in the draw and/or interview by entering a √ in the circle below.

○ Enter my name in the **draw for an iPad** as a thank you for completing this anonymous survey. The draw will be administered by an independent party and my name will be used for the draw only.

○ I would like to volunteer to participate in the follow-up interview and receive a **$40 gift certificate** as above. I understand my name and contact information will be provided to the researcher.

For the survey draw and/or participating in the interview, please provide your name, email address, and telephone number.

Your name _____

Email address _____

Telephone number including area code# _____

Thank you again for your participation!

Appendix B: Invitation to Participate in the Online Survey

Do you use a mobile device at work? If so, here's an opportunity to contribute to research for improving healthcare practices and win an iPad handheld computer.

Registered nurses who currently use mobile devices in the healthcare workplace are invited to participate in a research study that explores how these devices support and enhance informal learning in this context.

A mobile device is defined as a portable, handheld device that provides access to the Internet, e-mail, telephone, or other form of communication – such as a Smartphone, iPhone, Blackberry, iPad, iPod, or personal digital assistant (PDA).

This study involves the completion of an online questionnaire that will take approximately 20 minutes to complete. The survey is to be completed by October 21, 2011. There will be a **draw for one iPad handheld computer** from among those participants who complete the survey and choose to enter the draw. Only one survey is to be completed per participant. Chances of winning are estimated a 1 in 100, but may be higher or lower dependent upon actual entries.

You will also have the opportunity to volunteer to participate in a follow-up telephone interview. Participants in the interviews will receive a **$40 gift certificate.** Participation in the interviews will not affect your studies or your standing in your courses. Not all participants who volunteer will necessarily be chosen for the interview as there is a selection process.

This study is part of a dissertation research study conducted by Willy Fahlman, a doctoral student in the Centre for Distance Education. The Centre for Nursing and Health Studies has indicated their support of this research. The research is being supervised by Dr. Susan Moisey, Associate Professor, Centre for Distance Education. If you have any questions about the study, contact information for the Researcher and Research Supervisor are provided below

Researcher: Willy Fahlman,
Phone: 1-403-886-4975
Email: willyfahlman@shaw.ca

Research Supervisor: Dr. Susan Moisey
Phone: 1-866-403-7426
Email: susanh@athabascau.ca

Thank you in advance for your interest in this study. To participate, please click on the link below to proceed to the survey. *Link to access survey added here*.

Appendix C: Reminder Email

Recently you were invited to participate in an online survey on the use of mobile devices at work. If you have already completed this survey, thank you for your participation. It is much appreciated.

However, if you have not yet completed this survey, please do so. This is an opportunity to contribute to research for improving healthcare practices and to win an iPad handheld computer.

Registered nurses who currently use mobile devices in the healthcare workplace are invited to participate in a research study that explores how these devices support and enhance informal learning in this context.

Mobile devices include handheld devices such as Smartphones, iPhone, Blackberry, iPad, iPod, personal digital assistant (PDA), tablet, or any other portable device that provides access to the Internet, e-mail, telephone, or other form of communication.

This study involves the completion of an online questionnaire that will take approximately 20 minutes to finish. The survey is to be completed by October 21, 2011. There is a **draw for one iPad handheld computer** for students who complete the survey. Only one survey is to be completed per participant. Chances of winning are estimated a 1 in 100, but may be higher or lower dependent upon actual entries.

You will also have the opportunity to voluntarily participate in a follow-up telephone interview. Participants in the interviews will receive a **$40 gift certificate.** Participation in these interviews will not affect your standing in your courses. Not all participants who volunteer will necessarily be chosen for the interview as there is a selection process.

This study is part of a dissertation research study conducted by Willy Fahlman, a doctoral student in the Centre for Distance Education. The Centre for Nursing and Health Studies has indicated their support of this research. The research is being supervised by Dr. Susan Moisey, Associate Professor, Centre for Distance Education. If you have any questions about the study, contact information for the Researcher and Research Supervisor are provided below

Researcher: Willy Fahlman,
Phone: 1-403-886-4975
Email: willyfahlman@shaw.ca

Research Supervisor: Dr. Susan Moisey
Phone: 1-866-403-7426
Email: susanh@athabascau.ca

Thank you in advance for your interest in this study. To participate, please click on the link below to proceed to the survey.

Link to access survey added here

Appendix D: Survey Consent

To be completed only by post-RN Bachelor of Nursing students

Welcome to the survey site on informal learning by registered nurses using mobile devices in the healthcare workplace.

The purpose of this survey is to explore how nurses use mobile devices in the healthcare workplace, particularly for informal learning. There are no known risks in participating in this survey. Post-RN students who work in a variety of settings are invited to participate. The survey takes approximately 20 minutes to complete. Once the survey results have been collected, telephone interviews will be conducted with selected students.

The survey is anonymous. You will not be asked to identify yourself unless you wish to enter the draw for an iPad handheld computer and/or to volunteer to participate in a follow- up interview. Your identity and responses will be kept strictly confidential.

Participants completing the survey are eligible for the draw for an iPad handheld computer. The draw will be conducted on October 21, 2011. Chances of winning are estimated at 1 in 100, but may be higher or lower dependent upon actual entries.

Before you can begin the survey, you must provide your consent. Please take the time to read this page carefully. You may also want to print a copy of this page for your records

Your participation in the survey is voluntary, anonymous (unless you provide identifying information), and confidential. You may decide to not answer a question or discontinue the questionnaire at any time. However, once your answers are entered and submitted, they cannot be changed and become part of the study database.

Only the researcher, research assistant, and research supervisor will see the answers to the survey questions. Information will be grouped and summarized for the purpose of disseminating the results. Throughout the research project, the database will be maintained in a password-protected computer file that is only accessible by the researcher. Once the study has been completed, and results have been compiled, the survey data will be retained for future research use.

The draw will be administered by an independent party and your name and contact information will be used to conduct the draw only. Once the iPad handheld computer is awarded, the names and contact information will be destroyed.

If you volunteer for the follow-up interview, your name, contact information, and survey data will be provided to the researcher for the selection of participants to be invited for an interview.

You may obtain a summary of the results of the study by sending an e-mail request to the researcher. The existence of the research will be listed in an abstract posted online at the Athabasca University Library's Digital Thesis and Project Room; and the final research paper will be publicly available.

Questions or Concerns - If you have any further questions or want clarification regarding this research or your participation, please contact:

Researcher: Willy Fahlman email: willyfahlman@shaw.ca phone: 1-403- 886-4975

Research Supervisor: Dr. Susan Moisey email: susanh@athabascau.ca phone: 1-866-403-7426

The Athabasca University Research Ethics Board has reviewed this research study and may be reached by e-mailing rebsec@athabascau.ca or calling 1-780-675-6718 if you have questions or comments about your treatment as a participant in this study.

Giving your consent to participate in this survey indicates:

1. You are over the age of 18,
2. You understand to your satisfaction the information provided to you about your participation in this survey, and
3. You agree to inclusion of your data in this part of the study.

When you click the "PROCEED TO SURVEY" link below, you are giving your consent to participate in this part of the study.

PROCEED TO SURVEY

Appendix E: Semi-structured Interview Questions

I would like to gather additional information on your informal learning using mobile devices in your healthcare workplace. I have some questions to help guide this interview but please feel free to add any comments or you may refuse to answer any question during our conversation. The interview time is approximately one hour.

1. What prompted you to use mobile devices in your job?
    - Potential probe - Has this changed over time?
2. What strategies or processes do you use most frequently in your job to meet your learning needs?
    - Potential probe - Which one(s) involve the use of your mobile device?
3. In what ways do you use your mobile device for learning in your job spontaneously, without pre-planning? What do you use it for when you are able to plan ahead for your learning?
4. Why do you engage in informal learning in your job in the healthcare workplace?
    - Potential probe - Why might you use your mobile device in this learning?
5. What benefits do you get from using your mobile device to help meet your learning needs associated with your job?
6. How do you use your mobile device when learning something new? On your own or in collaboration with others?
    - Potential probe - Do you prefer to learn on your own or with others?

7. Describe a recent time when you solved a situation or problem in your job through informal learning involving the use of your mobile device.
    - Potential probe – Were you satisfied with outcome? Would you change anything?
8. For the future, how do you envision the use of mobile devices for your informal learning in your job?
9. How do use your mobile device for informal learning for maintaining competency for professional regulation?
10. Is there anything else you would like to add?

Appendix F: Semi-structured Interview Invitation/Consent

As a post-RN student enrolled in the [name] Bachelor of Nursing program, you are invited to participate in an interview in conjunction with a research study on the informal learning of registered nurses using mobile devices in the healthcare workplace.

Description of Research: As a follow-up to the survey on informal learning by registered nurses who use mobile devices in the healthcare workplace, telephone interviews will be conducted to gather further information on this topic. By participating in an interview, you will be providing valuable information about how registered nurses engage in informal learning using mobile devices in the healthcare workplace.

The telephone interview will take approximately 1 hour to complete. It will be recorded using a digital recorder and transcribed by the researcher. You will have the opportunity to read the transcription of the interview and make corrections as necessary. The interview will be scheduled at a time that is mutually convenient for you and the researcher.

Risks and Benefits: There are no known risks in participating in this interview. Your participation will not affect your standing in your courses.

Right to Refuse: Your participation in the interview is entirely voluntary. You may withdraw at any time, without prejudice or academic penalty. If you withdraw, the data collected from your interview will be withdrawn from the study data base. You may refuse to answer any question in the interview for any reason.

Privacy and Confidentiality: Steps will be taken to respect your privacy and confidentiality throughout the interview. The names and contact information of the respondents volunteering for follow-up interviews will be deleted once the interviewing process has been completed. A pseudonym will be used to identify you, both in the analysis and in reports. All data will be stored in password-protected files or in a locked cabinet at the researcher's home office. Only the researcher and the research supervisor will have access to the interview data. Once the study has been completed and results have been compiled, the data will be retained for future research use. This data will not have any identifiers except pseudonyms and no keys will be kept.

Dissemination of Results: Information will be grouped and summarized for the purpose of disseminating the results. No identifiable information will appear in the research report, now or in the future.

You may request a summary of the results of the study. The existence of the research will be listed in an abstract posted online at the Athabasca University Library's

Digital Thesis and Project Room and the final research paper will be publicly available.

Questions or Concerns - If you have any questions or require clarification regarding this research or your participation, please contact:

Researcher: Willy Fahlman email: willyfahlman@shaw.ca phone: 1-403-886-4917

Research Supervisor: Dr. Susan Moisey email: susanh@athabascau.ca phone: 1-866-403-7426

The Athabasca University Research Ethics Board has reviewed this research study and may be reached by e-mailing rebsec@athabascau.ca or calling 1-780-675-6718 if you have questions or comments about your treatment as a participant in this study.

If you would like to take part in an interview, please read the consent below and then email me that you give consent to participate in this part of the study.

Giving your CONSENT to participate in this part of this study indicates that:

1. You are over the age of 18.

   [if yes, proceed to next question]

2. You understand to your satisfaction the information provided to you about your participation in the interview part of this research project.

   [if yes, proceed to next question]

3. You agree to inclusion of your data in this study.

[if yes, please email willyfahlman@shaw.ca stating your consent for participation in this study]

Appendix G: Research Ethics Board Approval

MEMORANDUM

DATE: August 17, 2011

TO: Dorothy (Willy) Fahlman

COPY: Dr. Susan Moisey (Research Supervisor)

Janice Green, Secretary, Research Ethics Board

Dr. Simon Nuttgens, Chair, Research Ethics Board

FROM: Dr. Rhiannon Bury, Acting Chair, Research Ethics Board

SUBJECT: **Ethics Proposal #11-28** ***"Informal Learning of Registered Nurses Using Mobile Devices in the Healthcare Workplace"***

Thank you for your revised application arising from the Research Ethics Board's "Conditional Approval" memo of August 4, 2011. Your cooperation in addressing the outlined items was appreciated.

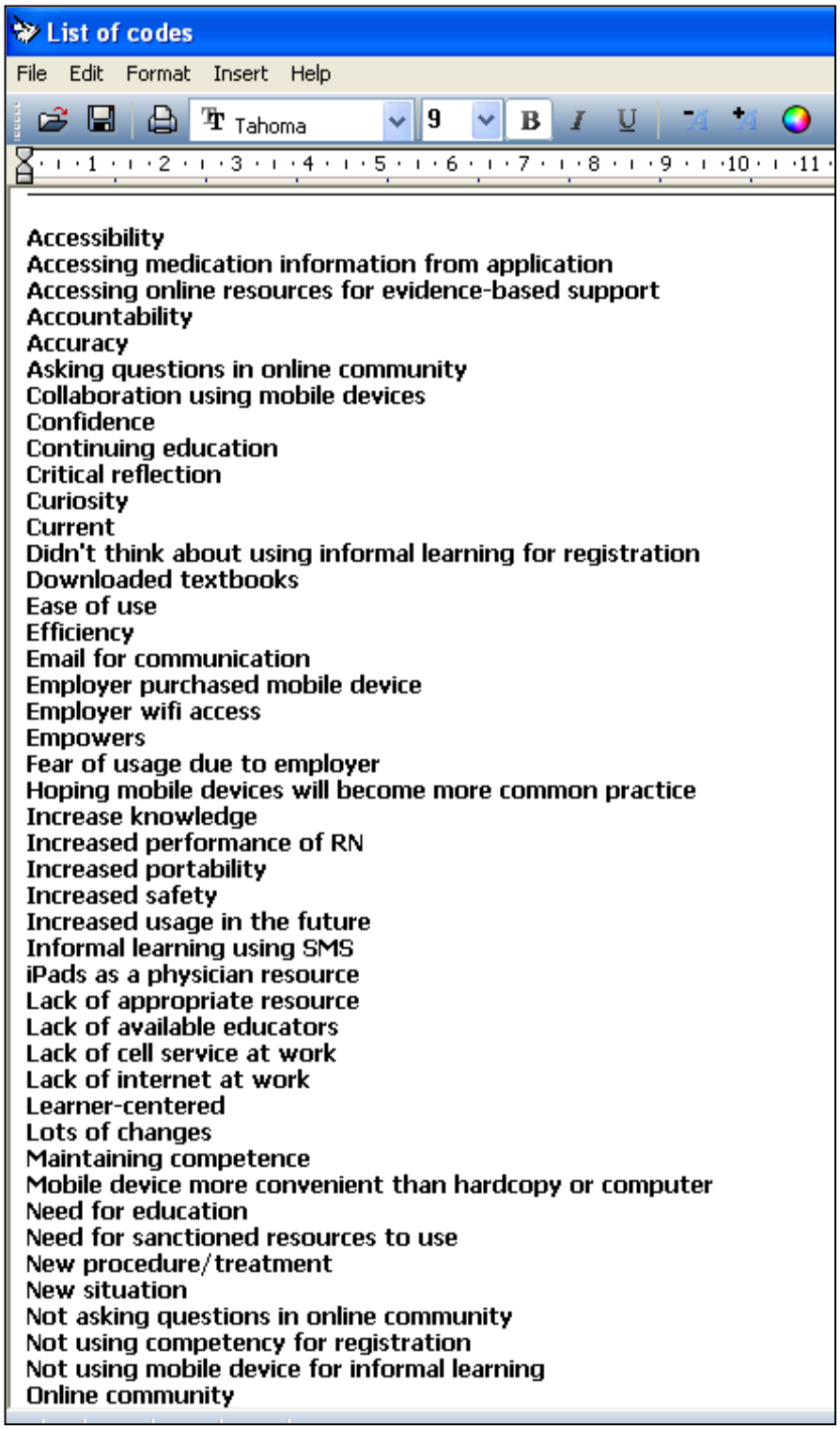
On behalf of the Athabasca University Research Ethics Board, I am pleased to confirm that this project has been granted **FULL APPROVAL** on ethical grounds, and you may proceed with participant contact as soon as the additional information noted below has been received.

For file purposes only (no further review required), prior to recruitment, provide a copy of **Athabasca University Institutional Permission**, issued from Vice-President Academic Dr. Margaret Haughey, allowing access to AU systems and students for research purposes.

The approval for this study "as presented" is **valid for a period of twelve months** from the date of this memo**. A final Progress Report (form) is to be submitted when the research project is completed.** Reporting forms are available online at http://www.athabascau.ca/research/ethics/.

As you progress with implementation of the proposal, if you need to make any changes or modifications please forward this information to the Research Ethics Board as soon as possible. If you have any questions, please do not hesitate to contact rebsec@athabascau.ca

Appendix H: Example of Codes from ATLAS.ti®



Appendix I: List of Code Categories

Code Categories
• Connectivity Issues • Fear of Mobile Device Usage • Lack of Educational Resources • Using own mobile devices • Ask questions in a professional listserve or online community • Interact with other people via email • Learn by trial and error • Read books, magazines, or journals • Reflect on previous action and take notes • Search an online database • Search the Web (including Intranet) • View a video, webcast, or podcast • Increased efficiencies • Increased patient/client safety • Increased self-confidence • Need for sanctioned resources • Positive reactions from patients/clients • Accessing resources for evidence-based support • Maintaining competence • New procedure/treatment • Patient/client teaching • Professional development • New situation • Non-routine conditions • Planned learning • Reflective practice

Appendix J: Example of Codes and Categories of a Theme

Codes	Categories	Theme
• Accessibility • Accountability • Accuracy • Confidence • Current • Ease of use • Efficiency • Empowers • Increase knowledge • Increased performance of RN • Increased portability increased safety • Increased usage in the future • Mobile device more convenient than hardcopy or computer • Need for sanctioned resources • Perceptions of competence by clients • Positive reaction from client • Resourceful • Small size of mobile device • Time savings	1. Increased efficiencies 2. Increased patient/client safety 3. Increased self-confidence 4. Need for sanctioned resources 5. Positive reactions from patients/clients	Perceptions of Informal Learning using Mobile Devices