Science and Mathematics Education Centre

Factors Influencing Nurses' Attitudes Towards Information Technology in Nursing Practice in Western Australia
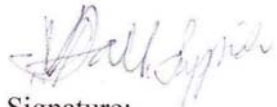

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Doctor of Philosophy
of
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DECLARATION

This thesis contains no material which has been accepted for the award of any other degree or diploma in any university. To the best of my knowledge and belief, this thesis contains no material previously published by any other person except where due acknowledgement has been made.

Signature:

Date: 27/6/2014.

ABSTRACT

The overarching aim of the study reported in this thesis was to examine factors that influence nurses' attitudes towards computerisation and the use of information technology, nursing informatics and information communication technologies in their daily nursing practice. In particular, this research focused on the use of information technology in the daily work of registered nurses and the training in information technology skills provided at the workplace. The nurses' perceived learning and training needs in relation to their personal skill-rating was examined according to nurses' age.

A mixed-methods approach involving the collection of both quantitative and qualitative data was used to provide a more exploratory approach to the emerging field of information technology and informatics in nursing practice. As a first step, I developed and validated a survey to examine nurses' attitudes towards information technology in health care. In the development of my survey, I drew on two existing surveys, Stronge and Brodt's (1986) *Nurses' Attitudes toward Computer* (NATC) questionnaire and Jayasuriya and Caputi's (1996) *Nurses' Computer and Attitude* (NCATT) Inventory. Permission to use the instruments to develop a new questionnaire, tailored for this research, was granted by both authors. The newly-developed 21-item instrument, named the *Nurses Computers & Information Technology* (NCIT) questionnaire, was piloted with 50 registered nurses at two Perth hospitals in terms of feedback and suggestions, face validity, and overall comprehensibility of each item. This feedback was used to refine the questionnaire.

The survey was sent to 500 registered nurses, randomly selected by the Nurses and Midwives Board of Western Australia (NMBWA), from the nurses' register. Of these, 134 surveys were received and found to be usable. Data collected from the 134 nurses were analysed in various ways to examine the factor structure and internal consistency reliability, both of which were found to be acceptable.

Simple correlations were used to examine whether there were statistically significant associations between nurses' personal skill-rating and their attitudes towards using information technology in health care. The findings suggest that the more competent

nurses rate themselves, the more likely they are to highlight the benefits of information technology in healthcare. The findings also suggested that the nurses who rated themselves as less competent, in terms of their skills with information technology, the more likely they were to focus on the pitfalls of information technology in healthcare and were less likely to perceive the need for information technology and associated skills in health care.

Multivariate analysis of variance (MANOVA) was used to examine whether differences in attitudes existed between younger nurses (less than 35 years) and older nurses (35 years or more). The findings suggested that the nurses in the older age group generally held more positive views of the Benefits of Information Technology and the Need for Information Technology and Associated Skills than their younger counterparts. In contrast, the younger nurses (less than 35 years) considered that there were more pitfalls associated with the use of information technology in nursing than did their older colleagues. The quantitative findings were strengthened by the interview data and textual comments provided in survey.

The results of this study indicated that Western Australian nurses had concerns with inadequacies in the implementation of clinical applications, the amount of time to attend training, the training, and also information provided to nurses. Others were concerned with data security and privacy, and some were stressed over increased workload and experiences of poor interdisciplinary cooperation among work colleagues. The findings of my study concur with similar findings identified by other Australian and international researchers in regards to the attitudes of nurses towards information technology.

For future research, it is recommended that this study is replicated with a larger sample size and with recent graduates to allow for broader generalisation of the findings. Moreover, because technology changes rapidly, questionnaire items about which skills should be updated to reflect current technology such as charting medication. My research provided insight into nurses' attitudes towards the use of information technology in clinical practice in Western Australia that could be of practical value as nurses move towards an increasingly paperless working environment.

DEDICATION

This Thesis is dedicated to

My late father, A.S.V. Suppiah.

For his wisdom in education, hard work and study.

And my dear cat, Rex.

Who, until recently, was my study companion who stayed with me into the wee hours of the morning. I dearly miss you Rex.

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I take this opportunity to thank Dr. Heather Jenkins, my supervisor at the start of this study, who was forced to relinquish her role on my thesis committee due to ill health.

I would also like to extend a big thank you to the administrative staff at Science and Mathematics Centre, Curtin University, including Petrina Beeton, Sonia McIntyre, Pauline Howat and Rosalie Wood for all of their administrative advice and support.

Many thanks go to my family, in particular my husband, John Dall for his understanding when I ignored him. My thanks for your tremendous support and the many cups of coffee and chats that helped me to get through my study.

A big thank you to all the registered nurses, staff development nurses and educators, and academics who participated in the research; my deepest hope is to faithfully represent them and their work in this dissertation.

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Chapter 1

INTRODUCTION

1.1   Introduction

Over the past two decades, there have been significant developments in the nature of information and communication technology and the extent of its use in nursing worldwide (Magnusson, Hanson & Borg, 2004; Smedley, 2005; While & Dewsbury, 2011). In many countries, health care systems are changing at a rapid rate. Many of today's nurses were born in the industrial age and are now living in an intensifying technological age (Porter-O'Grady, 2003). As information technology becomes critical to the workplace, nurses are required to come to terms with the increasing reliance on information technology in the work environment (Hughes, 2003; McCannon & O'Neal, 2003). The overarching aim of the study reported in this thesis was to examine factors that influenced nurses' acceptance of information technology in their practice.

The present study is indroduced in this chapter using the following headings:

- Background (Section 1.2)
- Nursing in the Technological Age (Section 1.3);
- Rationale for the Study (Section 1.4);
- Research Objectives (Section 1.5);
- Significance of the Study (Section 1.6);
- Conceptual Framework (Section 1.7);
- Limitations of the Study (Section 1.8); and
- Overview of Thesis (Section 1.9).

1.2   Background

Whether in research, administration, education or clinical services, information technology has, within a short time, become one of the basic building blocks of modern society (Alampay, 2005; Australian Bureau of Statistics, 2007; Commonwealth of Australia, 2005; de Veer & Francke, 2009). Many countries now

regard the understanding of information technology, together with the mastering of basic skills and concepts associated with information technology, as one of the core subjects of education, alongside reading, writing and numeracy. For nursing, this is no exception as the technology revolution of the twenty-first century has seen the emergence of communication and electronic technologies encroaching rapidly into every sphere of health care delivery.

The last two decades have heralded significant developments in the nature and use of information technology in nursing around the world, in general (Bickford, Smith, Ball, Frantz, Panniers, Newbold, Knecht, Farish-Hunt & Cortes-Comerer, 2005; Brittain & Norrist, 2008; Bucknall & Hutchinson, 2006), and in Australia, in particular (Garde, Harrison & Hoevnga, 2005; Smedley, 2005; Department of Health, Western Australia, 2006; Department of Health and Ageing, 2008; Dragon, 2006, 2008). A variety of terms and definitions have arisen, both within Australia and in other parts of the world, to describe the processes related to information technology and, as a result, discussions have, in the past, suffered from a lack of clarity. In an attempt to standardise the terms and definitions, both within Australia and in Australia's international dealings, the Health Online Committee[1] has suggested, that whilst health information management and telemedicine were interrelated components of health care delivery, a distinction needs to be made between the two methods of health care delivery. Health Information Management or health informatics was said to refer to the collection, storage and exchange of health data and information, by means of electronic technology; telemedicine or telehealth, on the other hand, was said to be the practice of medicine and the delivery of health care between two distant locations by means of interactive videoconferencing facilities (Commonwealth of Australia, 1997).

In many countries around the world, the internet, telecommunication and information technologies available in the wider society have assisted in the development of health care systems (Alampay, 2006; Ammenwerth et al., 2004; Edejer, 2000; Heeks, 2006; Woo & Reeves, 2007). Many developed countries are using telemedicine, (telehealth, telenursing, telehome health care, teleradiology, telepsychiatry, and

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[1] The Health Online Committee is an advisory committee that reports to a standing committee of the Parliament of the Commonwealth of Australia. It is composed of medical and legal professionals.

virtual medical centres) to deliver rapidly emerging health care and health information to patients and health care providers in remote areas and at major medical centres (Department of Health and Ageing, 2010). Australia is attempting to keep pace with other developed countries and it is widely acknowledged that Telehealth and Health Informatics can improve the delivery of Australian health services into the future (Australian Commission on Safety and Quality in Health Care, 2011; Australian Health Ministers' Advisory Council, 2008).

As a result of the pressure to keep pace with other developed countries, in 2003, the Australian Federal Government embarked on the Electronic Health (E-Health) Record strategy (Commonwealth of Australia, 1997, 2009; Department of Health Western Australia, 2006). This policy was based on the 'Health Connect' recommendations for a universal national electronic health record for each client (Australian Health Ministers' Advisory Coucil, 1996; Commonwealth of Australia, 1997). Health Connect is a network of electronic health records, from Australian states and territories, which is aimed at improving the flow of information within the health sector. The Electronic Health Strategy outlines the collection, storage and exchange of client health information via a secure network, with information technology that safeguards the privacy of clients' data.

Full deployment and use of technologies within the health care system was originally anticipated to be cost neutral (Commonwealth of Australia, 1997, p. 81). However, the rising costs and increasing demands of client and health care providers for up-to-date information is placing the Australian health care system under enormous strain. This strain is being further exacerbated by a shortage of skilled workers (Australian Institute of Health & Welfare, 2008).

As a result of these policies and other developments within Australian nursing, information and communication technologies have pervaded the profession to produce a technological transformation. The rising tide of information and communication technologies is revolutionising nursing and, in countries around the world, there is an increasing reliance on information technology in nursing practice, including health information systems (Ayres, Soar, & Cornick, 2006).

1.3   Nursing in the Technological Age

Health Informatics, as described earlier, has been defined as "a discipline concerned with the development, dissemination and use of information technology in health care to create, store and manage health information" (Commonwealth of Australia, 1997, p. 68). Health Informatics forms part of the wider domain of e-health and seeks to facilitate improved health care outcomes through the dissemination and utilisation of information, knowledge and technology (Commonwealth of Australia, 1997; Schaper, 2007).

E-health has been defined as "the combined use of electronic communication and information technology in the health sector" (Commonwealth of Australia, 2009, p. 7). E-health is the means of ensuring that the right health information is provided to the right person at the right place and on time in a secure, electronic form for the purpose of optimising the quality and efficiency of health care delivery. E-health should be viewed as both the essential infrastructure that underpins the information exchange between all participants in the Australian health care system and as a key enabler and driver of improved health outcomes for all Australians (Collins, 2006).

Throughout the world, information systems are being viewed as essential to the seamless integration of care (Department of Health UK, 2001). In his speech to the nation on the federal economic stimulus recovery package in 2009, the President of the United States of America alluded to a universal issue on the quality and safety in health care (US President Barack Obama, February 9, 2009):

> We have the most inefficient health care system imaginable. We're still using paper. Nurses can't read the prescriptions that doctors have written out. Why wouldn't we want to put that on an electronic medical record that will reduce error rates, reduce our long-term costs of health care, and create jobs right now?

In the health care environment, nurses initiate at least half of the patient's documented information and are responsible for maintaining this information (Gogler, Hullin, Monaghan, & Searle, 2008; Ramano, 1990). Although nurses have many skills and have traditionally adopted new technology into their professional

practice, the nursing profession has not always acknowledged that new technologies demand greater responsibility. The challenge for today's nurses and clinicians is to make the required adaptation and adjustment to technological changes in their workplace. The speed and availability of information technology will continue to impact on nurses and challenge many of the traditional process. According to Simpson (2003, p. 83), "to remain viable, nursing education programs must change or face possible extinction".

Although nursing informatics has been viewed as synonymous with Information Technology, the term Information Technology does not fully define Nursing Informatics. Whereas Information Technology can be described as the combination of hardware and software to manage and process information (Graves & Corcoran, 1989), Informatics is a term that encompasses all aspects of the computer, from theory to practice, and spans a variety of activities (Ball, Hannah, NewBold, & Douglas, 1995). Hersh (2009) states that informatics is focused on the acquisition, storage and use of information in a specific setting or domain. In nursing, this range includes: literature searches on the internet and world-wide-web to access information; the utilisation of word processing, spreadsheets, databases and emails; the utilisation of computer-assisted instruction for learning in a simulated environment; providing tutorials; and the use of clinical information systems.

Nursing informatics is considered to be a subgroup of health informatics and is a rapidly growing nursing speciality. Nursing informatics promotes the generation, management and processing of relevant data that are used to inform and develop knowledge that supports nursing in all practice domains and specialisations (Graves & Corcoran, 1989; Hebda, Czar, & Mascara, 2005). In the United States, nursing informatics is considered to be a priority for the nursing profession, with the American Nurses Association defining nursing informatics as a specialty that integrates nursing science with the application of computer science and information science to nursing (American Nurses Association, 2001).

In Western Australia, there has been a dramatic shift in the nature and extent of information and communication technology within the public health care industry. There is an urgent need for skilled nurses not only to work in clinical areas but also

to work with technology, especially as computerised patient records or electronic health (e-health) become a reality. This, in turn, has led to a genuine need for information technology skills because nurses are often placed in a position where they are forced to acquire skills in technology to obtain proficiency.

Given that nursing informatics is rapidly moving into all phases of nursing, it then holds that nurses require a degree of computer literacy from which they can draw. In Australia, information technology literacy was defined in the Education and Technology Convergence Report, as "the ability to use information and information technologies effectively to find, select and use information to create knowledge and insight" (Tinkler, Lepani, & Mitchell, 1996, p. 94).

Technology, within health care, have been used to support many aspects of general administration, information management and clinical practice, yet in many cases computers are not used to their full potential (Parkin, 2000). This could be because of a lack of adequate training or the failure to effectively disseminate the advantages of modern technology over traditional methods (Coiera, 1995; Parkin, 2000). The benefits of information technologies in clinical practice depend upon whether computers confer an overall advantage and are acceptable to both patients and clinicians. When computers and information technologies were first introduced, they brought the hope of decreased workloads and better job performance. In reality, however, the use of technology has brought with it the expectation that workers will multi-task, which has resulted, in many cases, in an increased workload for the nurse or clinician.

1.4   Research Objectives

Since the post war years, the field of nursing has involved increasingly sophisticated technology; for example, the development of intensive care units in the 1960s to the present-day compact digital point-of-care devices. The field of nursing has acquired technology that has been adapted from diverse arenas (such as, space travel, warfare and medicine) for the provision of patient care (Hebda et al., 2005). The infusion of technology into the West Australian public health care system dates back to the early 1960s, with the introduction of a large centralised mainframe computer system, and

has advanced to the use of several computerised systems for administrative and clinical functions.

Historically, Australian research and scholarly publications related to technologies and computers in the field of nursing has been limited and, in Western Australia, there is a paucity of research in this area. In more recent years, however, research related to health care workers and technology has emerged, the growth of which was spearheaded by the Australian Government through the Department of Health and Ageing (Commonwealth of Australia, 2002a; Fett, 2000). Several Australian studies related to health and medical informatics education for nurses and health service managers have identified a need to integrate nursing informatics into pre-registration curricula (Commonwealth of Australia, 2002a; Hovenga, 1998). These studies have highlighted the disparity in information technology knowledge and skills between nursing and medical staff and, as articulated by Smedley (2005), there is a clear need to upgrade the skills of the existing nurse workforce.

As the West Australian health care system moves assertively towards the widespread use of information technology, an important factor to consider is the nurses' uptake and use of this information technology. Because nurses' attitudes toward computerisation can influence how well the computer systems are utilised in a hospital, examining factors that influence nurses' use of information communication in their practice is important. In fact, it is reasonable to suppose that these factors influence the nurses' attitudes when, in part, determining the acceptance of computers by workers (Ammenwerth, Brender, Nykänen, Prokosch, Rigby & Talmon, 2003, Darbyshire 2004; Sultana, 1990). Understanding factors that influence nurses' attitudes towards using nursing informatics might provide valuable information in planning the implementation of information technology processes.

First, because past studies have not provided a sound questionnaire to be used to assess factors that influence nurses' attitudes towards information and communication technology in their practice, the present study involved developing a questionnaire that is valid and suited to the Western Australian context. Therefore, the first objective was:

Research Objective 1:

> To develop and validate a survey to assess nurses' attitudes towards the use of technology in hospitals in Western Australia.

Graduate nurses, the largest group of new nurses, are often expected to have computer skills but this might not always be the case. Two Australian studies found that the majority of nurses considered their level of computer competence to be less than proficient (Darbyshire, 2004; Smedley, 2005). Some graduate nurses have limited or no computer skills relating to the applications in use in their work environment (McCannon & O'Neal, 2003); computer proliferation is not synonymous with computer literacy, which is essential to facilitate the learning of information technology by nurses (Axford & Carter, 1996; Ramano, 1990).

The influx of new emergent technologies has changed the way in which health care is delivered and accessed today. As health care facilities become more technologically advanced, nurses across all disciplines and specialities are being challenged to be skilled in the use of information technology (Department of Health UK, 2001).

Given that effective information and communications technology use requires nurses to be computer literate, and that past research has indicated that nurses' attitudes towards information and communications technology can be influenced by nurses perceptions of their personal skill level[2] (Alpay & Russel, 2002; Barnard, Nash & O'Brien, 2005; Hegney, Eley, Buikstra, Fallon, Soar, & Gilmore, 2007; Webster, Davis, Holt, Stallan, New, & Yegdich, 2003) the second research objective was:

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[2] In this study, nurses skill level was a self assessment of their skilll related to the use information technology, that is, their perceived competency to use information technology to perform nursing tasks and to provide practical guidance in nursing practice (Brittain & Norrist, 2008; Smedley, 2005).

Research Objective 2:

> To investigate whether the attitudes of registered nurses towards information technology in the workplace are related to their personal skill rating.

Anecdotal and research evidence suggested that the age of nurses might be related to nurses' attitudes towards the use of information and communications technology in their practice. Given that nurses 35 years or younger were more likely to have used technology during their education and schooling, the present study used this as a convenient cut-off for the two age groups. Therefore, the third research objective was:

Research Objective 3:

> To investigate whether nurses' attitudes differ for nurses who are less than 35 years and those who are 35 years or older.

The acceptance of and competence in information technology is one of nursing's most significant priorities. Experts agree that information technology has the potential to reduce health errors and to improve care quality, access and cost effectiveness (Fetter, 2009b). Indeed, the exploitation of new technologies to provide better care and treatment is one of the fastest growing areas in health care today. The specialty of nursing informatics has moved beyond information technology competency, articulation and measurement, to the promotion of information literacy to support evidence-based practice and the cultivation of clinical wisdom (Fetter, 2009b; Garde, Harrison, & Hovenga, 2005; Graveley, Lust, & Fullerton, 1999; Hannah et al., 2006).

To better understand the factors that influenced nurses' acceptance of information and communications technology in their practice, the fourth research objective was:

Research Objective 4:

> To investigate factors that influence registered nurses' attitudes towards the use of information technology and nursing informatics within nursing practice in Western Australia.

1.5 Significance of the Study

Past research has provided clear indications that information technology can improve the work efficiency of the nurse and benefit patients and the health care organisations. The results of my study, which examined factors that influence nurses' attitudes and acceptance of information technology in the workplace, could be beneficial to a range of stake holders, including nurses and nursing educators at hospitals and university nursing faculties, nurse leaders, hospital administrators and policy makers. The study is significant as it provides additional knowledge that will influence the education, training, and delivery of patient health care.

The study reported in this thesis provides methodological implications through its contribution of a survey to assess nurses' attitudes towards factors that influence their acceptance of information technology in the workplace. The development and validation of an instrument that can be used to assess these factors makes available a practical, economical and reliable questionnaire that can be used by health care institutions and the developers' of professional development providers to address issues that might be perceived as important to nurses. Further, the data collected using the survey could be used as a basis for them to review the current professional development, processes and access to information technology that are currently available.

Given that information technology is becoming more prevalent in the nursing workplace, the results of this study are likely to be significant because they could shed light on the reasons and hindrances related to nurses' acceptance of information technology in the healthcare environment. These findings incorporate the practical viewpoint of participants who have encountered the use of technology in a range of environments. This is likely to be relevant to a range of health care organisations as

they struggle to implement increasingly technology-rich environments.

The results of the study are likely to prove practically significant because of their implications for promoting the acceptance of information technology, by nurses, in the workplace. For example, if the results of the study reveal that nurses of different age groups have different attitudes towards information technology in the workplace, then different forms of professional development would be recommended for different age groups.

Further, the results of the study are likely to be of significance to nurse educators within hospitals. If statistically significant relationships emerge between nurses' attitudes towards information technology and their personal skill rating, or if nurses are critical of the lack of training and development, recommendations would be suggested for nurse educators (both in hospitals and universities) about the importance of developing training schedules and providing frameworks for generic skills and competencies for the use of clinical information systems applications.

The results of this research are likely to be of significance to government officials and policy makers wishing to increase the use of information technology in the nursing environment. If the results identify barriers that prevent or restrict efficient access to information technology in the nursing workplace (e.g. physical remoteness, lack of infrastructure, lack of current and up-to-date computers, poor information technology support and password restrictions), then recommendations could be made about removing these barriers.

The study is likely to lead to recommendations for nurse educators, with respect to seeking regular feedback and carrying out audits to examine the ease of use and the usefulness of a clinical information systems to nurses. The perceived usefulness, user-friendliness and ease to learn all are likely to influence nurses' level of use of the system. Further, through well-designed learning and teaching concepts, nurse educators and academics can assist nurses' with innovative ways to learn how to use the information systems and clinical information technology systems programs as part of ongoing learning and support for nurses.

1.6   Conceptual Framework

The present study commenced from a more positivistic framework, favouring an objectivist view. As the study progressed, however, it employed an interpretative framework, drawing on elements of the constructivist paradigm (Schwandt, 1994; Taylor, 1994; von Glasersfeld, 1987, 1993). Such a shift meant that the researcher no longer favoured one method, but rather became multi-method in focus to help to make sense of the factors that influenced the implementation of information technology in nursing practice.

Paradigms, or interpretative frameworks, help to guide and inform an inquiry and are described in terms of ontology (the nature of reality), epistemology (the nature of the relationship between the knower and what can be known) and methodology (the means by which the knower came to know) (Guba & Lincoln, 1994). The constructivist perspective, drawn on for the present study, works from a realist ontology and assumes that there are multiple realities in which the researchers and their subjects create their own understandings (Schwandt, 1994; von Glasersfeld, 1987, 1993). From this perspective, the present study was emergent in both its design and nature. Closely related to the constructivist orientation is Gergen's (1995) social constructionist approach to knowledge, which also influenced the present study. The social constructionist approach centres on the idea of "worlds being constructed, or even autonomously invented, by inquirers who are simultaneously participants in those same worlds" (Steier, 1995, p. 70). The fundamental concern of the social constructionist is with language. According to Gergen (1995, p. 25), meaning is achieved through dialogue and communication between two or more persons and is concerned with "negotiation, cooperation, conflict, rhetoric, ritual, roles, [and] social scenarios ..."

Life experience is determined by one's history and previous experiences (della Porta & Keating, 2008), rather than by a single meaning; individuals can hold multiple meanings and these are often "negotiated socially and historically" (Creswell, 2003, p. 8). Patton states that one can mix methods without being limited by allegiance to a single paradigm and suggests that, even within a single study, researchers can view the same data from different perspectives and interpret data in multiple ways (Patton,

1990). Therefore, quantitative data, while giving a broad overview of trends, could not convey the nuanced meanings drawn from the qualitative data. Hence, the research involved collecting both qualitative and quantitative data.

The constructivist view challenges the traditional objectivist view that inquiry is a reflection of knowledge of the world. The voice of the inquirer is, in the case of constructivism, that of passionate participant (whereby the researcher voices his or her own construction as well as the constructions of other participants). Constructivism, as a theory, proposes that knowledge is created in each individual's mind (Abdal-Haqq, 1998). When we encounter something new, we have to reconcile it with our previous ideas and experiences or maybe change what we believe, or maybe discard the new information as irrelevant. Thus, through the lens of constructivism, I was able to gain a better understanding of nurses' experiences in providing patient care in a health care environment that is becoming gradually dominated by information technology.

The constructivist dialectic paradigm provided me with a method for understanding how humans as open systems take in and process data and release data, information, knowledge and wisdom (Guba & Lincoln, 1994; Lincoln & Guba, 2000). Constructivism assumes the relativism of multiple social realities, recognises the mutual creation of knowledge by the viewer (researcher) and the viewed (registered nurses) and aims towards interpretive understanding of subjects' meanings (Guba & Lincoln, 1994; Schwandt, 1994).

The study reported in this thesis embraced a process that involved dialectical tensions and critical reflexivity in which I, the researcher, formed new standpoints and assertions whilst new research objectives (some of which subsumed the original ones) were framed and generated. The epistemological status of the present study can best be described in the light of Denzin and Lincoln's (1994) analogy of the researcher as *bricoleur*. The research objectives, both original and emergent, formed the basis for the methodology by which data were collected from these multiple methodologies and pieced together to form a 'bricolage' to answer the research objectives that evolved.

Thus, using a mixed-methods approach, involving the collection of quantitative and qualitative methods, allowed me to secure a more in-depth understanding of the factors influencing nurses' acceptance of information technology and nursing informatics in nursing practice. Further, using a mixed-methods approach allowed me to combine the strengths of each method and to counterbalance any weaknesses (Bryman, 2008; Creswell & Plano Clark, 2007; Denzin & Lincoln, 2008).

The nursing profession, as a practical science discipline, requires the dialectic knowledge of: human beings, health, health care, society, and technology from historical, philosophical, ethical, scientific and theoretical perspectives. Having the best computer technology on the market serves no purpose if the end user does not have the skills or motivation to use the system. The present study examined and explored the factors that influence nurses' attitudes towards the use of information and communications technology in their practice.

Attitude varies widely from the conceptual to the theoretical. Fishbein and Ajzen describe attitude as "a learned predisposition to respond in a consistently favourable or unfavourable manner with respect to a given object" (Fishbein & Ajzen, 1975, p 6). Attitudes are conceived and described as complex internal states that affect choice of action of behaviour towards people, objects and events (Jayasuriya & Caputi, 1996). Whilst positive attitudes affect learning and the ability to retain information (Ajzen & Fishbein, 1980; Ammenwerth, Mansmann, Iller & Eichstadter, 2003; Chan, 2007; Moody, Slocumb, Berg, & Jackson, 2004; Porter-O'Grady, 2003), negative attitudes can impede learning and detract from information retention. Thus the measurement of attitudes becomes an integral part in gaining an understanding of an individual's behaviour. If nursing is to progress in the computer and technology revolution, areas of nurses' acceptance and resistance must be identified and appropriate support provided for the success of adopting information technology.

During the interpretation of the data and findings for the present study, Guba and Lincoln's (1989) criteria of *trustworthiness* (credibility, transferability, dependability and confirmability), which represent issues concerned with constructivism, and *authenticity* (fairness, ontological authenticity, educative authenticity, catalytic

authenticity and tactical authenticity) were of concern throughout the study. The methods used to collect and interpret the data are discussed in Chapter 3.

1.7   Structure of the Thesis

This thesis is divided into five chapters. This first chapter has provided an introduction and background information to the present study. The chapter has provided an overview of the introduction and gradual pervasion of information and communications technology into nursing practice. The chapter has outlined the purpose and the objectives of the study. Included in this chapter is information about how the results of the research might be of significance to a range of stakeholders within the health care system in Western Australia, particularly with respect to increasing the chance of reducing the factors that might inhibit the successful implementation of information and communication technology in nursing.

A review of literature relevant to the present study is provided in chapter 2, including pertinent literature related to nursing informatics. It reviews, first, early literature related to information technology and nurses use of technology and then literature related to the Australian national strategy for electronic health record and health care reform. The chapter reviews past research related to nurses' use of information technology and informatics and, in particular, their attitudes towards computers and technology.

the research methods used in the present study and details the procedural aspects of the study are described in Chapter 3. Described in this chapter are the steps taken in the development of the new questionnaire. Also included in this chapter are details related to the sample and sampling techniques. The chapter goes on to describe the methods used to collect the qualitative data for the study. The chapter ends with a description of the data-analysis methods used to address each of the research objectives and details of the study's ethical considerations.

The fourth chapter reports the results for research objectives 1 and 2. This chapter reports the development of the survey, providing a justification for each of the selected scales and the results of data collected to examine the face validity of the new survey. The results for the exploratory factor analysis and internal consistency

reliability are then reported. The chapter then reports descriptive analysis for each of the scales within the questionnaire. For each of the scales, analyses of the qualitative information are used to help to provide a deeper understanding of the factors that influence nurses' use of information and communications technology in nursing.

A summary and discussion of the study's findings and brings together the implications of the findings are provided in the fifth an final chapter. The contributions, outlined in Chapter 1, are provided in this chapter along with cautions with respect to the limitations of the study. This chapter concludes by offering recommendations for encouraging nurses in the uptake of information technology.

Chapter 2
REVIEW OF LITERATURE

> If one seriously adopts the constructivist approach, one discovers that many more of
> one's habitual ways for thinking have to be changed.   [von Glasersfeld 1995, p. 3]

2.1   Introduction

This review of literature begins by defining nursing informatics, and then it is structured into two chronological sections. First, a review of the literature that was available at the time when this study was initially planned, when the data collection was carried out, and when the application and role of information technology upon nursing was first discussed. Second, the chapter goes on to focus on literature that has since become available and that highlights information technology and nursing informatics as presently used in nursing practice and education.

The separation of the earlier literature on information technology used by health care professionals enables the study to be clearly situated within the knowledge and understanding of the time. More recent literature reflects the development of clinical information systems, patient information systems and the myriad of integrated health care systems, the increasing use of information technology and, finally, the evolution of nursing informatics as currently used within nursing practice and education. Commensurate with this trend has been the recent rapid increase of flexible and online learning within nursing (Kenny, 2002; Maag; 2006; Sampson, 2009; Seaton-Sukes, 2003). The review of current literature provides a more comprehensive understanding of how this rapidly-changing field of information technology is integrated with nursing informatics and its impact on nurses' attitudes towards information technology.

The overarching aim of this research was to better understand the factors that influence the attitudes of Western Australian registered nurses towards information technology and nursing informatics in the health care setting. This chapter reviews literature pertinent to the study using the following headings:

- Nursing Informatics (Section 2.2);
- Early Literature on Information Technology and Nurses (Section 2.3);
- Australian National Strategy for Electronic Health Record and Health Care Reform (Section 2.4);
- Nurses, Information Technology and Informatics (Section 2.5);
- Nurses' Attitudes towards Computers and Technology (Section 2.6);
- Chapter Summary (Section 2.7).

2.2   Defining Nursing Informatics

Information Technology refers to both computer software and hardware for managing and processing information. It includes generic software programs used for a variety of activities such as word-processing, spread sheets and databases, e-mail, the Internet and World Wide Web to access information for research and education, and specific computerised instructional programs such as the computer-assisted instruction for tutorials and simulations used by educational institutions (Barnard, Nash, & O'Brien, 2005).

The terms 'Information Technology', 'Informatics' and 'Nursing Informatics' are often used interchangeably in nursing literature. The term 'informatics' was first coined from the French word *informatique*. Ball et al. (1995) defined informatics as "… learning how to use the new tools and building upon the capabilities provided by computers and other information technologies" (Ball et al., 1995, p. 7). The more specific term, 'Nursing Informatics', was defined by Graves and Corcoran (1989) as "a combination of computer science, information science and nursing science designed to assist in the management and processing of nursing data, information and knowledge to support the practice of nursing and the delivery of nursing care" (p. 227). Specifically, nursing informatics include "…all aspects of the computer milieu, from the theoretical to the applied" (Ball et al., 1995, p. 7), which is the use of computer applications to accomplish tasks within the nursing discipline (Ball, Weaver, & Abbott, 2003; Smedley, 2005).

Nursing informatics was recognised as a specialty by the American Nurses Association in 1991 and, ten years later, nursing informatics was defined as the

"specialty that integrated nursing science, computer science and information science in identifying, collecting, processing and managing data and information to support nursing practice, administration, education, research and the expansion of nursing knowledge" (American Nurses Association [ANA], 2001). The American Nurses Association also released a policy statement on the scope and standards of nursing informatics practice "…because nursing is information intensive as well as information dependent, and the theory and practice of nursing informatics are fundamental to the discipline and the profession" (American Nurses Association [ANA], 2001, p. 1).

According to Cherry and Jacob (2002), many components of nursing informatics are embedded in the definition, such as information processing, language development and human computer interface issues (Cherry & Jacob, 2002; Nicholl, 2002). Nurses are encouraged to embrace information and communication technologies and establish strong foundations for taking these developments forward. As technology becomes more complex and commonplace, it is likely to influence and redefine nursing care, nursing decisions and the nursing role (Graveley, Lust, & Fullerton, 1999; Porter-O'Grady, 2002).

Computer literacy is defined as the knowledge and understanding of computers along with the ability to use them effectively (Simpson & Kenrick, 1997; Smedley, 2005). An important aspect of nursing informatics competency is having "an understanding of the systems used in clinical practice, education and research settings" (Nicholl, 2002, p. 381). Therefore, computer literacy is important for the future of nursing. Nursing and health care are being transformed in response to environmental changes whose drivers include demands such as the cost effective delivery of high-quality services and enhanced patient safety. Strategies have been considered for increasing the integration of information technology in nursing practice. One of the key issues identified is the need for research into the factors that contribute to enabling nurses to utilise information technology effectively in their daily practice.

2.3   Early Literature on Information Technology and Nurses

Articles relating to technology and nursing existed in the mid-1960s and became more prolific in the 1980s. However, literature from that period is of less relevance to this study apart from providing historical evidence of the technologies available, their capacities and capabilities to assist nurses and their benefits in patient care. Because the computers and information technology available have continued to change dramatically, past technology bears little resemblance to today's technology.

In 2007, 73% of Australian households reported that they had access to a computer and 64% had home internet access (Australian Bureau of Statistics, 2007) and these statistics were comparable to those in the United States and many European countries (Organisation of Economic Development and Co-operation, 2007). The exponential increase in information and communication technologies has advanced the information presently available, not only quantitatively but also qualitatively. Thus, the review of literature for this chapter focuses predominantly on information available from the latter part of 1997 onwards and includes only limited historical reference to peer-reviewed journal articles prior to this time. The review draws primarily on the literature from the United States, where integrated delivery systems have been in place for almost two decades, in addition to literature from Britain and an increasing amount of literature that reflects the current status in Australia.

In 1997, the Australian National Health Information Strategy was introduced as an outcome of the Australian government parliamentary inquiry aimed at improving health care delivery and increasing Australia's international competitiveness (Commonwealth of Australia, 2009). An outcome of this inquiry was 'The Health Online' national strategy for the implementation of a national Electronic Health Record (EHR) system and the development of information management and online information technologies in the health care sector (Commonwealth of Australia, 2002, 2009). As a result of the Health Online strategy, the HealthConnect project commenced with the aim of building an Electronic Health Record that could be used to track and store a consumer's health record from all care providers for the duration of the individual's lifetime.

One of the many tasks of the Health Online strategy was to assess the readiness of the health work force. The findings highlighted that health care professionals were not readily adopting or implementing technology for health care delivery, although the availability of biomedical technology was escalating at an unprecedented pace (McKinley, 2002, p. 85). The process for biomedical innovation and information technology diffusion was slow and not clearly understood because of "…a significant need for training and education in order to provide health professionals with a degree of computer competence and to resolve their so-called technophobia" (Commonwealth of Australia, 1997, p. 104).

Dramatic advances in Information and Communication Technology (ICT) have transformed the way in which health care professionals deliver patient care and health administrators manage health institutions (Ammenwerth, Graberb, Hermannc, Burkled, & Konigb, 2003; Lupiáñez-Villanueva, Hardey, Torrent, & Ficapal, 2011; Smedley, 2005). Today, clinicians around the world, in all areas of health care, use communication and information technology to exchange and share information. There is a risk of being left behind as more of the health care system becomes increasingly automated (Department of Health Western Australia, 2006; Department of Health and Ageing, 2006; Dragon, 2006; Miller, Piper, & Tucker, 1997; Smedley, 2005).

In the current health care environment, nurses are challenged to incorporate information and communication technology into their regular routine and, in many institutions, computer literacy has become a job requirement (Nicholl, 2002; Saranto & Leinpo-Kilpi, 1997; Smedley, 2005). Technology enables nurses to find, interpret, organise and evaluate information from a variety of sources in order to better inform decision-making and problem-solving within patient care (Lee, 2005; Mills & Staggers, 1994; Nahm & Posaton, 2000).

In Australia, nurses working within health care settings require different levels of computer and information literacy, depending on their roles and responsibilities. Along with the benefits of technology comes the awareness that the amount of knowledge required to function efficiently has also increased exponentially (Smedley, 2005, p. 107).

2.4   Australian National Health Care Information Strategy for Electronic Health Record and Health Care Reform

In 2001, following the recommendations of the 1997 Health Online Report, the Commonwealth Government embarked on a project to build the nation-wide Electronic Health Record (EHR), with its main project being HealthConnect (Commonwealth of Australia, 1997; Wooding, 2001). HealthConnect was conceived to be an information and technology architecture that included information and data standards, as well as a security and privacy framework, that would be available Australia-wide. The overarching aim of the Australian National Health Care Information Strategy was to improve the safety and quality of health care through better information systems for both carers and consumers.

The Australian National Health Care Information Strategy aimed to provide better-quality health care through improved information systems and a knowledgeable workforce (Commonwealth of Australia, 1997; Fett, 2000; Wooding, 2001). These national strategies aimed to provide the framework and standards to address health information initiatives and the integration of health systems within Australia (Commonwealth of Australia, 1997, 2002b, 2009; Fett, 2000; Wooding, 2001). Information technology was seen, not only to assist with diagnostic tools for assessment and treatment, but also to interact with the social and cultural needs of the patient. Australia's adoption of information technology was viewed as critical for: the improvement of quality and safety; the reduction in adverse events; the reduction of death and disability; shorter duration of patient hospitalisation; and a reduction in health care cost (Australian Health Ministers' Advisory Council, 1996). Subsequently, the National e-Health Transition Authority (NEHTA) was established to accelerate the adoption of an electronic health (e-health) record, which involves electronic longitudinal collection of individual health information which could be entered, accessed and accepted by health care providers (Commonwealth of Australia, 2002, 2009; Wooding, 2001).

One of the key intents of the National e-Health Transition Authority strategy was to foster workforce capacity and education to better utilise the priority electronic health solutions. Part of the initiative was to ensure that the workforce, of which nurses

were one of the largest group of health care workers, were skilled in the use of information technology in line with the National e-Health Transition Authority plans to develop the architecture for the e-health record (Fett, 2000; Wooding, 2001).

Tin summary, the priorities of electronic health solutions for the patients were:

- To provide patient safety and to improve the health of the population.

- To close the health gap between population groups with outcomes that were monitored at all stages, including prevention, treatment and support.

- To identify acceptable practice, that was evidence-based with positive, standardised health outcomes and to develop generic measures and terminologies for global use.

- To intervene with strategies for appropriate management.

Despite the publicity related to the benefits of e-health records, to date, there has been, and continues to be, a rising tide of concern over security of data, privacy and confidentiality of personal and medical information, accompanied by fears of loss and violations of privacy (Gallagher, 2008; Goldman & Hudson, 2000; Gunter, Terry, Roy, & Carver, 2005; Gururajan, Murugesan, & Soar, 2005). These concerns prompted the New South Wales Health Department in 2005 to announce an 'opt in' model in which patients could consent to an electronic record being made of their medical history; however, it posed serious concerns because of the high cost of the project and backlash from the public (Johnson, 2005).

In Western Australia, the adoption of information technology has not been consistent across all of the sectors of health care and disparities in infrastructure create obstacles in its implementation (for example, the lack of communication through network lines, and training and development programs to up-skill staff in information technology (Griffiths, & Riddington 2001; Hegney et al., 2007). The inadequacy and inequities appear more pronounced in the aged-care sector and in rural and remote

areas of Australia (Commonwealth of Australia, 2009; Health Department of WA, 2010).

2.5   Nurses, Information Technology and Informatics

This section starts by examining the need for nurses to embrace information technology in order to provide optimum care for their patients. The section also reviews the changing role of nurses as a result of the introduction of information technology. Additionally, this section evaluates the necessity of integrating information technology into nursing practice and the availability of training resources for nurses to up-skill their knowledge of information technology for optimal performance.

The Australian health care sector, as in many parts of the world, is facing significant changes in service and delivery, with health information technology and electronic health records viewed as tools for improving quality and safe health care (Jha, Doolan, Grandt, Scott, & Bates, 2008). These changes significantly influence contemporary nursing practice. Smedley (2005, p. 107) asserted that Australian nurses who work within the health care setting require different levels of computer and information literacy.

Today nursing, more than any other profession, is being challenged by new emerging technologies that impact nurses' work and education (Elfrink, 1996; Elfrink, Davis, Fitzwater, Castleman, Burley, Gorney-Moreno, et al., 2000; Hughes, 2003; Porter-O'Grady, 2002). Nurses still manage information through a combination of methods, including paper and pencil, computer-based records, remote monitoring devices and the use of the Internet (Elfrink, 1996; McNeil, Elfrink, Pierce, Beyea, & Averill, 2005). Research indicates that, although nurses might be willing to learn new technologies, such as complex monitoring equipment or complicated life-saving procedures, the mastery of information technology, to date, has been of low priority (Elfrink et al., 2000, 1996; Smedley, 2005).

The successful implementation of information technology in nursing can only be achieved by the full acceptance and integration of information technology into

professional practice (Ash, Berg, & Coiera, 2004; Barnard, Nash, & O'Brien, 2005; Bundy, 2004; Australian Nursing Council, 2002; Courtney, Demiris, & Alexander, 2005; Simpson, 2000; Smedley, 2005). Evidence suggests that, although nurses have adapted to changes, the nursing profession lags behind other professions in the use of information technology (McBride, 2005; Porter-O'Grady, 2002).

In 2003, Porter-O'Grady lamented that many nurses at that time were from the last generation of the industrial age, and they should have moved into an intensifying technological age because the traditional practices and functions of nursing were no longer relevant and sustainable (Porter-O'Grady, 2003). He also observed that the vision of nurse leaders was too tenuous and short-sighted and called for nursing leaders to be visionary agents for change and innovation:

> It is now time for the clinical leader to challenge the current concepts of practice and the work of nursing as a part of unbuckling nurses' attachment to the past. It is important to get nurses to engage their journey and to confront the challenges and vagaries of the journey as nursing is transformed for the 21st century.
>
> (Porter-O'Grady, p. 255)

Nurses' ambivalence and lack of knowledge have been hailed as significant encumbrances to optimal information technology integration in the workplace (Darbyshire, 2000, 2004; Heath & Duncan, 2002; Heller, Mills, & Romano, 1996).

Nursing practice is information intensive; the amount and complexity of information with which nurses have to work in the current digital age is growing exponentially and using information technology to support care delivery is central to Australia's health care system (Barnard et al., 2005; (Bundy, 2004; Carty & Phillip, 2001; Collins, 2006; Commonwealth Department of Education Science and Training, 2002; Eley, Fallon, Soar, Buikstra, & Hegney, 2008). Therefore, nurses need to be informed of the application of information technology and its advantages, through the integration of information technology into nursing education (Kenny, 2002; Prevost, 2008).

In 2004, the framework for Nursing Informatics Australia was established to promote, as its priorities, the use of appropriate language, education and ongoing

research in nursing informatics, as well as the use of information and communication technologies. This framework created an awareness of the technology available to nursing. Nursing Informatics Australia raised the concern that there was a lack of knowledge of information technology within the nursing profession and that this was impacting on nurses' use of evidence-based practice (Partridge, Edwards, & Thorpe, 2010). Information literacy is an important foundation for evidence-based nursing practice. Information literacy has been conceived to be part of evidence-based practice (Pravikoff, Tanner, & Pierce, 2005), a foundation for evidence-based practice (Jacobs, Rosenfeld, & Haber, 2003), or even a prerequisite to (Shorten, Wallace, & Crookes, 2001) evidence-based practice. In the context of nursing, Jacobs noted that "evidence-based practice hinges on the ability to identify, obtain and evaluate information which comes in many different forms and formats" (Jacobs, Rosenfeld, & Haber, 2003, p. 322).

Enhancing information technology competence is one of the most significant and urgent priorities that accompany the evolution of nursing informatics as a discipline within nursing (Barnard et al., 2005). Further, Smedley (2005) asserts that, while every nurse need not be an informatics specialist, every nurse must be information, computer and information technology literate because, as knowledge workers, nurses require accurate and up-to-date information. As information technology continues to expand, it will undoubtedly impact on how health care is conceptualised and delivered (Abbott & Coenen, 2008; Australian Health Ministers' Advisory Council, 2008; Moody et al, 2004; Smedley, 2005; Ward, Stevens, Brentall & Briddon, 2008).

Experts agree that information technology has the potential to: reduce health errors; improve the quality of patient care; improve nurse access to information; and improve the cost effectiveness of nursing care (Ash, Berg, & Coiera, 2004). Hospitals and agencies are urging nursing colleges to keep pace with what has been hauled as a revolutionary movement in health care (McBride, 2005).

In the past two decades, prior to the introduction of information technology, traditional sources of information and print-based material were used to support clinical practice (Dawes & Sampson, 2003). Today, in some areas, nurses experience difficulty in accessing such material on the Internet because of administrative

restrictions and lack of resources. Pravikoff, Tanner and Pierce (2005) lament that, although professional literature was the most important source of information for changes in practice, this literature often was not available to nurses at the workplace. In areas where nurses are supported with new technology and use the Internet, they often are able to access a range of materials including: current clinical information; evidence-based guidelines; books; periodical literature; and dynamic Web-based resources that provide updates as new knowledge is developed and validated (Hughes, 2003; Hughes & Clancy, 2009; Kenny, 2002).

The Australian Commonwealth government's electronic health initiative has called for a national review of nursing education (Heath & Duncan, 2002). Although nursing education has embraced some technologies, such as distance, flexible learning and clinical simulation, the results of recent studies indicate that many nurses and student nurses have relatively weak information technology knowledge and skills (Barnard et al., 2005; Eley, Fallon, Soar, & Buikstra, 2008; McCannon & O'Neal, 2003; McDowell & Ma, 2007; McNeil et al., 2003; Ornes & Gassert, 2007).

The ubiquity of information and communication technologies, the presence of the internet and the consequent networking of knowledge and social media are no longer limited to specialised professional areas of work and continue to play major roles in the provision of health care. Nurses must have adequate information technology knowledge and competency to operate in this technologically-enhanced environment. Given that data were sparse on Australian nurses' adoption and use of information technology, the Australian Nursing Federation in 2005 surveyed 10,000 members from all sectors of nursing to gauge nurses' experience and confidence with information technology (Hegney et al., 2007; Hegney, Plank & Parker, 2003). The response rate was 43.3%, with 86% of nurses claiming they used computers at work to manage patient records and access policies, procedures and clinical results, and had experience in using information technology for word processing and as a reference tool. Despite this high percentage of users, nurse confidence in the use of information technology was low, with only 25% of nurses fully confident. The results varied according to the nurse's level in the nursing hierarchy, the age of the nurse and her length of time in nursing. Younger nurses, with the least time in nursing, tend to be more experienced and more confident to use information

technology than older nurses. Nurses' use of information technology shows similar trends to previous studies in Australia (Webster et al., 2003), Scotland (Hillan et al., 1998), China (Liu et al., 2000), United Kingdom (Griffiths & Riddington, 2001) and the United States (Hegge et al., 2002), all of which revealed that nurses have limited confidence in the use of computers.

Studies of the status of training and education in information technology and informatics among Australian nurses revealed that nurses who had received training believed that it was adequate to meet the needs of their job and that training was provided at an appropriate time (Eley, Fallon, Soar, & Buikstra, 2008). These were, for the most part, senior nurses in management and supervisory roles who had more nursing experience, access to more specialised applications, and the ability to download information to spread sheets and databases. By contrast, the majority of nurses practising by the bedside were critical of the fact that essential training and technical support was unavailable and, if it was available, it was usually provided to ward managers and senior nurses (Kenny, 2002; Westbrook, Coiera, & Gosling, 2005). A range of studies indicated that, in general, nurses wanted to be able to communicate with colleagues, manage information, educate themselves and their patients, and be influential in the electronic health environment (Allen, 2004; Almerud, 2007; Alpay & Russel, 2002; Amenwerth, Iller & Mahler, 2006; Booth, 2006; Cole & Kelsey, 2004; de Veer & Francke, 2009; Eley et al., 2008). Further, nurses generally recognise the potential benefits of information technology for nursing practice (Alpay & Russell, 2002; Hegney et al., 2007; Hughes, 2003; Webster et al., 2003).

The emergence and prevalence of computers in society has made it imperative for all nurses to integrate the use of computers and technology into nursing practice. Moreover, the use of information technologies is purported to be the key to decreasing medical errors (Bates, 2003; Dragon, 2008; Munyisia, Yu, & Hailey, 2011; Timmons, 2003) and easing the burden of paperwork for nurses (Bates, 2003; Dragon, 2008; Munyisia, Yu, & Hailey, 2011; Timmons, 2003).

The ability to access timely information stored in electronic health records enables evidence-based decision-making, thus highlighting that informatics skills are essential for patient-centred, evidence-based nursing practice. All of these factors can be overcome by increased education and training in information technology for all staff (Hughes & Clancy, 2009; McKinley, Aitken, Doig, & Liu, 2002; McLane, 2005).

The large expansion of knowledge and the use of technology and the Internet have posed significant issues for nursing education (Delgado. 2004). Simpson (2002, 2005, 2007) emphasised the serious lack in the education and training programs of nursing informatics content as one of the major causes for the crisis in nursing. There are calls for nursing education curricula to provide nursing students with opportunities to use the tools of informatics to promote safety, quality and effective decision-making that facilitate online learning and increase nurses' exposure to information technology and systems in areas such as decision support, clinical applications and electronic health records (Grain, 2005, p. 295).

2.6   Nurses' Attitudes towards Computers and Information Technology

A recent comprehensive review of literature related to the introduction of information technology in the health care environment suggested that the attitudes of the staff were a significant factor that was likely to influence the success of the implementation. Negative attitudes have been found to impede staff acceptance and efficient use of information technology in their practice (Ammenwerth, Graberb, Hermannc, Burkled, & Konigb, 2003; McCaughan, Thompson, Cullum, Sheldon, & Thompson, 2002) . According to McLane (2005) and Sassen (2009) the successful implementation of a computerised system depends largely on the nurses' attitudes towards its use. For the purpose of the present study, and based on past research, user attitudes were viewed as critical for the successful implementation adoption of technology.

Whilst a number of earlier studies have been focused on nurses' attitudes towards the us of computers (Bongartz, 1988; Brodt & Stronge, 1986; Burkes, 1991; McBride & Nagle, 1996; Schwirinan, Malone, Stone, Nunley, & Francisco, 1989; Sultana,

1990), it can be assumed that much has changed with the advances in technology. More recent studies have examined nurses' attitudes and satisfaction with electronic medical records (Al Hashem, 2003; Top & Gider, 2012), medication administration record systems (Hurley, Bane, Fotakis, Duffy, Sevigny, Poon & Gandhi, 2007; Hurley, Lancaster, Hayes, Wilson-Chase, Bane, Griffin & Gandhi, 2006) and near paperless hospitals (Lium, Laerum, Schulz & Faxvaag, 2006). Studies related to nurses' attitudes towards computerised health systems have been carried out in numerous countries, both developed and developing, including, but not limited to,: Turkey (Top & Gider, 2012); Kuwait (Al Hasham, 2003; Alquraini, Alhashem, Shah & Chowdhury, 2007); United States (Moody, Slocumb, Berg & Jackson, 2004); Australia (Eley, Soar, Buikstra, Fallon & Hegney, 2009; Hegney, Eley, Buikstra, Fallon, Soar & Gilmore, 2007); Hong Kong (Chan, 2006; Chow, Chin, Lee Leung & Tang, 2011); and Norway (Lium, Laerum, Schulz & Faxvaag, 2006).

The findings of past research have indicated that nurses were, generally, supportive of computerisation in the workplace (Dillon, Blankenship & Crews, 2005) and that there is a generally positive attitude towards their use (Alquraini, Alhashem, Shah & Chowdhury, 2007; Eley, Soar, Buikstra, Fallon & Hegney, 2009;). Past studies related to differences in attitudes towards computerisation have revealed contradictory findings, making it difficult to draw conclusions. It is noted that variations in the findings could be attributed to variations of the systems, as well as the level of confidence and experience of the users in using information technology. This section of the thesis reviews a range of studies of different factors that could influence nurses' attitudes toward the computerisation of their workplace, including, age, computer competency, accessibility, perceived benefits of computerisation and specialty areas of work.

A number of studies have examined the impact of age on nurses' attitudes. For example, Krampf and Robinson's (1984) study, involving 238 professional nurses, predicted that age would affect nurses' attitudes towards computerisation. However, no significant relationships were found between nurses' attitudes about computers and their age. These findings were supported by other studies that also found that nurses' age had no bearing on their attitudes (Dillon, Blankenship & Crews, 2005;

Dillon, McDowell, Salimian, & Conklin, 1998; Eley et al., 2009; Scarpa et al., 1992; Sultana, 1990).

In contrast, the results of other studies have suggested that nurses' age is a significant predictor of attitudes, with younger and often less-experienced nurses having more positive attitudes towards computers than their older colleagues (Simpson & Kenrick, 1997; Webster et al., 2003). The findings of other studies suggest that older nurses, who were generally knowledgeable with respect to nursing but less skilful in IT, held more positive views and placed greater value on computer technology than their younger counterparts (Alquraini, Alhashem, Shah & Chowdhury, 2007; Bongartz, 1988; Brodt & Stronge, 1986; Burkes, 1991; Chan, 2006; Marasovic, Kenney, Elliott & Sindhusake, 1997).

The findings of past research also indicate that nurses' competency or computer experiences are likely to influence nurses' attitudes towards computerisation. In some earlier studies, researchers found that nurses' experiences with computers had a negative influence on their motivation to use computers in the workplace (Burke, 1991). However, the findings of more recent studies consistently indicate that the more experience that nurses have with computers, the more positive their views (Alquraini, Alhashem, Shah, & Chowdhury, 2007; Chan, 2006; Huryk, 2010). In particular, research indicates that the amount of experience that a nurse has with computeruse has a statistically significant influence association with their motivation to use computers in the workplace (Chan, 2006; Marasovic, Kenney, Elliott & Sindhusake, 1997).

Lee (2005) purports that education and training are critical factors in encouraging nurses' use of information technology systems in their daily practice. Lee (2005) also identified other factors, such as experience in computer use and educational preparation in information technology, that were predictors of nurses' attitudes. Past research has indicated that training was an essential factor in nurses' attitudes, while other contributory factors included the availability of hardware and the flexibility and design of the software that enhanced learning (Tennet, Becker, & Kehoe. 2005). Further, nursing faculty's use of information technology and lecturers' knowledge of the trends in information technology and ability to promote nursing informatics

amongst its nursing students were viewed as important in ensuring more positive attitudes towards technology in the health care environment (Tennent, Becker, & Kehoe, 2005; Warren & Connors, 2007).

My review of literature revealed that, generally, the more competent a nurse is with the use of computers, the more positive his or her attitudes are towards computers, computer software, hospital information systems and computerised clinical systems in the health care environment (de Veer & Francke, 2010; Huryk, 2010; Moody et al., 2004). Similarly, the more skilful a nurse is with respect to computer software and hardware, the better is his/her understanding of the benefits of technology in the health care environment (Hobbs, 2002). A study by Levett-Jones, Kenny, Van der Riet, Hazelton, Kable, Boureois and Lusford (2009), involving 971 nursing students, found that the competence of nurses was statistically significantly related to both their confidence in the use of technology and their understanding of the relevance of nursing to the health care environment.

The findings of past research indicate that nurses' attitudes towards computers and information technology in the health care environment are related to the perceived accessibility (Dee & Stanley, 2005; Hegney et al., 2007; McCannon & O'Neal, 2003; McNeil et al., 2003), user-friendliness (Alpay & Russell, 2002; Ammenwerth, Mansmann, Iller, & Eichstadter, 2003; Darbyshire, 2000, 2004; Eley, Fallon, Soar, & Buikstra, 2008; Lee, 2004) and benefits of computers in their work (Ammenwerth, Iller, & Mahler, 2006; Dillon, Blankenship, & Crews J, 2005; Fetter, 2009a; Maag, 2006). Researchers have found that nurses were frequently frustrated by deficiencies in access caused by login issues, as well as by a lack of internet access (Culler, Jose, Kohler & Rask, 2011; Hegney, Eley, Buikstra, Fallon, Soar & Gilmore, 2006), low numbers of computers available for use (Hegney, Eley, Buikstra, Fallon, Soar & Gilmore, 2006) and system-wide barriers that prevented charting at the bedside (Chan, 2006).

In addition to access, research in Australia and Singapore has suggested that the design of the system (Jayasuriya & Caputi, 1996; Jayasuriya, Milbourne, & Tooth, 1994) and the perceived user-friendliness of the system (that is, the system is more suited to the needs of the nurses) (Chow, Chin, Lee, Leung & Tang, 2011) influenced

nurses' attitudes towards the use of computers and information technology in the health care environment. Further, an Australian study found that a source of frustration to nurses (leading to less positive attitudes) was when the software provided to nurses did not suit the purpose for which it was intended (Hegney, Eley, Buikstra, Fallon, Soar & Gilmore, 2006). Darbyshire (2000, 2004), Axford and Carter (1996) and Lee et al. (2002) reported that a high proportion of nurses were uncomfortable about using computer technology in their nursing practice because of the slowness and ineffectiveness of the applications and the lack of appropriate access to the systems. Research in Australia and Taiwan indicates that the systems that were put into place were not always designed in a way that was relevant to the nurses' needs and did not always take into consideration the nurses' skills and understanding of information technology (Axford & Carter, 1996; Lee, Yeh, & Ho, 2002).

It is widely accepted that the implementation of a computerised system has the potential to improve patient care by saving time, increasing accessibility of information and enabling data sharing to facilitate communications among different professionals within health care (Ball, Weaver & Abbott, 2003; Gururajan et al., 2005). However, a study by Eley, Soar, Buikstra, Fallon and Hegney (2009) with a sample of 4330 nurses found that less than half of the nurses felt that the use of a computerised system made work easier (e.g., reduction of duplication, reduced errors in handling patient data). Moody et al. (2005), in their descriptive study of 100 nursing personnel at a large hospital in Florida, found that the majority of nurses (80%) were of the opinion that electronic health records improved the quality of patient care, improved nursing documentation, and ultimately led to improved care and patient safety.

Past research has revealed that, when nurses view computers and information technology as beneficial to either their work or to the patients, then their attitudes are likely to be improved (Culler, Jose, Kohler & Rask, 2011). For example, improved attitudes towards use of computers and information technology in the health care environment have been linked to improved accessibility of patient information in general (Culler, Jose, Kohler & Rask, 2011; Eley, Soar, Buikstra, Fallon & Hegney,

2009) and accessibility of pathology and radiology results in particular (Hegney, Eley, Buikstra, Fallon, Soar, & Gilmore, 2006).

The findings of past research also have indicated that nurses' job rankings influenced their attitudes towards computerisation of the work place (Chan, 2006; Eley et al., 2007; Oroviogoicoechea & Watson, 2009). Research findings suggest that nurses who were employed at a higher rank were more likely to adopt the use of computers than those nurses who were new to the profession (Chan, 2007; Eley et al., 2009). Findings also suggested that nurses with more computer experience and skills were likely to have more positive attitudes to the use of a computerised system (Moody et al., 2004; de Veer & Francke, 2009).

Past studies also have compared the attitudes of staff in computerised and non-computerised health care settings (for example, Bongartz, 1988) and, also, before and after the implementation of an electronic health care system. Bongartz's (1988) study examined the attitudes of 440 nurses employed in hospitals where computers were used and 273 nurses in hospitals where no computers were used. Analysis of the data indicated that, relative to nurses from hospitals with computer systems, nurses who worked in hospitals without computers had more favourable attitudes toward computers, greater concerns that computers were a threat to their job security, and a feeling that computers might provide more time for patient care and speed up the process of information handling.

2.7   Information Technology in Nursing Education

Prior to 1999, most university nursing faculties used computers predominantly for email correspondence, document preparation of manuscripts and student lectures, spread sheets, power point presentations and statistical applications. In today's demanding and evolving health care system, it is a necessity for nurses to provide evidence-based practice and safe, high-quality care to meet the expectations of the consumers. The ubiquity and complexity of technology compels nurses to adapt, but constraints in resources have rendered nurses unable to embrace technology on the same scale as other health professionals and medical counterparts (Institute of Medicine, 2003). Experts in nurse education emphasise that it is paramount for

present-day Australian nurses to be well trained and prepared to use and apply information technology to deliver safe and high-quality health care (Barnard, Nash, & O'Brien, 2005; Bartels, 2005; Bond, 2007; Cole & Kelsey, 2004; Commonwealth of Australia, 2005; Dragon, 2006; Fetter, 2009b; McNeil et al., 2005; Porter-O'Grady, 2003; Prevost, 2008).

In Australia, there has been a rapid rate of increase in the ownership and use of home computers (Australian Bureau of Statistics, 2007, 2014) and Australian universities are attempting to keep pace with this trend. Nursing schools are encouraged to provide state-of-the-art distance and online learning opportunities with the use of advanced communications and multi-media technologies (Courtney, Demiris, & Alexander, 2005; Fetter, 2009b; Garrett & Jackson, 2006, Grain, 2005; Kenny, 2005; Maag, 2006, Smedley, 2005; White & Dewsbury, 2011). Nurse educators are challenged to develop teaching methods that accommodate students' preferred ways of learning new information. Internet technology has had considerable impact on this development.

Advances in technology and the World Wide Web have allowed student-learning capabilities to expand rapidly to unprecedented levels. Research has indicated that demographic variables have an influence on nurses' computer literacy (Saba, 2001). There are age differences in an employee's existing skill set and, in some instances, an inverse relationship with their training proficiency. For example, because older nurses might not have had as much access to computer technology as their younger and more technology-savvy colleagues, it is understandable that younger nurses generally have more computer skills, more technology skills and/or even the ability to learn faster than older nurses. The length of a nurse's work experience and the skills that he/she has gained from previous experiences play a role in his/her computing skills. However, this depends on the duration of their past experience and nurse's position during previous employment (Alpay & Russell, 2002; Ash, Berg, & Coiera, 2004; Bates & Gawande, 2003; Estabrooks, O'Leary, Ricker, & Humphey, 2003; McCaughan et al., 2002; Pravikoff, Tanner, & Pierce, 2005).

Over the last decade, the demands of new technologies have influenced the education and training of nurses within Australia, including Western Australia. Nurses in

remote and rural areas, require direct contact to develop their skills, knowledge and expert advice; and have the potential for better access to education and training by using various technologies that had been unavailable in the past (Kenny, 2002). However, past research indicates that, in different parts of Western Australia, there are marked differences in the levels of access to information technology because of the tyranny of distance and lack of financial and infrastructure resources (Gerrish et al., 2006; Loh, Flicker, & Horner, 2009; Wilbright et al., 2006; Yu, 2005). For instance Loh, Flicker and Horner (2009) studied residential care facilities in Western Australian to determine why the introduction of health consulting services via Telehealth video conference consultations fail. They identified that there was a perception that more training and resources were required. Access to information communication technology (ICT) protected by password and security procedures were sometimes seen as a barrier to work flow and communication. There was also a perception that not all Aged Care Workers were able to use ICT and the management of the organisation did not consider routine access to ICT as necessary. Some staff mentioned that they had difficulty getting access even if they were quite technologically adept; clearly some aspects of ICT were not user friendly and wasted time. The unavailability of hardware and the slow speed of computers also contributed to the perception that the software was not user friendly. Even access to health advice via telephone was time consuming.

Evidence indicates that, while computers might seem ubiquitous in today's society, their distribution is highly stratified. There is a real need for WA health care workers, with nurses among the largest group, to have physical resources including more up-to-date hardware and accessible training in information and communication technologies

2.8   Chapter Summary

This chapter provided a review of literature relevant to the present study of Western Australian registered nurses' attitudes towards the use of computers and information technology in nursing practice and education. The chapter began by providing background to the federal government's Australian National Health Information

Strategy, whose purpose was to improve the quality of health care through better information systems for registered nurses, health care workers and consumers.

The review of literature defined the notion of nursing informatics and what it means in the work environment. The section explored the importance of nursing informatics, in particular, and information technology and computer literacy, in general, to the practice and delivery of nursing care.

The chapter also reviewed early literature related to information technology in nursing practice and the many advance in information and communication technology in nursing practice. Information related to workforce readiness, examined as part of the Health Online strategy introduced by the federal governments, indicated that there was much need to improve the competence and reduce the technophobia among nurses across the country.

Next, the chapter described the Electronic Health Record as part of the Australian National Health Care strategy, which was introduced Australia-wide to improve the safety and quality of healthcare through better information systems for carers and consumers. This section examined the introduction of a range of initiatives that were associated with this strategy to improve the health care system through the adoption of information technology.

The next section focused on the need for nurses to embrace information technology and how, ultimately, this has impacted on the role of nurses. The chapter reviewed literature related to the impact of new technology on nursing practice, how these technologies have influenced what nurses do and how they do their work, the need for nurses to keep up with the emerging technology, and how a lack of knowledge related to information technology can be an encumbrance on the performance of nursing. The need to enhance information technology competence among nurses is perceived as paramount if the introduction and use of technology in the health care environment is to be optimised.

The final section of the chapter provided a review of literature related to nurses' attitudes towards computers and information technology in the health care

environment. Although nurses have been found to be generally supportive of computerisation of the workplace, past research has investigated a range of factors that influence these attitudes, such as nurses' age, nurses' competency in the use of computers and information technology, the user-friendliness of the system in place, and the perceived benefits of computerisation.

The present study drew on and extended these past studies by examining factors that influence nurses' attitudes in Western Australia. Unlike many of the previous studies reviewed in this chapter, my research also included a mixed-methods approach to provide a broad overview of nurses' views. The next chapter provides details of the research methods that were used in the present study.

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Chapter 3

RESEARCH METHODS

</div>

3.1 Introduction

This chapter provides details related to the research methods used in the present study. The research adopted a mixed-methods approach that involved the collection of both quantitative and qualitative data. Creswell (2008, p. 62) stated:

> The core argument for a mixed-methods design is that the combination of both forms of data provides a better understanding of a research problem than either quantitative or qualitative data by itself. Mixed-methods design involves procedures for collecting, analysing and mixing both quantitative and qualitative data in a single study or in a multiphase series of studies.

The data collected, using the different research methods, allowed triangulation and cross-validation, providing a more coherent and complete picture of the factors that influence nurses' acceptance of informatics. On the one hand, the quantitative approach involved conceptualising reality in terms of selected variables and the relationships between them. On the other hand, the qualitative approach employed an interpretative framework drawing on elements of the constructivist paradigm to describe the inductive processes used to answer the research objectives.

The research design and methods used for data collection are described using the following headings:

- Research Objectives (Section 3.2);
- Research Design (Section 3.3);
- Sample (Section 3.4);
- Data Collection (Section 3.5);
- Analysis of Data (Section 3.6);
- Addressing Ethical Considerations (Section 3.7); and
- Chapter Summary (Section 3.8).

3.2   Research Objectives

The overarching aim of the present study was to gain an understanding of the factors that influence nurses' acceptance of information technology and nursing informatics. The specific research objectives used to address this aim were outlined in Chapter 1 and are reiterated below.

Research Objective #1:

To develop and validate a survey to assess nurses' attitudes towards the use of technology in hospitals in Western Australia.

Research Objective #2:

To investigate whether the attitudes of registered nurses towards information technology in the workplace are related to their personal skill ratings.

Research Objective #3:

To investigate whether nurses' attitudes differ for nurses who are less than 35 years of age and those who are 35 years or older.

Research Objective #4:

To investigate registered nurses' attitudes towards the use of information technology and nursing informatics within nursing practice in Western Australia.

3.3   Research Design

I sought an understanding of the factors that influenced the acceptance of information technology and nursing informants at a time when these were gradually dominating nursing practice. A mixed-methods design was selected because of the need for multiple sources of data that would contribute to a more comprehensive exploration of this emerging field.

A mixed-methods approach is generally used to enhance completeness, and "quantitative and qualitative methods are used to measure overlapping, but [somewhat] different facets of a phenomenon, yielding an enriched, elaborated

understanding" (Greene, Caracelli, & Graham, 1989, p. 258). By combining different research methods, it is possible to provide a more complete picture (Bryman, 2008; Creswell, 2009; Creswell & Plano Clark, 2007) and to allow the researcher to view a phenomenon through different lenses (Sandelowski, 1995).

Denzin (1978) referred to this approach as triangulation, which involves taking different points of reference through the collection of data and information, using a range of research methods and cross-validation of the data, to provide a coherent picture. The mixed-methods design enabled the collection of information of greater breadth and depth and more meaningful results to meet the aims of the research. Greene and Caracelli (1997, p. 7) state that "different kinds of methods are best suited to learning about different phenomena. All methods have limitations and biases; using multiple methods can help to counteract some of these".

The mixed-methods approach was considered to be appropriate for the present study for three reasons. First, because no single method could grasp the subtle variations involved in this study, the use of a mixed-methods approach was likely to overcome this (Denzin, 2000; Denzin & Lincoln, 1994). Second, by including data from multiple sources and seeking feedback from multiple participants, the information formed the basis of a constructivist inquiry in which perspectives from different realities were sought (Denzin, 2000; Greene & Caracelli, 1997; Guba & Lincoln, 1994). Third, a mixed-methods approach was better for providing both confirmation and completeness to research findings, when used alongside triangulation theory, which involved a multi-dimensional framework comprised of epistemological, ontological and developmental perspectives.

In this study, data were collected in two phases. In the first phase, a survey was used to collect quantitative data to provide a context for understanding the factors that influence nurses' attitudes towards information technology and nursing informatics within nursing practice in Western Australia. The survey was based on Stronge and Brodt's (1985) Nurses' Attitudes towards Computers questionnaire and Jayasuriya and Caputi's (1996) Computer Attitude and Computer Anxiety in nursing questionnaire. Details relating to the development of the survey and the collection of quantitative data are described in Section 3.4.1.

In the second phase, qualitative methods, involving open-ended questions (that were included in the survey) and semi-structured in-depth interviews with registered nurses, were used. The qualitative aspect of the study employed an interpretative framework that drew on elements of the constructivist paradigm in which "a naturalistic inquiry should be stimulated through the experiences, interest, and knowledge of the investigator" (Appleton & King, 1997, p. 17). Whilst quantitative data assisted in explaining nurses' attitudes towards technology, the qualitative data provided explanations for the quantitative results and insights into the complexity of information technology and nursing informatics in nursing practice. The qualitative methods are described in Section 3.5.2.

3.4   Sample

This section provides a description of the sample and sample-selection process used in the present study. As discussed in the previous section, the study involved two separate phases: Section 3.4.1 details the sample to whom the survey was administered; and Section 3.4.2 provides details of the sample used for the gathering of interview data.

3.4.1   Sample for Survey

The first phase of the study involved the administration of a questionnaire to nurses who were registered with the Nurses and Midwives Board of Western Australia (NMBWA). Whereas a registered nurse (the group of which midwives and nurse practitioners are a part) is a Division 1 nurse, an enrolled nurse is a Division 2 nurse (based on educational level attained). Given that the size of the register included over 40,000 nurses, my sample included only Division 1 nurses (including registered nurses, midwives and nurse practitioners); this decision that was made for logistical and financial reasons. Figure 1 was accessed from NMBWA and provides a breakdown of nurses based on the category in which they are employed.

Number of Current Registrations in Western Australia (September 2009)
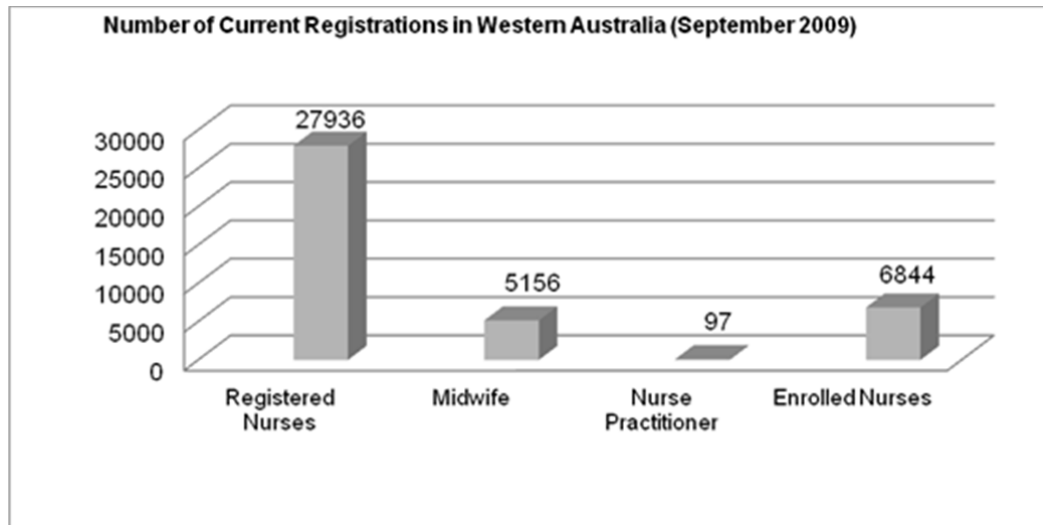
Figure 3.1   2009 Profile of Nurses Registered with Nurses Board of Western Australia (NMBWA)

Registered nurses (selected for inclusion in this study) must be registered with the state/territory registration board (Australian Institute of Health & Welfare, 2008). Therefore a registered nurse is one who meets a set of prescribed standards of education and clinical competence. Registered nurses include persons with a minimum of a three-year training certificate and those holding postgraduate qualifications. This is a comprehensive category of nurses which includes community mental health practitioners, general nurses, intellectual disability nurses, midwives (including pupil midwives), psychiatric nurses, senior nurses, charge nurses (or unit managers), supervisory nurses and nurse educators. The category of registered nurses also includes nurses engaged in administrative duties, irrespective of the extent of their engagement, such as directors of nursing and assistant directors of nursing.

Given the time and financial constraints of the research, it was decided that 500 registered nurses would be selected from the nurses' register for administration of the survey. The researcher relied on the advice given during discussions with NMBWA staff to ensure that the inclusion criteria were met. Non-probability sampling techniques were deemed appropriate because there were no sampling frames available and the population was widely dispersed (de Vaus, 1995). At the researcher's request, NMBWA staff sorted the registered nurses by geographical location to ensure that a representative sample was drawn from rural and

metropolitan areas, as well as from private and public health facilities. Random sampling was then undertaken for the purposes of administration of the survey.

The sample of randomly-selected registered nurses from the Western Australian Nurses Board register for the survey involved 500 nurses. The total useable return response was 27%, or 134 respondents (*N*=134). The nurses who returned surveys worked within the public health care sector (*n*=116) and private health care sector (*n*=18) in hospitals located in metropolitan (*n*=81), rural (*n*=44) and remote (*n*=9) regions of Western Australia. The sample included nurses from various areas or sectors and health care in Western Australia. For the sample, 60% of the nurses worked in metropolitan health care facilities, 33% worked in health care facilities located in rural areas and 7% of the nurses worked in health care facilities located in remote areas. This sample was consistent with the national survey of nursing and midwifery labour workforce (Lee, Taylor, Meyer, Braddock, & Broadbent, 2008). Given the cross-sectional nature of the sample, it was assumed that the researcher could have a degree of confidence in the results.

This sample consisted of around 20% of 'younger' nurses (less than 35 years) remainder of participants in my study were 'older' nurses (≥ 35 years). The cut-off point of 35 years was selected as it was anticipated that nurses who were less than 35 years would have acquired a reasonable level of familiarity with computers and information technology during both their secondary-school education and their tertiary nursing and university studies. In contrast, nurses over 35 years have had more limited exposure to computers and IT during their secondary and tertiary studies than their younger counterparts. It was felt that these differences in prior experience with IT could lead to differences between younger and older nurses in the attitudes towards Information

3.4.2   *Sample for Interviews*

The second phase of the study involved the collection of qualitative data through the use of in-depth semi-structured interviews. The interviews were conducted with two groups of participants. The participants for the first group were all registered nurses who had responded to the questionnaire and indicated (on the survey) their

willingness to be involved. The second group of interviewees were the nurse educators from health care organisations and academics from universities, who had responded to an invitation following an email letter sent to the Nurse Directors of each of the major teaching hospitals and heads of department of nursing faculties at the universities within Western Australia.

All 33 of the registered nurses who volunteered their contact details in the returned response to the survey were contacted either by telephone or email. The final number of registered nurse participants who agreed to be interviewed was 20. Eighteen of these registered nurses were from public hospitals and two were from private health care facilities. The nurses worked in health care facilities across the metropolitan, regional and rural areas and specialised in a range of areas including paediatrics, medical, surgical, rehabilitation, critical care and emergency. Thirteen of the registered nurses (65%) whom were interviewed were working in the metropolitan region and the other 7 (35%) were working in regional and rural areas. Table 3.1 provides a breakdown of the demographics of the 20 nurses who were interviewed, including the sector in which they worked and their sex. Thus the interview data source became a convenience sample, with all of those who responded being included and interviewed. Details of interview process are described in Section 3.4.2.

Table 3.1   Location, Employment Sector and Sex of Registered Nurses who Self-Selected for Qualitative Data Collection

Location	Number of Nurses				
	Total	Employment Sector		Sex	
		Public	Private	Male	Female
Metropolitan	13	11	2	3	10
Country	4	4	-	-	4
Rural	3	3	-	-	3
Total	20	18	2	3	17

The procedure for selecting nurse educators involved maximum variation sampling. The plan was to gain nurse educator participants from different settings. The Nurse Directors of each of the five major public and two private hospitals in Perth, Western Australia were approached, by email, to seek permission to invite their nurse

educators to be interviewed. Three nurse educators, two from public hospitals and one from a private hospital, contacted the researcher and agreed to be interviewed.

An invitation letter and information package was sent to the four Deans or Heads of Departments of Nursing Schools in Western Australia's universities, inviting the course coordinators and lecturers (involved with information technology and/or nursing informatics) to participate in the research. Three academics, including a male senior lecturer and two female lecturers from two of the universities, agreed to participate and were contacted by the researcher to arrange an interview at their convenience.

3.5   Data Collection

This section describes the two phases of data collection and the methods used. The first phase involved the collection of quantitative data through the administration of a questionnaire (described in Section 3.5.1) and the second phase involved the collection of qualitative data through structured interviews and open-ended questions on the survey (described in Section 3.5.2). Table 3.2 provides an overview of the relationship between research objectives, data type and data collection in this study.

Table 3.2   Overview of the Relationships between Research Objectives and Data Collection

	Research Objectives	Data Type	Data Collection
1.	To develop and validate a survey to assess nurses' attitudes towards the use of technology for use in Western Australia.	Quantitative and qualitative	Survey responses and interview data
2.	To investigate whether the attitudes of registered nurses towards information technology in the workplace are related to their personal skill ratings.	Quantitative	Survey responses
3.	To investigate whether nurses' attitudes differ for nurses who are less than 35 years old and who are 35 years or older.	Quantitative	Survey responses Demographic information Free-text comments Interview data
4.	To investigate registered nurses' attitudes towards the use of information technology and nursing informatics within nursing practice in Western Australia.	Qualitative and quantitative	Free-text comments Interview data

3.5.1   Quantitative Data Collection

The overarching aim of this research was to better understand the factors that influence the attitudes of Western Australian registered nurses towards information technology in the workplace. To provide an overview of nurses' attitudes, quantitative data were collected using a newly-developed survey. This section details the development of the new survey (Section 3.5.1.1), the pilot testing of the survey (Section 3.5.1.2) and the administration of the survey (Section 3.5.1.3).

3.5.1.1   Development of the New Survey

The development of the survey involved a multistage approach. First, a review of literature was carried out to identify the characteristics that influence a person's ability to achieve success when using technologies and his or her attitudes towards technology.

My review of the literature was also used to find an appropriate framework and suitable questionnaires that had already been developed. Fishbein and Ajzen's (1975) theoretical framework of attitude, development and measurement was used as a reference for examining the factors that influence Western Australia's registered nurses' attitudes toward the use of information technology and nursing informatics in nursing practice. Fishbein and Ajzen's theory of reasoned action (Fishbein & Ajzen, 1975) is one of the most widely used theoretical frameworks related to attitude research. The theory of reasoned action proposes that it is possible to predict intentions by measuring attitudes towards performing behaviour.

An attitude is defined as a feeling about a specific subject and, according to the theory of reasoned action, attitudes are a function of beliefs (Fishbein and Ajzen, 1975). For example, when a person believes that a given behaviour will lead to a positive outcome, the behaviour will be looked upon with a favourable attitude. Conversely, if a person believes that a given behaviour will produce a negative outcome, then it will not be considered favourably. Each person holds certain beliefs that determine attitudes towards behaviours.

Behavioural change, according to the theory of reasoned action, results from a change in a person's beliefs about whether or not to engage in behaviour. In order to bring about a change in an individual's attitude, communication must contain information that links the target behaviour to various positive or negative attributes (Ajzen & Fishbein, 1980). Communication that stimulates a shift in underlying beliefs will influence attitudes, causing intentions and behaviour to change (Fishbein & Ajzen, 1975). The theory of reasoned action has been applied to a variety of socially-relevant behaviours in many types of research settings. In addition, numerous studies related to nurses' attitudes have been published using the theory of reasoned action as a framework making it a suitable choice for this study (Brood & Stronge, 1986; Scarpa et al., 1992).

Following an extensive review of literature, it became evident that the majority of instruments used to assess attitudes in health care and nursing had been developed in the United States, United Kingdom and Europe (Cork, Detmer, & Friedman, 1998; Detmer & Friedman, 1994; Moody, Slocumb, Berg & Jackson, 2004; Rosenbloom, Talbert & Aronsky, 2004; Stronge & Brodt, 1985; Teach & Shortliffe, 1981). In the majority of cases, these studies involved the assessment of attitudes as an element of a larger study and often did not include either the validation of the instruments or a relatively large sample (Lai, Lueng, Wong, & Johnston, 2004). There were, however, two questionnaires that were validated with large samples, namely, Stronge and Brodt's (1985) Nurses' Attitude towards Computerization (NATC) questionnaire and Jayasuriya and Caputi's (1994) Nurses' Computer and Attitude Inventory (NCATT). Both of these instruments were drawn on for the development of my own survey and are described below.

Stronge and Brodt (1985) initiated research in the area of technology use for patient care by developing the Nurses' Attitude towards Computerization questionnaire to evaluate American nurses' attitudes toward general computer use. The NATC includes six scales related to nurses attitudes, namely, job security, legal ramifications, quality of patient care, capabilities of computers, employees' willingness to use computers and benefit to the institution. At the time of carrying out my study, the NATC instrument had been compared, evaluated, adopted and adapted by a number of authors for use with registered nurses and nursing students

(Bachman & Panzarine, 1998; Brumini et al., 2005; Jayasuriya & Caputi, 1996; McBride & Nagle, 1996; Scarpa et al., 1992; Schwirian et al., 1989; Stockton & Verhey, 1995). Although developed more than 29 years ago, close scrutiny of individual items and scales within the instrument suggested that many of them were still relevant to nursing at the time of carrying out my study.

The NATC is a 20-item instrument with a Likert-type response scale ranging from Strongly Agree to Strongly Disagree. An evaluation for content validity revealed that the items were fairly evenly distributed over most of the identified constructs. In a study involving 385 nurses, data were analysed using the Spearman-Brown formula to determine the internal consistency reliability of the questionnaire. Analysis resulted in a split-half reliability coefficient of 0.90, indicating a good internal consistency for the questionnaire (Brodt & Stronge, 1986). It was noted, however, that the factor structure of the survey was not established.

Jayasuriya and Caputi (1996) developed the Nurses' Computer and Attitude Inventory (NCATT) by adapting the Stronge and Brodt questionnaire to assess nurses' anxiety towards computer use and by rewording individual items for use in an Australian nursing environment. In a study involving 170 Australian nurses in a single hospital, the NCATT was used to assess nurses' attitudes prior to implementing a computerised information system. Three factors were identified: (a) patient care, (b) computer anxiety and (c) patient confidentiality. The internal consistency of individual scales was not reported, but the internal consistency reliability with this sample (for the survey as a whole) was 0.90. Although the NCATT had been modified for use in Australia and validated to some extent, this study was carried out in a single hospital and did not involve a wide range of health professionals. Further, the absence of evidence to indicate whether the factor structure of the NCATT had been established led me to develop my own survey.

In the development of my survey, I drew on both the NATC (Stronge & Brodt, 1986) questionnaire and the NCATT (Jayasuriya & Caputi, 1996). Permission to use the instruments in the development of a questionnaire, tailored for this research, was granted by both authors. Copies of their correspondence are included in Appendix A (Dr. Stronge's email) and Appendix B (Dr. Jayasuriya's email).

An important stage in the development of the survey involved an expert panel, the make-up of which included three registered nurses, two staff development nurses and a nurse educator (the selection of whom is described in Chapter 3). These members were asked to examine the scales and individual items in the survey to ensure that they were meaningful and that the items adequately covered the scale that they were to assess. During this process, several revisions were made to the items, including the rephrasing of ambiguous items and the removal of items that appeared to be duplicates. For example, items that were identified by the expert panel as unclear were, in some cases, negatively worded and thus were removed to avoid confusion. In other cases, the items were simplified to provide a more succinct representation of the item. Moreover, computer and technology jargon was minimised. For example, words perceived by nurses as computer jargon, such as e-health (electronic-health), EPR (Electronic Patient Record), EHR (Electronic Health Record), were spelled out in full rather than given as acronyms.

The final questionnaire consisted of three parts. The first part included questions related to demographic and background information of the participants, namely, age, sex, highest level of education, length of time at the current institution, number of years of nursing experience, and a personal rating of skills in using computers and technology, and computer programs or systems. The second part involved a 20-item survey and the third part included two open-ended questions together with space for the nurses to respond.

The second part of the survey consisted of 20 statements in three scales: benefits of information technology in health care (to assess nurses' views about whether the use of information technology in health care improved patient care and safety); pitfalls of information technology in health care (to assess nurses' experiences or views about negative aspects related to information technology such as barriers to access and increased workload for nurses); and the need for information technology in health care (to assess nurses' attitudes towards the need for information technology and information technology skills and whether this leads to a more productive nursing work force). A more detailed description of each of the three scales is provided in Chapter 4. (See Appendix C for a copy of the survey.)

Each of the statements in this section was responded to on a five-point Likert-type scale ranging from Strongly Agree to Strongly Disagree. The statements were arranged in cyclic order and included negative or reverse-scored items to guard against passive responses.

To minimise confusion and to provide contextual information, a brief definition of information technology was provided at the beginning of the section:

> Information Technology refers to those systems (programs/software plus computers) used to process and manage information (Corcoran & Graves, 1989). It includes the use of computer technology and software for word processing, spread sheets, databases, email, internet, literature searches, use of clinical and information systems and computer-assisted instruction such as simulations.

In the third part of the survey, two open-ended questions provided space for nurses to express their opinions or to make suggestions pertaining to the use of information technology in the nursing workplace. A copy of the newly-developed survey, named the Nurses Computers & Information Technology Questionnaire (NCITQ), is provided in Appendix C.

3.5.1.2   *Piloting the New Survey*

The newly-developed survey was pilot tested at two non-teaching hospitals, following approval from the Director of Nursing at each of the hospitals. Nurse involvement in the pilot study was voluntary. The pilot study involved the random distribution of the survey, by a staff educator from each of the hospitals, to 50 nurses at each site. The nurses involved in the pilot study were asked to: (a) complete the questionnaire; (b) record the approximate time that was required to respond to the questionnaire; (c) comment on the ease of completion; and (d) provide their opinions about the clarity and readability of the individual items. To reduce bias, as the researcher was known amongst the staff, the anonymity of the researcher was maintained. Therefore, all questions raised during the pilot study were directed to the staff educator, who discussed queries with the researcher.

3.5.1.3   Administration of the New Survey

As described in Section 3.4.1, the newly-developed survey was sent to 500 nurses from metropolitan, remote and rural hospitals in Western Australia (described in Section 3.4.2). Prior to the pilot test, written permission was obtained from hospital executives to conduct the pilot with the nurses within their organisation. Also, the researcher negotiated the administration procedures with the staff development nurses and nurse educator in each of the hospitals. (A copy of the letter to hospital executive can be found in Appendix G.) Administration of the survey was undertaken via post and each of the prospective participants was sent a package that included:

- a cover letter to explain the purpose of the survey;
- instructions on how to complete the survey;
- an information sheet that outlined the participants' rights;
- a consent form that included contact details of the researcher (should participants require clarification);
- a copy of the survey; and
- a prepaid return addressed envelope.

Given that the participants were widely dispersed across Western Australia, the data were collected over a period of 12 weeks. The number of survey respondents was based on the 'saturation' principle (Creswell, 2008), with saturation being considered to have occurred when no further responses to the survey questionnaire were received six weeks after the closing date for the second mail-out of the questionnaires. It was felt that this would give the nurses time to respond. At the end of the sixth week, a reminder letter was sent to all participants.

As the surveys were returned, the responses were numbered sequentially and the data entered into an Excel spread sheet. At the end of the 12-week period, the responses of 11 male registered nurses and 123 female registered nurses were received, providing a total sample of 134 nurses.

3.5.2 *Gathering Qualitative Information*

Qualitative information was gathered using in-depth interviews with the sample of nurses and nurse educators described in Section 3.3.2. A key criterion for my qualitative component was transparency: the reader should be able to clearly see how the interpretation of the data related to the information collected. A further important criterion involved ensuring that the interpretation was plausible. The qualitative data were collected using interviews (described in Section 3.5.2.1), journal notes (described in Section 3.5.2.2) and personal narrative (described in Section 3.5.2.3).

3.5.2.1 *Interviews*

The purpose of the interviews was to better understand the factors that influence the attitudes of registered nurses, nurse educators and academics in an environment that is progressively being dominated by technology. The interview approach was structured around a general interview guide (Patton, 2002) that provided a framework for the topics to be explored with each participant. There are many advantages to using this approach because it ensures a comprehensive collection of data by maintaining a basic outline of the topics for the interview and, at the same time, allowing the researcher the freedom to explore and probe the experience of the individual in a way that is responsive to that person and allows his/her particular story to emerge (Patton, 2002). By using this interview method, I was able to make efficient use of the participants' time because it allowed the opportunity for both participant and researcher to ask pertinent questions that required clarification. Furthermore, from a constructivist perspective, the interviews provided the capacity to involve a mutual creation of knowledge (Creswell & Plano Clark, 2007; Denzin, 2000; Guba & Lincoln, 1994; Schwandt, 1994). The interview followed a standard format with a set of open-ended questions. The purpose of the interviews was not only to describe, but also to understand the attitudes of the participants with respect to their use of Information Technology in the workplace.

The interviews varied in length from half an hour to two hours. The length of the interviews was dependent on the participants' responses to the interview questions. Given the logistical problems related to the geographically-diverse locations and the

work schedules of the nurse participants, the majority of the participants chose to be interviewed over the telephone rather than face-to-face. It was recognised that the researcher would not have the benefit of making use of body language and facial expressions in interpreting the interviews; therefore, it was important to ensure that the questions were sufficiently broad to encourage nurses to provide rich and varied data (Patton, 2002). Two separate sets of interview questions were prepared for the two groups of interview participants, namely, one for the registered nurses and another for the nurse educators and academics.

To ensure that the questions were likely to elicit the information needed, a pilot study of the interview questions was conducted with a group of six registered nurses and two staff educators (as recommended by Kvale, 1996). All of the registered nurses who volunteered to be involved in this phase had experience with and had used computers and technology regularly in their work. This group also assisted with the development of the interview questions. An important consideration was to maintain the opportunity to explore individual experiences and perspectives and to be open to unanticipated information, from which important insights could emerge and salient themes could arise.

All of the interviews that were conducted with nurses during the main study were audio-recorded and transcribed verbatim within 48 hours of the interviews being held. In this way, any item or points could be clarified with the interviewees whilst it was still fresh in their minds. Participants were given the opportunity to read through the typed transcript to clarify that the researcher had understood what was said during the interview and had interpreted the interviewees' accounts accurately. Participant nurses were informed that, if they felt that their views were not reflected accurately, they could correct or update the information in the transcripts.

3.5.2.2   *Journal Notes*

As a participant observer, I recorded the daily interactions between nursing staff, nurse managers and educators. These interactions were recorded as anecdotal notes and included staff concerns and events relating to nurses' use of information technology. These notes often led to new and emerging themes that spurred interest

for further investigation. These anecdotal notes became a rich source of data for the research. The researcher's reflective journals and anecdotal notes were used to provide additional depth to the qualitative data.

3.5.2.3   *Personal Narrative*

For the duration of the study, the researcher was working within the nursing management stream. The role involved nursing, human resource management and supporting clinical staff in Hospital and Clinical Information systems. As a colleague and co-worker, I was called upon to act as a resource person who could provide assistance when nurses were having issues with computers or technology. My role included providing guidance, training and support for both doctors and nurses. The principal advantage of working in the same organisation was the access to the research setting itself. This included access to documentation, key informants and the participants. This position permitted a truly "emic, or insider's perspective" (Merriam, 1998, p. 6).

The insider's perspective provided me with the opportunity to observe whilst working alongside colleagues and senior nurses to gain "direct experiential and observational access to the insiders' world of meaning" (Jorgensen, 1989, p. 15). Cornford and Pollock (2003) advocate the use of participant observation alongside other methods of data collection to gain an in-depth and full picture of phenomena, including the issues often found in real-life situations. As a participant observer, I was able to become directly involved in the participant nurses' working lives (Jorgensen, 1989, p. 20). My relationship with nurses involved in the study setting was linked to the training responsibilities and role of the researcher within nursing management. During training classes on how to use information technology applications, I found that some nurses were experiencing difficulty in using the hardware and understanding basic computer commands and terminology. The comments from peers and colleagues encouraged the researcher to maintain a journal as evidence to support a request for more training for nurses in computer and technology skills.

While there were advantages to being an 'insider' within the research context, there were potential disadvantages also. The main disadvantage was the close working relationship between the researcher and registered nurses and management colleagues, which could involve potentially ethical and sensitive situations. However, in an attempt to avoid these and to foster a more positive relationship, an 'appreciative inquiry' lens was used to guide the researcher when approaching research participants. Appreciative inquiry has been described as a "way of thinking, seeing and acting for powerful, purposeful change in organisations", while working on the assumption that the solutions and answers already exist within the organisation (Hall & Hammond, 1998, p. 1). The traditional approach to change management in an organisation is to put the spotlight on the identification of problems and problem solving. In contrast, appreciative inquiry suggests looking for what works within an organisation (nursing) and aims to build on these examples. The inquiry utilises the real experience of the people within the organisation to identify what has worked best and where the strengths are. It assumes that people will know how to build on their successes. The health care organisation of which nursing is a subset was viewed as organic which, as Hammond explains, indicates that "all parts are defined by the whole; thus, you cannot take an organisation apart to study its pieces" (Hammond, 1998, p. 7).

3.6   Data Analysis

The combination of quantitative and qualitative methods facilitated a deeper interpretation of meaning from registered nurses. The analysis of the data involved a layered approach using both quantitative data analysis (described in Section 3.6.1) and qualitative data analysis (described in Section 3.6.2) to explain and enrich the general findings.

3.6.1   Research Objective 1

Research Objective 1 was to develop and validate a survey to assess nurses' attitudes towards the use of technology in hospitals in Western Australia. For the present study, the quantitative data collected using the newly-developed survey, the Nurses' Attitudes towards Computers and Technology (NACT), provided an overview of the

nurses' attitudes which was used to guide the interview questions, as recommended by Creswell (2002). In this respect, I adopted sequential procedures, as described by Creswell (2002, p. 16), in which I "elaborated on or expanded the findings of one method with another method".

The first reserach objective involved developing and validating a survey to assess nurses' attitudes towards the use of technology in nursing practice in Western Australia. The multistage approach used in the development of the survey was described earlier in Section 3.5.1.1. Once the newly-developed survey had been administered, the quantitative data were analysed using the Statistical Package for Social Sciences (SPSS version 21).

To examine the validity and reliability of the newly-developed NACT survey, data were analysed to examine the factor structure and internal consistency reliability. To examine the factor structure, factor analysis was used. Factor analysis is typically undertaken to validate the scale structure of an instrument using data obtained from a sample of respondents completing the total instrument. It is a way of determining the nature of the underlying patterns among a larger number of variables (items). Principal axis factoring with varimax rotation was used. The two criteria used for retaining any item were that it must have a factor loading of at least 0.40 on its own scale and less than 0.40 on any of the other scales (Field, 2005; Thompson, 2004; Stevens, 1992).

The internal consistency of each scale provides an index of the extent to which items in the same scale are intercorrelated and therefore measure a common construct. The Cronbach alpha coefficient was calculated for each factor/scale to provide an indication of its internal consistency reliability.

3.6.2   *Research Objective 2*

Research Objective 2 was to investigate whether the attitudes of registered nurses towards information technology in the workplace are related to their personal skill ratings. This objective involved associations between nurses' attitudes towards information technology in the workplace and their self-reports of computer or

technology skills. To address this objective, simple correlation analysis was used to examine the bivariate relationship between each nurses' attitude scale and self-reports of their computer and information technology skills.

3.6.2   *Research Objective 3*

Research Objective 3 was to investigate whether nurses' attitudes differ for nurses who are under 35 years of age and those who are 35 years or older. This objective focused on whether nurses' attitudes towards information technology differed for nurses who were 35 years of age and under and for those who were over 35 years of age. As explained in Section 3.4.1, I chose 35 years as the age at which to split the sample into two groups because younger nurses (less than 35 years) would have gained a degree of familiarity with using Information Technology during their secondary and tertiary education. To examine whether differences in attitudes were statistically significant, a one-way multivariate analysis of variance (MANOVA) was used. As a first step, testing of preliminary assumptions was conducted to check for violations of normality, linearity and homogeneity of variance-covariance matrices. Once these conditions were satisfied, MANOVA was performed to investigate age differences in nurses' attitudes (less than 35 years 35 years or older). Wilks' lambda was checked to ensure that there was a statistically significant difference between the two age groups for the whole set of attitude scales, prior to interpreting the one-way ANOVA for between-group differences for each individual attitude scale.

In addition, the effect size for each scale was calculated, to determine the magnitude or importance of these differences (as recommended by Thompson, 2001). The effect size was calculated by dividing the difference between the two means by the pooled standard deviation, thus expressing the difference between the means of the two age groups in standard deviation units. This effect size is known as Cohen's *d*.

3.6.2   *Research Objective 4*

Research Objective 4 was to investigate registered nurses' attitudes towards the use of information technology and nursing informatics within nursing practice in Western Australia. To address this objective, the data were analysed to describe the

attitudes of nurses towards information technology in the workplace. As a preliminary step, descriptive statistics (means, standard deviations and percentages) were used to portray the demographic data of individual survey participants. In the analysis of the data, frequency distributions and percentages were used to describe the sample of nurses and their responses. The data collected from the 134 registered nurses were used to examine information about the nurses' attitudes towards computers and information technology in their work environment. This quantitative data served to provide a large-scale overview of the factors influencing nurses' attitudes towards information technology in the workplace. In addition to the quantitative data, important qualitative data were collected to provide depth to the findings.

The analysis of this qualitative data involved coding, whereby the researcher went through the data, reading, rereading and annotating the data to identify particular objects of interests. As recommended by Patton (2002, p. 432), coding was accomplished by 'moulding' the interview data into findings by "reducing the volume of raw information, sifting trivia from significance, identifying significant patterns and constructing a framework for communicating the essence of what the data reveals".

The thematic coding process in this research involved reading and rereading the interview transcripts, and making notes, while constantly looking for emerging patterns and themes within and across participant interviews and the qualitative comments in the open-ended responses from the survey and notes from the reflective journal entries also were usef for the thematic coding.

The challenge of making sense of the data involved reducing the volume of raw information by identifying significant patterns and constructing a framework for communicating the essence of what the data revealed (Patton, 2002). Whilst there is no absolute rule that the interpretation of the data by the researcher is free of bias, the analysis used in my research involved exercising due care in checking that the data interpretation reflected the real situation (Patton, 2002). The analysis commenced with an iterative process of reading and rereading the transcribed interviews of the

data to enable coding to be undertaken. Data collected in the open-ended questions in the free-text section of the questionnaire were analysed line by line, thematically.

The method used in the data analysis was guided by the framework approach suggested by Pope et al. (2000). The key stages of the analysis involved:

- Familiarisation: Once the interviews were transcribed, immersion into the raw data commenced to enable familiarisation with the information collected.

- Identifying: A brainstorm of initial themes was undertaken to allow grouping of ideas and patterns of emerging themes. In the context of this study 'themes', which can be multiple in anecdotes or interviews, are described as the main subjects which can be evinced or interpreted from the words expressed by the interviewees (for example, 'no computer available', 'cannot logon – no code'). The textual comments were transferred word-for-word into an Excel spread sheet and then analysed thematically, with each word and statement being read and reread for nuances and meanings. Then the data were categorised into themes or groups of ideas (for example, 'barrier to access', 'workload'). The outcome of this stage was a detailed table of information with titles for subsequent easy retrieval and exploration. Extensive written notation on the transcripts and additional note-taking during analysis of each transcript, and across transcripts, allowed a record of thoughts about the data.

- Indexing: The interview documents were carefully reread and every quote that represented an experience, issue, need, conflict or strategy was highlighted and colour coded with individual colours representing different themes.

- Collation: Once all of the interviews were coded, the codes were collated into individual theme documents. The most poignant and salient quotes were included in the summary charts. The completed summary chart provided distilled summaries of the views, experiences, perceptions and attitudes of the

research participants. The final stage of the analysis was the inclusion of the participant recommendations.

Because the data were collected using multiple methods, the analysis involved triangulation to add rigour, breadth, complexity, richness and depth to the research inquiry study (Teddie & Tashakkori, 2009). The interviews, conducted with multiple participants in various health care settings, created a multi-dimensional picture of the use of information technology in the workplace. An important feature of this constructivist inquiry was the use of analysis that took into consideration the multiple perspectives of the nurses. This helped to broaden the many-sided kaleidoscope of the realities faced by nurses in various settings rather than using only a single view (Denzin, 2000; Guba & Lincoln, 1994).

In my study, triangulation was used to help to confirm the research findings. Triangulation is frequently used to describe the purposes of the researcher in making the decisions about research design and methods (Morse & Field, 1995; Sandelowski, 1995). According to Greene and Caracelli (1997), analysis of data through triangulation is not expected to verify or confirm previously-gained data, but is expected to contribute additional information to increase the completeness of the data (Greene & Caracelli, 1997). Confirmation balances the strengths and weakness of different approaches to test the consistencies in the findings from the different sources of data and approaches (Patton, 2002; Shih, 1998). The purpose of triangulation in my study was to reveal the varied dimensions of nurses' views of the use of technology in the workplace and the factors that influence views.

3.6.3   *Criteria Used to Ensure Quality in the Research*

Throughout this research, the collection and analysis of the data were carried out in a meticulous way, based on clearly articulated theories and in response to specific research objectives, as recommended by Yin (2011). To be of value, the results of the data analysis were required to be meaningful to the audience for whom they were intended and used a language that could be understood. The validity of the data was represented by authenticity and credibility.

Throughout the analysis of the data, I frequently asked myself whether I really understood the data and I endeavoured to describe my research in language that was similar to that used by the nurses who use computers technology in their daily nursing practice. A range of terminology has been used to describe the processes that contribute to rigour in qualitative research. Lincoln and Guba (1985), Appleton and King (1997) and Patton (2002) used the term 'trustworthiness' with respect to a study, which is tested according to four tenets: credibility, transferability, dependability and confirmability. In this section, the issue of trustworthiness and how it was addressed are discussed. In my study, rigour was paramount at all stages of the research process and consideration was given to credibility (described in Section 3.6.3.1), dependability (described in Section 3.6.3.2) and confirmability and transferability (described in Section 3.6.6.3), each of which is addressed below.

3.6.3.1   Credibility as Validity

The term 'credibility' refers to internal validity and is described as an attempt to establish the match between the constructed realities of the respondents with the realities represented by the researcher. In this study, credibility issues were addressed in ways that were consistent with Guba and Lincoln's (1989, p. 237) constructivist strategies. Upon embarking on this research, nursing staff and senior nurse managers were consulted at their place of employment to ensure that the intentions and methods of the research used were valid, reliable and credible.

Credibility for qualitative research is described as the truth, value or believability of the findings. To enable this, an honest and trusting relationship was established between the researcher and interviewees in order to encourage the disclosure of candid pertinent information and perceptions (Guba & Lincoln, 1989). All participant nurses were provided with a typed copy of their interview transcripts to allow them to check and confirm that the details were accurate. The interview participants were also able to change any part of the transcripts that they felt did not represent what they had said. This form of 'member checking', as recommended by Creswell and Plano Clark (2007), allowed me to be confident in the data that were collected. According to Creswell and Plano Clark (2007), member checking allows the investigator to take case studies and themes back to key participants to check if

the investigator's findings are 'an accurate reflection' of the participant's experiences.

After each interview session, the audio-recordings were transcribed within 48 hours and, where expressions or comments were unclear or the tape was inaudible, the researcher contacted the interviewee for clarification to verify the conversation that had taken place.

3.6.3.2   Reliability as Dependability

Reliability is concerned with the stability of data over time or the extent to which findings can be replicated (Guba & Lincoln, 1989; Lincoln & Guba, 2000). As the researcher, I ensured the accuracy of the findings by checking that the interview transcripts did not contain mistakes made during transcribing. I compared the typed transcripts line by line with the audio recordings. Mistakes and omissions were corrected and I ensured that there was no ambiguous information remaining following the coding process. This was achieved through a process of constant comparison of data with the code and review of the transcripts (Creswell, 2003, 2009). By verifying details with interviewees, I was assured that my interview data were reliable and dependable. All tape recordings, the interview timetable and transcribed notes were kept on file electronically. By ensuring the above processes were followed and documented, the research processes for this study can be considered dependable.

3.6.3.3   Transferability

External validity is concerned with the findings of the study and how they can be applied to other situations. According to Guba and Lincoln (1989), establishing transferability requires a sufficiently detailed database to facilitate transferability judgements on the part of others who might wish to apply the study's findings to their own situation.

In this research, the interview participants were from varied work locations, including metropolitan, rural and remote Western Australian settings. The registered

nurses worked in public and private health care facilities and the nursing care delivered varied from acute, high patient-turnover areas, such as emergency, intensive care and coronary care units, to medical and surgical, maternity, community, aged-care and remote nursing. The analysis of the interview data involved finding items of similar patterns and then organising the information into groups so that it resembled a coherent explanation or description with rich information of emerging themes that highlighted dilemmas and constraints and provided insights faced by the registered nurses in their work environment. I have endeavoured to provide a detailed description of registered nurses, staff educators and academics, interview details including time, and the context of the research so that it can be replicated with different research populations by other researchers.

3.7   Ethical Considerations

This section describes the ethical considerations made at each stage of the study. According to Anderson and Arsenault (1998), common concerns for the welfare of human subjects involved in a study raise some general considerations which must always be addressed. This section describes the process undertaken to ensure the study's ethical acceptability prior to the collection of data (described in Section 3.7.1), and issues relating to informed consent (described in Section 3.7.2), confidentiality (described in Section 3.7.3) and the position of the researcher (described in section 3.7.4).

3.7.1   *Prior to Data Collection*

Prior to the collection of data, permission to conduct this study was given by the Human Research Ethics Committee, Office of Research and Development, Curtin University. (A copy of ethics approval can be found in Appendix D). Ethics approval was also sought and obtained from the Nurses and Midwives Board of Western Australia (NMBWA) for permission to survey practising nurses. (A copy of ethics approval can be found in Appendix E.) The NMBWA randomly distributed 500 questionnaires on behalf of the researcher. The return of the completed survey implied active consent and those nurses who provided contact details were considered to be potential interviewees.

In the survey package, each prospective participant received a written invitation to participate in the study. The invitation summarised the study, provided assurances of confidentiality, anonymity and notification that participants could withdraw from the research at any time. All participants were assured that their participation in the study was voluntary and that all interview data collected would be available only to the researcher and would remain anonymous. I assured the interview participants at the start of the interview that they would be provided with a copy of the typed interview transcript so that they could verify its contents. Nurse participants were also informed that, should they wish to withdraw at any stage during or after the interview, they could do so and that this decision would not impact on their work performance or achievement. (A copy of this information statement can be found in Appendix F.)

3.7.2 Informed Consent

The registered nurse participants formalised their agreement to participate in the interviews by providing their contact details on the returned questionnaire and signing a consent form. Invitation to nurse educators to participate in this research was sought via email contact with the Director of Nursing at the five teaching hospitals in Western Australia. The letter introduced the researcher and provided an information sheet that included a brief summary of the study. Participation by the nurse educators was voluntary and all of the nurse educators provided their consent to the researcher. All nurse educators were assured of confidentiality.

3.7.3 Confidentiality

The researcher approached the Heads of Nursing Schools of the universities within Western Australia through a letter sent electronically. The academics, as advised by Head of Nursing School, approached the researcher directly through email or telephone, thus enabling their participation to be kept confidential between interviewee and the researcher. The academics' personal details or institution were not recorded during the interview. The researcher explained and gave a synopsis of

the research to the participating academics and answered all questions that they asked. If the academic decided to participate in an interview, a convenient date, time and location for either a face-to-face or audio-recorded telephone interview was arranged.

With permission from the participants, the interviews were fully transcribed verbatim. Participants' details were masked through the use of codes to ensure anonymity. For example, the codes used for nurses were Nurse 1, Nurse 2, etc. and, similarly, Educator 1, Educator 2, etc. were used for nurse educators and academics. All interview participants were assured that any information published as a result of this study would not be traceable to any individual and that the data would be reported only in aggregate form.

3.7.4 *Position of Researcher*

In interpretive-based research, it is well recognised that the assumptions held by the researcher (based on his/her prior experiences and background) and the problem under investigation can influence the decisions made and the process of the investigation. Polkinghorne (1992, p. 26) states that, positioned within the "hermeneutic circle" of understanding, researchers cannot act otherwise.

I came to this research having had several years of experience working on the Western Australia Health Department Clinical Information System project, which involved implementing computerised patient information systems at all sites within the metropolitan area. The hospitals nominated key personnel to be trained as expert systems users. These experts then trained other staff members within their own organisational divisions. Having seen the implementation and the training and how it was disseminated, I have first-hand experience of both nursing and information technology. While my familiarity with certain aspects of information technology and nursing practice allowed deep engagement with the data, all attempts were made with analysing the findings to remain vigilant about my pre-conceived ideas and expectations. By remaining mindful of my own position in the hermeneutic circle and by reflecting on my own assumptions, I made every effort to remain attentive to the understanding of participants, particularly the registered nurse participants, nurse

educators at the hospital and the academics from the nursing faculties at the universities.

3.8   Chapter Summary

Chapter 3 provided details of the research methods used to address each of the research objectives. The data collection used a mixed-methods approach that involved the collection of qualitative and quantitative data. This design was considered to be appropriate for the present study because it enabled me to draw on the strengths and minimise the weaknesses of each method of data collection. The study involved two distinct phases. First, a large-scale quantitative survey was administered to nurses in Western Australia to provide an overview of the factors influencing nurses' attitudes towards nursing informatics. Second, in-depth qualitative data were gathered using interviews with nurses to help me to better understand nurses' responses to the survey and to provide more information with respect to nurses' attitudes towards information technology in health care.

The sample for the present study involved a total of 134 nurses from both private and public health care facilities in remote, rural and metropolitan areas in Western Australia. Given the wide range of facilities, specialties of nurses and locations, I considered this sample to be representative of nurses in Western Australia. In addition to this larger sample, I interviewed 20 of the nurses who indicated (on their survey) their willingness to be involved. The selection of these nurses (out of a total of 33 who volunteered) was based on their location and type of health care facility that they were working in to ensure a wide range of experiences with information technology.

To provide an overview of nurses' attitudes towards the use of computers and information technology in health care, I developed a survey, based on those developed and validated by Stronge and Brodt (1985) and Jayasuriya and Caputi (1996). My newly-developed survey, the Nurses' Computers & Information Technology Questionnaire (NCITQ) consists of three parts. A copy of the questionnaire is attached in the Appendix C. The first section sought information related to the demographics and background of the nurses. The second part assessed

nurses' attitudes towards information technology in the workplace and consisted of 20 statements in three scales. Finally, the third section contained two open-ended questions to provide nurses with the opportunity to express their opinions with respect to information technology in the workplace.

The newly-developed instrument was pilot tested with 50 nurses at each of two sites prior to the main administration. On the basis of the pilot study, minor adjustments were made to the survey before it was sent out to 500 randomly-selected nurses from around the state. Of the 500 surveys that were posted, 134 were returned complete and usable.

Once the survey data had been collected and analysed, the collection of the qualitative data took place. Qualitative data were gathered using in-depth, semi-structured interviews with nurses and nurse educators, journal notes written by myself and based on the interactions with nursing staff, nurse managers and educators, and personal narrative (to capture my interactions, observations and discussions with nurses in the workplace).

Analysis of the data included, first, an examination of the validity and reliability of the newly-developed survey (factor structure and internal consistency reliability). Second, to investigate whether associations existed between the attitudes of nurses towards information technology in health care and their competence, simple correlation was used. Third, to investigate whether the attitudes of younger nurses (under 35 years) and older nurses (more than 35 years) differed, one-way MANOVA was used to test for statistical significance and effect sizes were used to portray the magnitude of differences.

Finally, to explore nurses' attitudes towards the use of computers and information technology in health care, both quantitative and qualitative data were used. Descriptive statistics (involving the data collected from 134 nurses) were used to describe the nurses' responses to the three scales whilst qualitative data were used to help to understand and add depth to those responses. The analyses of the qualitative data (from interviews and open-ended questions on the survey) were guided by the

framework approach to data analysis suggested by Pope et al. (2000) that involved familiarisation, identifying, indexing and collation.

Chapter 4

DATA ANALYSIS AND RESULTS

4.1   Introduction

Whereas the previous chapter was devoted to describing the research methods used to carry out the present study, this chapter reports analyses and results of the present study using the following headings:

- Development of a Survey to Assess Nurses' Attitudes (Section 4.2);
- Pilot Testing the New Survey (Section 4.3);
- Reliability and Validity of the New Survey (Section 4.4);
- Difference in Attitudes towards Nursing Informatics Between Younger and Older Nurses (Section 4.5);
- Self-Reports of technology Use and Competence (Section 4.6);
- Relationships between Personal Skill Rating and Attitudes (Section 4.7); and
- Understanding Nurses Attitudes towards IT (Section 4.8).

4.2   Development of a Survey to Assess Nurses' Attitudes

As described in Chapter 3, the development of the survey to assess students' attitudes involved a multistage approach. Stage one involved two steps. The first step involved an extensive review of theories and research related to nurses' attitudes (detailed in Chapter 2). The second step involved defining the scales that emerged from the review of literature.

The second stage involved writing individual items within the scales of the survey. Various instruments were examined with respect to their suitability to nursing and, if appropriate, were adapted to define concisely the scales identified in step one. These instruments were examined with respect to their suitability for nursing, the length of questionnaire, the time needed to complete it, complexity, focus and psychometric issues. Two surveys were identified as particularly useful and I drew on these to help to identify scales and items. These instruments are the Nurses' Attitudes towards Computers (NATC) questionnaire (Brodt & Stronge, 1986) and Nurses' Computer

and Attitude Inventory (NCATT) questionnaire (Jayasuriya & Caputi, 1996). To ensure that an adequate number of items was included in each scale, additional items were written. The new survey, named the Nurses Computers and Information Technology (NCIT) questionnaire, consisted of three scales: Benefits of Information Technology in Health Care, Pitfalls of Information Technology in Health Care, and Training for Information Technology in Nursing. Table 4.1 provides a description and sample item for each of the three scales. Each scale had seven items, giving a total of 20 items. The response format involved a five-point Likert-rating scale of Strongly Disagree, Disagree, Neither, Agree and Strongly Agree.

Table 4.1   Description and Sample Item for Each Scale in the Newly-Developed Nurses Computers and Information Technology (NCIT) Questionnaire

Scales	Description	Sample Item
	The extent to which nurses view that …	
Benefits of Information Technology in Health Care	… information technology is beneficial to patients and useful in their practice.	The use of information technology in nursing improves the quality of care for the patients.
Pitfalls of Information Technology in Health Care	… information technology is problematic in nursing care.	The use of information technology in nursing compromises patient confidentiality.
Need for Information Technology and Associated Skills in Nursing	… information technology education and skills are required in nursing practice.	The need for IT skills is essential for nursing in the 21st century.

Stage 3 involved two steps. The first involved the use of an expert panel, made up of nurses, and the second involved a pilot study. The results of each are described in the next section.

4.3   Pilot Testing the NCIT

The refined survey was pilot tested with 50 registered nurses who were working at two non-teaching hospitals (the sample for which is described in Section 3.4.1.3).

The return rate from the two hospitals that were involved in the pilot study was 97% and 95%, respectively. In collaboration with the staff educators in both hospitals, and based on comments made in the returned responses, minor adjustments were made to

the questionnaire. The updated questionnaire was then distributed to a convenience sample of 20 registered nurses. The retest of the questionnaire had a 75% response rate with no request for changes. According to Cohen, Manlon and Morrison (2000), the most salient check on face validity involves seeking the opinions of a representative sub-sample about their comprehension of items. To check the face validity of the new survey, 12 of the registered nurses who responded to the survey (six from each of the two representative hospitals), were selected based on their willingness to be interviewed. In-depth, semi-structured interviews were conducted with each of the 12 participants to ensure that nurses had responded to items in ways that were intended by the researcher. The interviews focused on the reasons for the nurses' responses as a check of the overall comprehensibility of each item. Analysis of the interview data indicated that the items were worded clearly and were easily understood by the nurses. In all cases, the registered nurses clearly explained their understanding of the items and the reasons for their responses. The nurses' responses supported the face validity of the survey and no major changes were made, with the exception of replacing two cases of technology jargon with words that were more likely to be familiar to nurses with limited computer literacy. For example, CPR, an acronym used for Computerised Patient Record, was written out in full as this was found to be confusing given that CPR is also an acronym in nursing that is used for cardio pulmonary resuscitation.

As recommended by De Vaus (2002), the interviews also were used to evaluate the layout and design of the survey, the ability of the survey to hold nurses' interest and the amount of time required to administer the survey. The pilot test indicated that the time taken to complete the questionnaire ranged from 20 to 30 minutes. Comments included suggestions to rephrase some items to make them more relevant to the Western Australian context. Based in these interviews, revisions were made to ensure the relevance of the items. For example, one of the negatively-worded statements, "The use of information technology is not beneficial for patient care", was changed to "The use of information technology assists nurses to provide safe patient care". A copy of the final version of the survey that was administered to the main sample can be found in Appendix C.

Following the pilot study and subsequent changes to the survey, the large-scale administration was conducted and the data were used to answer the various research objectives, the results of which are reported in the following section.

4.4 Reliability and Validity of the New Questionnaire

While the pilot study was used to examine the face validity of the new survey when used with nurses, the data (*n*=134) collected for the main sample were used to examine the criterion-based validity of the newly-developed survey (Trochim & Donnoly, 2006). To answer the first reserach objective, the data collected from 134 nurses were analysed in various ways to examine the reliability and validity of the Nurses Computers and Information Technology (NCIT) questionnaire in terms of its factor structure (described in Section 4.4.1) and internal consistency reliability (described in Section 4.4.2).

4.4.1 Factor Analysis

First, the multivariate normality and sampling adequacy of the data were tested. Bartlett's test of sphericity indicated that chi-square $(\chi^2) = 29234.753$ and this value was statistically significant ($p<0.001$). The Kaiser-Maiyer-Olkin measure of adequacy was high (0.973), confirming the appropriateness of the data for further analysis.

Exploratory factor analysis was carried out to extract salient factors. Principal axis factoring with varimax rotation was used to check the structure of the 21-item three-scale NCIT questionnaire. The two criteria used for retaining any item were that it must have a factor loading of at least 0.40 on its own scale and less than 0.40 on any of the other scales (Field, 2005; Thompson, 2004; Stevens, 2005). During the factor analysis, a number of items were omitted as they did not meet the criteria and were found not to assess a unique dimension. The removal of the items increased the discriminant validity of the scales. The remaining 12 items (four items in each of three scales), without exception, had a factor loading of at least 0.40 on their *a priori* scale and no other scale. The factor analysis, depicted in Table 4.2, supports the 12-item three-scale structure for the NCIT survey. The percentage of the total variance

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extracted with each factor (reported at the bottom of Table 4.2) varied from 9.97% to 38.62% for the three scales, with the total variance accounted for being 61.80%. The eigenvalues were all above one and varied from 1.20 to 4.64 for the different scales.

Table 4.2   Factor Loadings, Percentages of Variance and Eigenvalues for NCIT Scales

Items	Factor Loadings		
	Benefits of Information Technology	Pitfalls of Information Technology	Training for Information Technology in Nursing
3	0.49		
4	0.62		
5	0.64		
11	0.81		
8		0.44	
6		0.68	
7		0.81	
2		0.67	
13			0.52
14			0.55
20			0.66
21			0.77
Eigenvalue	1.59	4.64	1.20
% variance	13.21	38.62	9.97

N=134 nurses

4.4.2   Alpha Reliability

The Cronbach alpha reliability coefficient was used as an index of scale internal consistency and was generated separately for the three scales of the 12-item version of the NCIT questionnaire survey. The alpha coefficient was developed by Cronbach (1951) for measuring the internal consistency or reliability of a scale for a particular sample group. Alpha coefficients range in value from 0 (inconsistent) to 1 (consistent) and can be used to describe the reliability of factors extracted from questionnaires that involve rating scales. The higher the coefficient, the more reliable the generated scale is. By convention, a lenient cut-off of 0.60 is common in exploratory research; the alpha reliability should be at least 0.70 or higher for a satisfactory scale; and a cut-off of 0.80 is required for a 'good' scale (Cohen et al., 2000). According to Nunnally (1978), an alpha coefficient of 0.70 is widely considered to be an acceptable value. The Cronbach alpha coefficient, reported in Table 4.3, shows that the scale reliability estimates were high, ranging from 0.77 to 0.80 for the three scales.

Table 4.3   Internal Consistency Reliability for the Three Scales of the NCIT Questionnaire

Scale	Cronbach Alpha Coefficient
Benefit of IT to Health care	0.77
Pitfalls of IT to Health care	0.77
Need for IT and Associated Skills in Nursing	0.80

N=134 nurses

4.5   Relationships between Nurses' Personal IT Skill Ratings and Attitudes

Given that nurses' competency in information technology is fast becoming essential to health care in Australia, it was considered important to investigate whether relationships exist between nurses' personal IT skills rating (or self-ratings of their competencies with information technology/nursing informatics) and factors that influence their attitudes towards information technology in the workplace (Research Objective 2). Using the data collected from 134 nurses, simple correlations were used to describe the bivariate relationships between the factors of nurses' attitudes and their personal skill ratings. The results reported in Table 4.4 indicate that the personal skill rating of nurses was statistically significantly ($p<0.05$) related to all attitude scales. For two of the scales, Benefits of Information Technology in Health Care and Need for Information Technology and Associated Skills in Health Care, these relationships were positive. For the third scale, Pitfalls of Information Technology in Health Care, the relationship was negative. These findings suggest that the higher that nurses rated their competency with information technology, the more positive that they felt about the benefits of information technology to patient care and the need for Information Technology and associated skills in nursing. Further, the results indicated that nurses with lower computer literacy ratings were more likely to highlight possible pitfalls associated with the use of information technology in nursing.

Table 4.4   Correlations Between Nurses' Attitudes Towards Information Technology and Personal Skill Ratings

Scale	Personal IT Skill Rating (*r*)
Benefits of IT to Health Care	0.18*
Pitfalls of IT to Health Care	-0.26**
Need for IT and Associated Skills in Health Care	0.23**

*$p<0.05$ **$p<0.01$

4.6   Differences in Attitudes to Nursing Informatics Between Younger and Older Nurses

To address Research Objective 3, the data collected from 134 nurses were used to check whether there were differences in the attitudes for nurses of different age groups (those who were younger than 35 years and those who were 35 years or older). In Section 3.4.1, the choice of age 35 years to form a group of 'younger' and 'older' nurses is justified. A one-way multivariate analysis of variance (MANOVA), with the three attitude scales as the set of dependent variables and the age group (less than 35 years and 35 years and older) as the independent variable, was used. The means, reported in Table 4.5, indicate that nurses aged 35 years or older generally held somewhat more positive views of the Benefits of Information Technology and the Need for Information Technology and associated skills in Nursing than their younger counterparts. In contrast, the younger nurses (less than 35 years old) considered there to be somewhat more pitfalls associated with the use of information technology in nursing than their older colleagues.

Because the Wilks' Lambda was found to be statistically significant, the one-way ANOVA for between-group differences was interpreted for each attitude scale. The results, reported in Table 4.4, indicate that there was a statistically significant difference in attitudes for only one scale, namely, the Benefits of IT, with older nurses (35 years and older) perceiving information technology in the nursing workplace to be more beneficial than their younger counterparts.

In addition to investigating the statistical significance of age differences using MANOVA, effect sizes were used to portray the magnitude or educational importance of differences (Thompson, 2001). As noted in Section 3.6.2, Cohen's *d* statistic portrays a difference in standard deviation units and is calculated by dividing the differences in group means by the pooled standard deviation. Effect sizes are shown in Table 4.5. The effect size for the Benefits of IT scale was 0.36 standard deviations which, according to Cohen (1988), is considered to be a relatively small effect (see Table 4.6).

Table 4.5   Average Item Mean and Standard Deviation and Age Difference (Effect Size and ANOVA Results) for Nurses' Attitudes towards Information Technology by Age

Scales	Average Item Mean		Average Item Standard Deviation		Difference	
	<35 Years	≥35 Years	<35 Years	≥35 Years	Effect Size	*F*
Benefits of IT to Health care	2.54	3.15	0.75	0.83	0.36	11.71**
Pitfalls of IT to Health care	3.65	3.49	0.69	0.74	-0.11	1.04
Need for IT and associated skills in Nursing	1.75	1.90	0.59	0.56	0.13	1.41

** $p < 0.01$
N=26 nurses under the age of 35 years and 108 nurses were 35 years or older.

Qualitative data, collected during interviews with registered nurses as described in Section 3.5.2 indicated that nurses in the different age groups generally used information technology for different purposes, which appear to have impacted on their views of IT in nursing. The results indicated that those nurses who were less than 35 years of age tended to use computers to access patient/client management and clinical information (for example, laboratory and x-ray results, ordering supplies, accessing policies and procedures, and accessing evidence to support nursing practice such as formal research findings) and continuing professional education or development (of which a minimum of 20 hours per year is required for nurses to maintain their registration). In contrast, the interviews indicated that nurses who were in the older age group (35 years or older), who used information technology for more clerical tasks, were likely to find the use of computers and technology in the health care setting to be more beneficial.

The interviews with nurses in the younger age group (less than 35 years) supported the results reported in Table 4.4, indicating that these nurses were more likely to point out the drawbacks related to the implementation of computerised systems. These younger nurses expressed their concerns over issues that they had encountered with the implementation of Electronic Health Records, such as the system's general lack of speed, the frequency of system downtime and the poor system design.

Also supporting the quantitative results reported in Table 4.4, the interviews with nurses who were 35 years or older (who were generally in more administrative roles) suggested that they were more likely to use technology for consultation purposes (such as providing advice to peers), administrative purposes (such as reporting, developing policy/procedures related to the daily work of the nurses and other staff,

dealing with complaints from the general public which are required to be lodged online) and for accreditation (a process in which certification of competency or credibility is presented). Interviews with these nurses suggested that they were more satisfied with information technology and viewed information technology in health care as beneficial to their work.

Although these findings are expanded upon in Section 4.9, it is interesting to note here that they generally support the findings of many past studies that have suggested that younger nurses are more likely to have misgivings about the benefits of information technology for patient care than their older counterparts who hold more positive views of computer technology (Alquraini, Alhashem, Shah & Chowdhury, 2007; Bongartz, 1988; Brodt & Stronge, 1986; Burkes, 1991; Chan, 2006; Marasovic, Kenney, Elliott & Sindhusake, 1997).

4.7   Understanding Nurses' Attitudes towards IT

Each of the items in the newly-developed NCIT questionnaire survey was responded to by nurses using a five-point Likert scale. Table 4.6 reports the frequency (%) with which the nurses chose each of the five responses and the mean response for each item. Although the items were presented randomly in the survey, the statements presented in the tables below (Tables 4.6, 4.7 and 4.8) are grouped according to their scale. The three scales and their items are:

(i)   Benefits of Information Technology to Health care (Items 3, 4, 5 and 11);

(ii)   Pitfalls of Information Technology to Health care (Items 8, 6, 7 and 2);

(iii)   The need for Information Technology and Associated Skills in Nursing (Items 13, 14, 20 and 21).

An important component of the present study was the inclusion of qualitative information, gathered using the open-ended questions and in-depth interviews, to better understand nurses' attitudes towards information technology in the workplace. Interviews were conducted with registered nurses who volunteered to participate, including hospital staff, clinical educators, clinical tutors and universities academics. Of the 33 registered nurses (*n*=33) who indicated their willingness to participate in an

interview and provided their contact information, 20 were interviewed. These nurses were from both rural-remote and metropolitan areas of Western Australia. The interview data were complemented by the free-text information entered into the comments section of the questionnaire to provide rich sources of information. I examined the contributions that information technology had made in assisting nurses in their practice and the manner in which information technology was used for nurses' education in Western Australia.

Rigour in the analysis of the data was maintained by considering both the comments in the survey and the emerging themes from the interviews and research journals. Consistent with the dialectical approach to a mixed-methods design, the findings of data from the survey, interviews, journal and personal narratives are described below. Although each type of data is presented discretely, the survey nonetheless provides the context within which the interview findings were located. The data are strengthened and provide new knowledge through both the convergence of and the differences within the findings.

This section reports the results of the qualitative and quantitative data collection in terms of: the Benefits of Information Technology to Health care (Section 4.7.1); Pitfalls of Information Technology to Health care (Section 4.7.2); and Need for Information Technology and Associated Skills in Nursing (Section 4.7.3).

4.7.1   *Benefits of Information Technology to Health Care*

As described in the previous chapter, analysis of information gathered from the descriptive statements of the survey and in-depth interviews with nurses were analysed, grouped, tabulated and categorised. The statements on the Nurses Computers and Information Technology Questionnaire (NCIT) Survey included three scales. The statements that assessed the benefits of information technology to health care were:

- The use of Information Technology in health care improves the quality of patient care. (Item 3)

- Information Technology in health care improves communication in health care, thus benefitting patients. (Item 4)
- Information Technology saves time when seeking information regarding patients (for example, medical records, pathology). (Item 5)
- The use of Information Technology in health care allows nurses more time to improve patient care. (Item 11)

For this scale, nurses responded on a 5-point scale to items concerning the benefits of information technology in healthcare, such as whether it improves patient care or saves time. The percentages for each response category, along with the mean and standard deviation for the items included in the Benefits of Information Technology in Healthcare scale, are given in Table 4.6. As the results show, the nurses' mean score for each item ranged from 3.31 for Item 11 to 4.10 for Item 5.

Although, as reported in Section 4.5, nurses were divided in their views about the benefits of information technology in health care (with nurses younger than 35 years being less positive about the benefits of using information technology and nurses of 35 years and older being more positive), analysis of the qualitative information suggests that nurses considered there to be three main benefits in using information technology in health care: improved quality of patient care (described in Section 4.7.1.1); improved communication between nurses and other health care staff (described in Section 4.7.1.2); and a reduction in paperwork that saves nurses' time and leaves more time for patient care (described in Section 4.7.1.3).

Table 4.6 Descriptive Information for the Registered Nurses' Views of the Benefits of Information Technology in Healthcare

Item	Statement	% Response					Mean	SD
		SD	D	N	A	SA		
3.	The use of Information Technology in healthcare improves the quality of patient care.	3.0	17.2	14.9	54.5	10.4	3.52	0.99
4.	Information Technology in healthcare improves communication in health care, thus benefiting patients.	0.7	9.0	13.4	61.2	15.7	3.82	0.83
5.	Information Technology saves time when seeking information regarding patients (for example medical records, pathology results).	0.7	3.0	7.5	63.4	25.4	4.10	0.71
11.	The use of Information Technology in healthcare allows nurses more time to improve patient care.	3.7	17.2	32.1	38.1	9.0	3.31	0.98

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SD=Strongly Disagree, D=Disagree, N=Neither Disagree nor Agree, A=Agree, SA=Strongly Agree

4.7.1.1   *Quality of Patient Care*

The results shown in Table 4.6 indicate that 64.9% of the nurse respondents agreed or strongly agreed that information technology improved the quality of patient care and allowed nurses more time for nursing practice. In contrast, 14.9% of the nurses were ambivalent, neither agreeing nor disagreeing, and 20.2% of the nurses either disagreed or strongly disagreed (mean=3.52, SD=0.99).

Analysis of the interview data indicated that the main benefit of using information technology in terms of the quality of patient care was related to improved patient safety. Safety generally refers to the notion of being and feeling protected against harm, and it is an important aspect of physical and mental wellbeing (Institute of Medicine, 2007, p. 4). All nurses who were interviewed highlighted that an important benefit of information technology is the improvement in patient safety. Of the 20 nurses interviewed, all agreed that using information technology improved patient safety by helping to reduce medication errors, including the administering or prescribing of the wrong drug, wrong dose or wrong route of administration to a patient. These included cases in which drugs might be provided without regard to drug allergies or interactions with other medications that the patient might be taking (enhancing and triggering side effects). Examples included prescribing a wrong dosage, administering a wrong dosage for a prescribed medication, or failure to give (by the nurse) or take (by the patient) a medication. Medication errors can have serious direct and indirect results, and are usually the consequence of breakdown in a system of care. Direct results include patient harm as well as increased health care cost to the organisation. Indirect results include harm to nurses in terms of professional and personal status, confidence and practice.

The nurses who were interviewed stated that the errors and mistakes made by nurses were often attributable to multiple factors. An example given by one interviewee was of nurses who were either new or inexperienced in an area of specialty, making them unfamiliar with the medications used for treatment. It was generally agreed that new or inexperienced nurses were most likely to make mistakes. In most cases, however,

nurses considered that mistakes tended to occur during attempts to transcribe a doctor's illegible handwritten orders which often lead to miscalculations of medication dosages, with some resulting in adverse drug events and near misses. For example one of the nurses recalled:

> The other day, as I was about to complete the evening medication … for one of my patients (who was admitted earlier during the day), I still hadn't really got him settled and it took me a long time to sort his medication as I had to struggle to read the doctor's orders which I could not decipher. I had to get help from the coordinator and a senior nurse, both of whom were busy. Trying to read the doctor's orders not only delayed my work and the rest of the other patients' medications, but also caused me to feel rushed and stressed. I still had to check the medication label carefully, as the spelling of different medications can be very close. I almost gave the wrong medication as the tablet looked very similar in colour and shape. If it were not for the coordinator coming to see how I was doing, I believe I would have given the wrong medication.
>
> [Nurse 6]

The nurses generally agreed that the use of information technology reduced the rate of errors in three ways, namely, preventing errors and adverse events, facilitating a more rapid response after an adverse event has occurred, and tracking and providing feedback about adverse events. Firstly, information technology reduced the risk of errors if it was incorporated into the medication ordering systems. For example, a warning alert can be set to trigger an alarm to warn a doctor if she or he did not provide sufficient/incorrect specifications such as dosage and frequency for a medication prescribed for a patient. Secondly, the nurses claimed that using information technology that linked a patient's medication chart to the pharmacy dispensing unit helped nurses to cope in stressful situations by alleviating the need for them to read and interpret the medication orders or instructions from doctors with poor handwriting on the medication charts and medical notes. One of the nurses explained:

> With information technology, if there is new medication, then you [the nurse] can stand at the end of the bed and access the eMIMS [electronic Monthly Index of Medical Specialities – a pharmaceutical prescribing reference guide published in the UK] online rather than having to find a hardcopy manual. Whereas the

nurses using the hard copy of the MIMS have to ensure it is up-to-date, you know that the eMIMS will be. It is useful in this aspect. I like to read about the new medication and what it is used for and, if I was concerned about the patient, I could get the doctor to sort out the dose, such as e-change the dosage and frequency or even change medication and treatment. In this way, IT allowed me to access the eMIMS which can alleviate potential side effects or issues for the patient.

[Nurse 16]

According to the nurses, computerised clinical information systems and medical record tracking systems have saved nurses valuable time in not having to search for misplaced medical records and case notes, laboratory and radiological results and medication charts. Prior to computerisation, the patient's laboratory and radiological tests results and x-ray reports were either handwritten and/or dictated on recorder for typing before the report was then delivered through the internal mail to the various departments and wards. Urgent results were telephoned through to the doctor and, if the doctor was unavailable, the results were given to the nurse or ward clerk who answered the telephone. This process was not only time consuming (often taking hours or days), but it also had many stages during which mistakes could be made (such as writing down the results taken over the telephone). Also there were opportunities for the results to be misplaced, lost or placed in the wrong patient's notes. The advent of a computerised system has improved, not only the turnaround time for results, but also reduced the errors that could be made during manual transcribing, recording results over the telephone or filing. Although the earlier computerised systems were plagued with navigability issues, lack of automatic response and slow system response time, the more up-to-date computerised information systems have overcome these issues. One of the nurses who was interviewed explained:

I think information technology has made a huge impact. It has made an amazing difference to the way we practice. We moved away from the old manual process. Now we can access a patient's medical records and have blood test results online, which means that we can get treatment to them in a timely manner. It has certainly made a difference. Being at the main public hospital for women and children, we get the sickest patients, and so we need to know results quickly so that treatment for them can begin in a timely manner. We have seen a bit of

> paradigm shift. I think research is starting to get more focused and supported by
>
> the organisation.

<div align="right">[Nurse 16]</div>

In another case, a nurse highlighted the benefits of technology for patient safety and care, particularly for its time-saving characteristics, such as electronic reminders that prompt and alert nurses:

> In a normal functioning business, if you do an assessment, you can get a result
>
> that can automatically send off an email to get things happening. I've seen that,
>
> at one of the demonstration labs down at one of the tertiary hospitals where they
>
> do a score for pressure area risk and, if you get the risk of 12, it means you need
>
> a special mattress. It automatically sends an text message to the staff member
>
> who is responsible for delivering the mattress.

<div align="right">[Academic 2]</div>

Some of the nurses interviewed admitted that, although they were sceptical of information technology at its inception, they had generally gained confidence and, as a result, appreciated the availability of information technology and its impact on nursing practice for patient safety and care. The patient safety issues that were identified by nurses in my study support much past research that suggests that these were universal problems (Ash, Berg, & Coiera, 2004; Bates & Gawande, 2003; Mayo & Duncan, 2004). Conversely, Lee, Yeh and Ho (2002), in their study of nurses in an intensive care unit in a Taiwanese hospital, reported that de-individualization of patient care was highlighted as a major disadvantage of the computerised nursing care plan system because it took nurses more time to complete tasks.

4.7.1.2   *Improved Communication between Health Workers*

By and large, information technology in nursing is used to communicate, manage knowledge, mitigate error and support decision making. The nurses who responded to the survey (see Table 4.6) generally agreed that the computerised information system helped to improve communication and information sharing among various health care members (Item 4) with 76.9% of the nurses either agreeing or strongly

agreeing with this statement (mean=3.82, SD 0.83). The interviews with nurses supported these results. According to the nurses who were interviewed, information technology enabled important, evidence-based data to be readily available for discussions at team meetings about patients' health care needs. The results of various diagnostic tests prescribed for the patient are available online so that the data could be collated and trends and reports could be printed and placed in patients' case notes. Moreover, the immediate availability of the information saved nurses valuable time that would otherwise be spent on telephone calls or duplicating copies of results on paper (that could be misplaced or incorrectly filed). To this end, one nurse asserted:

> I think that, provided the technology works and the people know how to use it, information technology will improve a lot of the patient safety issues. It will enable a nurse to spend more time with a patient because you [the nurse] won't have to chase up blood results and it stays in the case notes
>
> [Nurse 8]

According to the nurses whom were interviewed, one of the main advantages of information technology in health care was the availability of current online materials, not only for nurses to use in evidence-based practice, but also for patient and carers at home.

It is not uncommon for nurses to be confronted with patient care issues that require urgent attention. With the advent of information technology, a patient's laboratory results can be communicated as soon as they become available. Furthermore, information systems can identify and rapidly communicate low or abnormal results to medical staff so that the patient's treatment can be attended to as soon as possible. To this end, one nurse claimed, "IT is better than traditional systems in which results are communicated to a clerk and, when medical staff are not at hand, the results get buried among less critical data" [Nurse 6]. Another nurse stated: "If a nurse is concerned about the treatment, dose or frequency, then the patient's doctor can be contacted immediately to change the medication or treatment, thus alleviating potential side effects or issues for the patient" [Nurse 16].

An important point made by a nurses was the need for IT in more isolated settings. These nurses felt that, having the communication available (afforded by information technology) meant that information was more readily available. To this end, one nurse said:

> I think IT has become a vital part of nursing because of the speed of communication, especially for me and for country nurses because we work in isolation and with the nearest area manager can be hours away. So it is really important for isolated nurses.
>
> [Nurse 8]

And another nurse stated:

> Computers [in nursing] are good to have. Results from laboratory tests and radiological examinations are available at the drop of a hat. It allows nurses to communicate between health centres when treating a patient. In particular, for nurses in remote areas, being able to use teleconferencing is a huge benefit.
>
> [Nurse 15]

4.7.1.3   *Reduction in Paperwork and Saving Nurses' Time*

The survey results, reported in Table 4.6 indicate that nurses generally agreed that information technology saves time in terms of seeking information regarding patients (Item 5). Nurse responses to this statement suggest that 88.8% of the nurses either agreed or strongly agreed to this statement (mean=4.10, SD=0.71). The mean for this item indicated a high level of agreement. Regarding whether information technology in healthcare allows nurses more time to improve patient care (Item 11), 47.1% of nurses either agreed or strongly agreed with this statement, 32.1% of the nurses were neutral and 20.9% of the nurses either disagreed or strongly disagreed (mean = 3.31, SD = 0.98). These results suggest that there were somewhat mixed views about the time-saving aspect of information technology. Interviews with nurses helped to explain these results.

Thorough nursing documentation is a precursor to good patient care. Nurse documentation is an important part of the clinical routine, as it provides a vessel for

efficient interdisciplinary communication and cooperation (Ammenwerth, Mansmann, Iller & Eichstädter, 2003; Turpin, 2005). However, a common complaint conveyed to me by both nurses and patients during my work on the wards and documented in my journal entries was the enormous amount of paperwork that has to be completed, which is compounded by the complexity of admission and discharge processes.

The nurses interviewed commonly cited paperwork as one of the worst features of nurses' jobs. While the nurses all agreed that documentation was essential, they generally felt that some of the non-essential form-filling could be undertaken more efficiently and that, in many respects, information technology had helped to streamline some of these processes. The following narrative from [Nurse 9] sums up nurses' frustration:

> Whilst computers are essential in these rapidly-advancing times, patients are people. Genuine nursing skills are deteriorating. What happened to empathy – the power of understanding another person's feelings? Nurses should be capable of nursing – seeing the patient/client as a whole person with feelings. The focus for nurses now is more on machines and documents. The amount of paperwork is supposed to have decreased with technology, but the reverse is true; there is a phenomenal amount of forms and paperwork to be completed.
>
> [Nurse 9]

Many of the nurses whom I interviewed felt that information technology was a useful tool and that it saved nurses valuable time, particularly with respect to reducing the amount of paperwork that was required for nurses to complete, but others disagreed. For example, one nurse commented:

> It saves nurses' time in report writing, when compared with the manual report writing that was labour intensive. It took a lot of time and effort to complete, even if one was organised and had everything at the fingertips. [Before IT] report writing took forever and consumed an enormous amount of energy and time.
>
> [Nurse 15]

These findings generally are consistent with past studies that revealed that information technology was helping nurses to handle bureaucratic tasks and make the

admissions and discharge processes more streamlined – including avoiding the need for the duplication of information (Darbyshire, 2004; Lomas, 2012). However, it was interesting to note that a percentage of nurses also felt that the introduction of information technology into the workplace had increased their workload, a point that is explored in the next section.

4.7.2   *Pitfalls of Technology*

Whereas the previous section highlighted nurses' views of the benefits of information technology to health care, this section examines less positive outcomes associated with using information technology. Although the application of information technology in health care settings has the potential to transform and improve the delivery of care and streamline processes by making procedures more accurate and efficient to reduce medication errors and accident rates in the work environment, there have been occasions when this has not been the case. According to Ash et al. (2004), medication errors alone have been estimated to cause 80,000 hospital admissions per year in Australia, costing taxpayers $350 million.

To fully comprehend the pitfalls of information technology to nursing and patient care, one has to retrace the history of technology and nurses. Barnard (1996, p. 437) states:

> Technology is conceptualised as standardising and regulating the function of a nurse and is regarded as activities associated with the performance of nursing functions. Technology is noted to be a collection of discrete technological moments which are created in order to maximise health care and the practice of nurses.

The four statements related to the Pitfalls of Information Technology in Health care were:

- The use of Information Technology in health care de-personalises patient care. (Item 9)
- The use of Information Technology in health care violates patient privacy and confidentiality. (Item 10)

- The use of Information Technology in health care increases paper work completed by nurses and increases nurses' workload. (Item 11).
- The use of Information Technology in health care contributes to nursing job losses. (Item 12)

Table 4.7 summarises the results for this scale in terms of the percentage of responses for each response alternative and the mean and standard deviation for each statement. The mean score for individual items in this scale ranged from 3.13 (Item 10) to 3.84 (Item 11).

Table 4.7   Registered Nurses' Attitudes towards Pitfalls of Information Technology in Healthcare

Item	Statements	% Response					Mean	SD
		SD	D	N	A	SA		
9.	The use of Information Technology in healthcare for the de-personalises nursing care.	3.7	10.4	20.1	46.3	13.4	3.49	1.04
10.	The use of Information Technology in healthcare increases nurse's workload.	6	24	26.1	37.3	6.0	3.13	1.04
11.	The use of IT has contributed to nursing job losses within health care organization.	0.7	4.5	23.9	52.2	18.7	3.84	0.81
12.	The use of Information Technology in healthcare violates patient privacy and confidentiality.	5.20	14.9	20.1	50.7	14.2	3.64	0.90

SD=Strongly Disagree, D=Disagree, N=Neither Disagree nor Agree, A=Agree, SA=Strongly Agree

The interviews with nurses were used to help to understand these scores. While interviews with nurses indicated that, in general, they accepted the need for technology, they also indicated that there were some nurses who were aware of its limitations and were concerned about the possibility of an over-reliance on technology. The interesting duality is expressed by one of the academics who was interviewed in the course of this study:

> I think the biggest dilemma that we [nurses] face at the moment is that the health
> care system itself is way behind in technology. Its way up there in diagnostics,
> anything medical is way up, but anything related to electronic patient records is
> not even happening. Considering that word processing has been around for
> decades, the continued use of a paper-based system of records is appalling.
>
> [Academic 1]

There were also nurses who were sceptical about the benefits of information technology in health care, with one nurse stating:

> Information technology is dangerous for patient care when care is put at risk due
> to the monitoring system being weak. Sometimes safety is not observed because
> of weak operational practices and weak protocols. [Nurse 67's free text entry in
> questionnaire]

Another nurse expressed her misgivings about information technology when she said:

> For IT to work, the education side needs to be very precise. I don't know, to be
> honest, I really don't know. Information technology should be good. Maybe I am
> just old fashioned. [Nurse 53: free text entry in questionnaire]

Analysis of the qualitative information suggested that many of the nurses had a degree of apprehension with respect to the increased reliance in using information technology to provide nursing care, because they feared the loss of nursing jobs (discussed in Section 4.9.2.1), increased nurses' workload (discussed in Section 4.9.2.2), the violation of patient privacy (discussed in Section 4.9.2.3) and issues related to confidentiality and de-personalisation of patient care (Section 4.9.2.4). Each of these points is elaborated on below.

4.7.2.1   *Nursing Job Loss*

The results reported in Table 4.7 suggest that nurses generally agreed that the use of Information Technology has contributed to nursing job losses (Item 11), with 70.9% of nurses either agreeing or strongly agreeing to this statement (mean = 3.84, SD = 0.81). Of the nurses, 23% were neutral and 5.2% either agreed or disagreed.

The qualitative information supported these quantitative findings, with the nurses reporting that they felt that information technology was and continued to replace some of the tasks that nurses currently performed and that this, ultimately, could lead to job losses. For example, nurses felt that technologically-driven devices, such as the vital signs monitoring, assisting wound care management and intravenous fluid

administration machines that already were in use, had resulted in reduced nurse–patient ratios, with fewer nurses being required to provide care during shifts. To this end, one nurse said:

> There are already signs of job loss, as there is a reduction in the number of nurses needed to attend to critically ill patients. In the past, there was one nurse per patient to watch the vital signs and to count the drops used to administer the dosage. With the advent of technology, one nurse can now look after several patients.

> [Nurse 19]

Consistent with world trends to improve communication between various groups of health care workers, in a bid to provide a multidisciplinary approach to health care services, the Western Australian health care system is going through significant upgrading and revamping of its information technology. However, austerity measures and concerns for world recession and funding cuts, coupled with a drive for efficiency, are impacting on the recruitment of professional health care workers including nurses. Interviews with nurses suggest that they viewed the use of information technology as a contributing factor to the loss of nursing jobs and the reduction in the recruitment of nurses. These findings support the results reported in Table 4.7, which suggest that just over 70% of the nurses agreed or strongly agreed that nursing positions were and would be lost as a result of the introduction of information technology.

4.7.2.2 Increased Nurses' Workload

The results reported in Table 4.7 indicate that nurses were divided in their views about whether the use of information technology had increased nurses' workload. Just under half of the nurses (43.3%) either agreed or strongly agreed that the use of information technology had increased nurses' workload and 26.1% were neutral about the issue. However, 30% of nurses either disagreed or strongly disagreed that the use of information technology in the workplace had increased nurses' workloads. Analysis of the interviews with nurses suggested that the introduction of IT had led to the need to duplicate methods of clinical documentation. Because there were too few computers readily available, nurses were often required to record on hard copies

or pieces of paper and later, when a computer became available, transfer the data across to the computer. For example, one of the nurses said "Yes Information Technology has increased workload because we double up, we do both. So we do record it all on a piece of paper and then input it into the computer" [Nurse 10]. Another nurse stated:

> I know we need to keep abreast. I can see the benefits of using computers to aid us maintaining records and accessing information but at the moment, there is still a 'hard copy' of all information that needs to be completed as well. Lots of 'double entry', if you like. Technology is sometimes too slow to be relied on. It is times like this that it takes away time from patient care and/or can generate workload for shift.
>
> [Nurse 17]

In addition to the lack of computers and the need to duplicate the work, the low speed of the computers also has added to the nurses' already-heavy work load. Many of the nurses complained that the computer applications that were available for them to use were too slow to be useful because they took them away from valuable patient care time. To this end, two of the nurses said:

> We've only got one computer. It's a dinosaur alright. When it works, it's very slow and very time consuming. Sometimes, it doesn't come fast enough, and you can't always deal with it there and then because perhaps you are busy. So you have to come back to it, and it can be a little bit difficult getting hold of somebody at the right time for help with IT. [Nurse 11]

> Some of the computer programs that we are required to use are doubling the work required by nurses. I know these computer programs were meant to cut down on some aspects of paperwork required in various settings for the nurse, but this hasn't necessarily happened. Therefore time is taken away from the patient when we do the same thing twice, once on the computer and once on paper.
>
> [Nurse 10]

The nurses all agreed that, although there were many advantages of using information technology in the workplace, not all of the effects of information technology on nursing have been positive. Many of the negative comments about

information technology stemmed from the lack of integration of applications and the duplication of effort on the part of nurses. For example "Often the writing is illegible, the increase of error is great, and having a paper-based system prevents a computer system from working" [Nurse 13].

The nurses generally felt that the introduction of information technology led to a blurring of the boundary that exists between the roles of medical staff and nurses. It would appear, from the interviews, that this blurring often led to additional responsibilities and stress for nurses. For example, one nurse stated:

> ... [We are located] miles away from anywhere and the nearest town is hours away. So when there is no doctor around, we nurses have to do our best for the patient during an emergency. With technology, the role that the nurse plays in these emergencies has increased dramatically. … With technology, during an emergency, you are it. You are making decisions based on what you see in front of you and you use whatever technology tool is available to you, there and then, for patient's safety.
>
> [Nurse 18]

The findings from my study are similar to those of Webster et al. (2003) who found that 30% of nurses thought that computers detracted them away from patient care because of duplication of nurses' workload. Similarly, Timmons (2003) found that British nurses expressed concerns that, compared to a paper-based system in which patient notes stayed at the bedside, electronic-based records took nurses away from the patient's bedside, resulting in a delay in data entry and potential for omission of critical information or errors. Also it delayed treatment being carried out from prescribed orders in the case notes.

4.7.2.3   *Violation of Patient Privacy*

The results reported in Table 4.7 indicate that 51% of the nurses agreed and a further 14.2% strongly agreed that the use of information technology in the health care workplace had the potential to violate patient privacy and confidentiality. A further 20.1% of the nurses were neutral and 21.1% of the nurses either disagreed or strongly disagreed that the use of information technology in health care violates

patient privacy and confidentiality. Privacy offers protection against harm and, in some cases, if an individual's medical condition becomes public, it has the potential to discriminate against the person. For example, a person with a positive HIV blood test can have his/her chances of employment jeopardised. According to Moor (1997), some personal information, that might be damaging if generally released, should be protected (Moor, 1997).

In Australia, Section 141 of the Health Service Act 1988 (Thomson, 2004) governs the privacy and confidentiality of information that may be lawfully disclosed under circumstances as stipulated. However, the nurses voiced concern over the easy access to computerised data which makes information retrieval quick and easy with the potential of accidental exposure. Both in the free text comments section of the questionnaire and during interviews, nurses expressed concerns over privacy and confidentiality of patient information, particularly with the increased emphasis on electronic format.

During the interviews with nurses, the issue of violation of patient privacy and confidentiality, particularly when sending and receiving information electronically, was raised. The nurses whom were interviewed generally agreed that the use of computer systems enabled unauthorised persons to access confidential information more easily than with hardcopy medical records that are restricted to the clinical staff who are providing care to the patient and are physically working within the area. For example, one nurse wrote in the free-text section of the survey:

> Information Technology (IT) can violate patient privacy when, for instance, if someone knows a patient who is ill and wants to find out what is wrong with the patient. He/she can get access to the pathology results and other information on the system. … Health professionals do have access to a lot of things related to health electronically and able to use the information for professional purposes or inadvertently ruin a career through carelessness in observing the security of programs, applications and passwords. [Free-text comment in questionnaire from respondent Nurse 315]

Another point of contention raised by the nurses related to multiple users using the same generic logon to access a computer and the unauthorised use of mobile/wireless

devices that could be lost or stolen. The privacy and confidentiality concerns were mentioned by nurses in both metropolitan and remote rural regions within the Western Australian health care system. It appeared, however, to be less of a concern for nurses from the private sector, who did not experience the same issues as nurses working in public hospitals. For example, one of the nurses from the private sector commented:

> The younger generation [of nurses] … have all got their iPods and are connected to their mobile phones, and a lot of their education is solely IT based. They do simulated clinical practice to learn their basic clinical skills. With generational change, this has become the norm, but patient safety and violation of confidentiality and erosion of an individual's privacy will be difficult issues to monitor and will bigger than Ben Hur to manage.
>
> [Nurse 8]

4.7.2.4   De-personalised Care

The results in Table 4.7 indicate that, of the nurses who responded to the survey, 59.7% either agreed or strongly agreed that the use of information technology in healthcare depersonalised nursing care, compared to 14.1% of nurses who either disagreed or strongly disagreed to this statement. The interviews with nurses supported these results, with many of the nurses feeling that the increasing use of technology in the workplace had the potential to de-personalise patient care. My review of literature indicated that the use of information technology in the nursing workplace was increasing rapidly, driven in part by strategies for adopting electronic health records. Telehealth, mobile devices and internet use were all becoming part of delivering health services in Australia. Although past research has indicated that clinicians and nurses generally reject information technology in nursing because of the assumption of de-personalised care, the results of my survey indicate that nurses did not generally perceive information technology to de-personalise patient care. To this end, one nurse stated:

> Information technology is not going to replace someone from comforting a patient or the physical touch of the hand, which are important to patient care. I certainly don't feel information technology can replace nurses or nursing care

but, rather, it can be a very useful tool to assist nurses in their learning and up-skilling, provide immediate information on patient's diagnostic results, help nurses to manage diet input and requests from kitchens, and provide drug information and much more.

[Nurse 14]

Another nurse agreed that information technology was not responsible for depersonalised care when she stated:

Information technology cannot be responsible for depersonalised care; that will only happen when professionals distance themselves from the patient and their families and treat the person in bed as an object with a number, not a person.

[Nurse 9]

However, other comments made during the interviews suggest that some of the nurses were resentful towards information technology and others were critical of their own colleagues. Nurses generally felt that nursing should be a 'hands-on' profession. One nurse, critical of her young colleagues, said:

The new generation of nurses understands and spends more time on computers. The positive is that they understand and are quick to master and quick to adapt to change, but some of them tend to spend an awful lot of time on the computer and forget that they have patients to look after.

[Nurse 1]

Nurses generally were of the opinion that nursing should be a hands-on profession and many felt that the advent of computers had led to more de-personalised care. To this end, one nurse said:

Whilst computers are essential in these rapidly advancing times, patients are people. Genuine nursing skills are deteriorating. What happened to empathy – the power of understanding another person's feelings? Nurses should be capable of nursing – seeing the patient/client as a whole person with feelings. The focus for nurses now is on machines.

[Nurse 6]

Still another expressed her concerns with respect to patient safety and the possibility of nurses over-relying on technology to provide all of the data:

> Gradually the nurses' senses are being replaced by technology that has been designed to detect physical changes in patient conditions. Although information technology has helped with patient care, all is not as smooth sailing as we are led to believe. We have heard that some nurses and health care staff in city hospitals are so tuned into technology that they focus on data that are on the screen and often fail to detect potentially important clinical changes in a patient's condition.
>
> [Nurse 12]

The pitfalls of information technology and the many negative effects from technology have resulted from the apparent lack of consultation with end-users, and the lack of adequate training and integration of systems have resulted in duplication of tasks (Ball, Weaver, & Abbott 2003).

4.7.2.5   Barriers to Access

Although the survey did not include questions on barriers to access, interview data indicated that barriers to access to information technology experienced by nurses included a lack of training, password restrictions and limited access to computers.

The nurses who were interviewed had all been in the workforce for an extended period of time. Many of these nurses, particularly those who were employed part-time, felt that they had missed out on training that was needed to use the information technology effectively and access. One nurse stated:

> As an older midwife, IT was introduced when I was working part-time. I really needed to complete IT training and adequate time to practise the skills. Unfortunately, the training has always been fragmented and, in many ways, minimal with respect to learning a particular program.
>
> [Nurse 8]

Many of the nurses whom were interviewed had also experienced problems with accessing a range of hardware associated with information technology, including personal computers, printers, scanners and fax machines. An overall shortage of

equipment and a consequent lack of access had caused these nurses to experience problems with time management and had created performance issues among some nurses. In many cases, a lack of access to computers, particularly when a number of staff members needed to use the same computer, caused problems to occur more often. According to the nurses interviewed, it was not uncommon for doctors, nurses, physiotherapists, occupational therapists, dieticians, social workers and other clinical staff to require access to the same computer. This over-reliance on a single machine for multiple users inevitably led to a clash with nurses who were required to document the nursing care and vital signs observed in patients' medical records. One nurse complained regarding the lack of computers when she said:

> We don't have our own dedicated computers … We have one computer for all of the staff and we just don't have enough. The doctors have two computers. The orthopaedic team, physios, orthopaedic doctors and pharmacists all use our [the nurses'] computers. There are not enough computers for all of us. The resources aren't there and so, to do things at work, we are constantly at each other's throats.
>
> [Nurse 17]

The lack of resources appeared to be more common for nurses in rural/remote health care facilities. For example, one nurse stated:

> Because we haven't got a printer that works, I often have to print bits off at home and take them in as I can't use a different format (softcopy). I would have to think about how I would present to staff about the topic if the staff just get a couple of hard-copy handouts to share.
>
> [Nurse 16]

The majority of nurses who were interviewed considered the password restrictions as problematic. They all agreed that, even where computers were available password restrictions on computer terminals made it difficult for nurses and other health professionals to log on. This was an issue in both metropolitan and rural/remote area regions, but the problems were more frequent in the latter environment as this nurse asserts:

> I, personally, think that if you lack IT knowledge it is difficult but, without sufficient access or no access it is devastating in the health care environment. For the moment it is only certain members of staff have access to a lot of the online material, the rest of us "Indians'' have to read pinups on the notice board. You can't blame nurses for not adapting to technology especially if there are boundaries and hurdles to overcome all the time.
>
> [Nurse 16]

Additionally, the nurses interviewed reported that the information technology staff members were not always available to support them because the helpdesk service at most metropolitan hospitals was unavailable after hours, on weekends and during public holidays. Nurses were frustrated, not only with the lack of support with information technology, but also with intimidation experienced in interactions with some helpdesk staff as this senior nurse, from a rural hospital, commented:

> They [help desk staff] treat us like morons and chew our head off if we ring up to have a password reset. It's time consuming waiting on the telephone for helpdesk to respond; this time that could be used more effectively on patient care. Sometimes we are place on hold waiting for someone to help us with our call.
>
> [Nurse 10]

The nurses from geographically-isolated locations, without exception, complained about the reliability of the computers and the network (which was not always available). The lack of network, they felt, increased their sense of isolation. The network problems, coupled with the lack of technical support and the attitudes of some technical support staff compounded the barriers to access for rural and remote health care workers, with nurses being worst affected:

> The ward equipment is limited and old. It frequently breaks down. Some of it is obsolete technology that is slow to operate. The information technology helpdesk operate from 8 to 5pm but there is always a waiting queue and, with the present staff shortage, we nurses have to carry more weight. All of these problems just waste our time.
>
> [Nurse 9]

An interview comment from a clinical educator provided further insight to situations at an organisational level and the comment was not confined to a single health-care setting, but was applicable across all boundaries of health care:

> It's not everybody who has access to this lovely technology. I think that's where the difficulty lies; in an acute hospital, you don't sometimes have the access that you would like to have to certain technology that you know is out there for teaching purposes. That makes it very difficult because you're using substandard equipment when you know that there is something better. So our nurses don't have access because there is no equipment to practise on or to use that mirrors the workplace elsewhere.
>
> [Nurse Educator 1]

The nurses argued that, even if they preferred the electronic system over the paper-based system, the slowness, lack of hardware and barriers to access were a hindrance and detracted for nurses using computers and information technology in the ward areas. These findings support past studies in which nurses reported that their work was hindered through problems related to the system, including down time and limited availability (Kassaman et al., 2008).

4.7.3   *Need for Information Technology and Associated Skills in Nursing*

In today's technological environment, the health industry has come to rely on the use of technology across all areas of health practice, with the use of computers and information technology becoming an integral part of the industry's daily practices. The advent of information technology has required that nurses are proficient users of information technology to ensure that they are able to access, manage and disseminate data for effective decision making. As health-care professionals, nurses require appropriate educational training to enable them to use technology efficiently, because patient care is shared within multi-professional teams in both hospitals and the community (Alpay & Russell, 2002; Schluter, Seaton, & Chaboyer, 2011).

Therefore, given that health care systems are becoming more reliant on information technology for data management and communication, it is important that nurses have the appropriate information technology skills and knowledge to be able to carry out

their jobs successfully. Computer literacy involves the level of expertise and familiarity that an individual has with computers and his or her ability to use the applications associated with their use.

As a first step, information about nurses' views of their competency with respect to working with computers and/or information technology in their daily nursing practices was sought. Nurses were asked to report on whether they viewed their computer skills to be beginner, intermediate or advanced. The results, reported in Table 4.8, indicated that approximately 15% (*n*=20) of the nurses rated their computer literacy to be at an advanced level, more than half (59%, *n*=79) rated their skills to be at an intermediate level and approximately a quarter of them (26%, *n*=35) rated their skills to be at a beginner's level. These results suggest that more than 80% of the nurses rated themselves at either a beginner or intermediate level of competency, a percentage similar to that reported in previous studies carried out in Australia (Webster et al., 2003), Scotland (Hillan et al., 1998), China (Liu et al., 2000) and the UK (Griffiths & Riddington, 2001).

Table 4.8   Nurses' Levels of Computer Literacy Skills

Computer Skills	Frequency (*n*)	Percent (%)
Beginner	35	26
Intermediate	79	59
Advanced	20	15

N=134

To complement these data, nurses were also asked about whether they had attended computer/information technology training and, if so, the length of that training. The results, reported in Table 4.9, indicate that just over half of the nurses who responded to the survey (51.5%) had received some form of information technology training (whether it was part of a course of study or a work-related course). In contrast, of the 134 nurses, just under half of the nurses (48.5%) had not received any kind of formal training in the use of information technology.

Interviews with nurses also reflected these results, with nine of the 20 nurses stating that they had not received official training in how to use information technology in the workplace.

Table 4.9   Number of Nurses who Had or Had not Received IT Training

IT Training	Frequency (*n*)	Percent (%)
Nurses who had not received IT training	65	48.5
Nurses who had received IT training	69	51.5

N=134

Table 4.10 provides the frequency of different types of training that the nurses had received and Table 4.11 provides a breakdown of the duration of that training. The results, reported in Table 4.10, indicate that, of the 69 nurses who had received training in information technology, 29 of the nurses (39%) had received on-the-job or work-related courses. A further 20 nurses (27%) had learned skills related to information and technology as part of a course of study (e.g. from the library of the university where they had undertaken their undergraduate degree). Interestingly, approximately 41% of the nurses (*n*=31) claimed that their knowledge of information technology was self-taught with the help of family members and friends.

Interviews with the 20 teachers indicated that, on the whole, learning how to use work-related technology and applications was achieved through collaboration with a colleague during shift hours on the ward. In some cases, however, nurses were shown how to use a particular application or system during implementation of a clinical information system.

Table 4.10   Frequency of Different Types of IT Training

Source of IT Lessons	Frequency (*n*)	Percent (%)
Work-Related IT course	29	39
Part of study	20	27
Self-taught	31	41

N=90

Interviews with nurses indicated that the majority of training related to the use of information technology in the workplace was related to the use of computerised clinical systems or application software (such Microsoft Word, Excel, email or PowerPoint). For those nurses working in staff development areas, training also included how to present evidence-based documentation to nursing and clinical colleagues.

Of the nurses who responded to the survey (*n=134*), 65 specified that they had not received training. The results reported in Table 4.11 indicate that, for most of these nurses, the training had been for less than one month in duration. Interviews suggested that many of these training sessions had taken the form of 'show and tell' workshop sessions that were conducted to inform nurses of a specific computer application or function.

Conversely, approximately 23% (*n=15*) of the 65 nurses indicated that they had received between three to six months of training and three nurses (approximately 3%) indicated that they had received more than six months of training. In all three cases, this training was not offered to the nurses as part of their jobs but, rather, was self-directed learning taken by the nurses. Those nurses who had studied or were still studying at the university had attended computer courses through their university's library that had helped them to conduct literature searches and navigate databases.

Table 4.11   Frequency of Different Durations of Training Received in the Workplace

Length of Training	Frequency (*n*)	Percent (%)
Less than 1 month	47	72
3 to 6 months	15	23
6 to 12 months	2	3
More than one year	1	1.5

N= 65

Of the nurses who responded to the survey, approximately one quarter (*n=31*) expressed a desire to acquire more in-depth skills in basic information technology and the management of information beyond the ability to use the software or computer systems in the workplace. Interviews with nurses suggested that they generally felt that they needed more training to acquire the skills required to use information technology effectively and to manage their work more efficiently. On the other hand, three quarters of the nurses considered that the training that they have received met the needs of their current job and they thought that it had been delivered at an appropriate time for use in the workplace. Furthermore, the results of the survey indicated that a majority (75%) of the nurse respondents said that they would be interested in training towards a national computer and technology competency

standard if it was offered, but just over a quarter (*n*= 36) would be interested in a university-level health informatics course.

To assess the extent to which nurses viewed Information Technology and the skills or training associated with information technology to be important, I used the following statements:

- Information Technology skills are essential for nursing in the 21st century. (Item 13)
- Nurses require more formal education to use Information Technology. (Item 16)
- Technology skills are a requirement for lifelong learning. (Item 20)
- There is a need for information technology education within nursing. (Item 21)

Table 4.12 provides the frequency of different response alternatives (SA, A, N, D and SD) and indicates that the mean score for the different statements in this scale ranged from 3.30 for Item 13 to 4.22 for Item 21. These generally high means indicate that nurses generally agreed that the use of information technology in nursing and the associated education are important. This section reports the results for the analysis of the qualitative and quantitative data for each.

Table 4.12   Descriptive Information for the Registered Nurses' Views of the Need for Information Technology and Associated Skills in Nursing

Item	Statement	% Response					Mean	SD
		SD	D	N	A	SA		
13.	Information Technology is essential for nursing in the 21st century.	0.7	0.7	5.2	56.7	36.6	3.30	0.66
14.	Information Technology in healthcare is required to improve nursing.	1.5	6.7	10.4	61.9	19.4	3.91	0.84
20.	Technology Skills are a requirement for lifelong learning.	0.7	3.0	5.2	64.9	26.1	4.13	0.70
21.	There is a need for Information Technology education within nursing.	0.8	0.8	6.0	60.9	31.6	4.22	0.65

SD=Strongly Disagree, D=Disagree, N=Neither Disagree nor Agree, A=Agree, SA=Strongly Agree

4.7.3.1   Need for Information Technology in Nursing

Of the 134 nurses who responded to the survey, 93.3 % either agreed or strongly agreed that information technology is essential to nursing (Item 13). Also, 81.3 % of nurses either agreed or strongly agreed that information technology is a requirement for improving nursing (Item 14). These results were strongly supported by the interview data collected from the 20 nurses involved in the study. In addition to the benefits of information technology described above, all of the nurses agreed that, in general, information technology was important in nursing. For example, one nurse agreed that learning and using computers and information technology is essential for nursing when she verbalised:

> I have seen a huge change in some of the things that we do as nurses and midwives, how practices change and what we have moved away from. This is great because it means that we can actually do things better, more effectively and more efficiently. It will improve a lot of the patient safety issues; we now have the information online and alerts on Patient Information Systems on patients' past medical history and health issues that flash onto the screen. This is unlike the manual system for which one has to wade through pages of paper and documentation to find anything regarding the patient.
>
> [Nurse 2]

The nurses interviewed all felt that information technology was becoming a vital part of nursing practice. In terms of the communication technologies, the nurses felt that this was important in remote areas. Nurse 3, who was working in obstetrics stated that, when confronted with a problem at her remote facility, she could consult with specialists and nurses at a hospital. For example, if a patient was in a critical condition, information technology made it possible for her to consult with staff at a major teaching hospital to find out how to stabilise the patient before sending her on a flight to a hospital.

4.7.3.2 Need for Training in Information Technology

Nursing education has faced many changes and challenges that have led to significant improvements to health care delivery and service. The health care industry is rapidly evolving from a task-based industry to a knowledge-based vocation; hence, nursing must, likewise, evolve from a vocation of task performers to knowledge professionals. This transition is achievable only with a workforce that is skilled and competent to use information technology for a range of tasks.

Of the 134 nurses, over 90% agreed or strongly agreed that technology skills are an essential requirement for lifelong learning. Further, over 80% of the nurses either agreed or strongly agreed that there was a need for information technology education within nursing (Item 21). The majority of nurses interviewed expressed concern over the lack of access to basic training related to the use of computers and information technology in the workplace. Many of the nurses had learned basic skills related to applications such as the Internet, e-mail, spreadsheets, Power-point and publishing software at home and from family members. These nurses all felt that having this knowledge and skills with the use of information technology was important to their professional career. One nurse stated:

> Nurses need basic training in systems if they are going to use them. If they are expected to give out targets, figures and results, then they need to have training in Outlook and Excel. … Just being shown 'this is how you do it' when one is put on the spot is not good enough.
>
> [Nurse 7]

Another nurse stated:

> I think that, if we are going to move to using only computers in the future, there is going to have to be a lot of education for nurses because, especially for some of the older nurses, there is still a lot of anxiety about using them and many don't know what they are doing. This lack of training also has the potential for a lot of information to be lost as well.
>
> [Nurse 11]

Nurses were generally in agreement about the importance of ongoing training and learning in the workplace. To this end, one of the nurses stated:

> If a nurse has little or no IT training, it actually hinders her work and takes up more of her time in trying to access information via computers. Therefore better training will lead to a more efficient nurse.
>
> [Nurse 17]

Other nurses made the point that new technology was continually emerging having the potential to benefit both nurses and patients. If nurses did not have the skills to access and use these tools, then they were unlikely to be used. For example, one of the academics stated:

> In some areas we, are starting to see improved technology and applications of the existing technology. For example, the Wound Assessment Tool uses digital images of wounds captured with a digital camera to map the wound. When a patient returns a week later, you can take another digital photograph and the application can be used to compare the two pictures side-by-side so that you can see whether it is healing or not. … I want our students to be good enough at using it so that they go out to hospitals and can be showing it to other staff.
>
> [Academic 2]

Many of the more experienced nurses felt that they were of a generation that had limited opportunities to learn how to use computers during their formal education. Some of these nurses had relied on their family members and children to help them with computers at home and, often, these nurses had taken work home (so that family members could assist) to successfully overcome barriers with information technology knowledge. It would appear that, for many of the nurses, the professional learning related to the use of information technology that was provided by the hospitals was not sufficient. One nurse stated:

> I would love to see some allocated times so that I could do studies at work because, as nurses, we have got to do ongoing learning. At the moment, that is all in our own time at home and, apart from the mandatory study days that we are allocated, there are only two optional study days. I just don't think that is enough.
>
> [Nurse 3]

Training or the lack of training appears to be a contentious issue as clearly identified by a nurse with more than 23 years experience:

> Yes, technology is advancing so fast now that we are in the 21st century. More and more technology is coming to the workplace. Someone was saying the other day that she had this new equipment coming and the training was not adequate for enabling people to move around the application. See that as a problem? I do. I welcome technology and, yes, it is innovative but, if the training is not enough and support is lacking, it defeats the purpose.
>
> [Nurse 14]

The nurses generally felt that they had to demand the required training because, generally, they were not offered it. Overall, these nurses felt that they were not provided with sufficient training to use the technology. One nurse expressed:

> Nursing IT has been enhanced but we have a long way to go yet. I do believe that we need training. We need more training [than we are currently receiving]. Just recently, we had someone come up and tell us how to use something. I just think that these one-off in-services aren't enough. There should be more. It has got to be arranged and I think we've got to be quite vocal in asking for these teaching sessions. If you don't say anything, then you will get missed and left behind. You have to actually be quite vocal.
>
> [Nurse 6]

To this end, another of the nurses stated:

> Apart from the basic things like reading results, that we are often taught from other nurses who are on the same shift, I learned at home. It was self-taught … trial and error. My daughter helped me a lot and I asked her when I get stuck.
>
> [Nurse 4]

In addition to the need to be provided with training, the nurses were in agreement that there needs to be support in their use of information technology. Nurse 7 stated, "To be confident and able to use clinical applications efficiently, especially for the older nurses who were trained before the introduction of computers, there needs to be supportive resources".

The results of my study support the findings of research supported by the Australian Nurses Federation (Hegney, Eley, Buikstra, Fallon, Soar, & Gilmore, 2007) for which almost 50% of nurses said that information technology was important in terms of nurses' career paths (for example, whether you decide to go into nursing administration or clinical nursing or perhaps move into another profession). Moreover, Hegney et al. (2007) reported that, on average, training undertaken by nurses was at work during work hours (9.8%) and away from work in their own time (10%), and the proportion of nurses trained by a colleague was 3.4%. Also, nurses who had been in nursing for 10 years or less were likely to have employer-funded training.

The views of nurses in my study are supported by Kapitzke (2003) who argued that there is a presupposition that "information literacy bestows power on those who understand and apply its precepts and standards" and "that in and of itself [information literacy] is a key to prosperity of both the individual and the nation in the new knowledge economy" (p. 40).

4.8   Chapter Summary

The overarching aim of the present study was to gain an understanding of the factors that influence nurses' attitudes towards information technology and nursing informatics. The effective use of information and communications technology requires nurses to be computer literate, but past research has indicated that nurses' attitudes towards information and communications technology could be influenced by their perceived skill levels.

Given the dearth of reliable instruments, suited to the Western Australian context, that were available to assess nurses' attitudes towards computerisation in the

workplace, is was necessary to develop one for the purposes of this study. The development of the survey involved a multistage approach and drew on two existing surveys, the Nurses Attitudes Towards Computerization (NATC), developed by Stronge and Brodt (1986), and the Nurses Computer and Attitude Inventory (NCATT), developed by Jayasuriya and Caputi (1996). The new survey, named the Nurses Computers and Information Technology (NCIT) questionnaire, consists of three scales: Benefits of Information Technology in Health Care, Pitfalls of Information Technology in Health Care, and Training for Information Technology in Nursing.

The new NCIT was piloted at two metropolitan Western Australian hospitals following approval from the respective hospital administrators. A total of 40 nurses and a total of six staff development nurses and educators from the two hospitals provided feedback to ensure that the administration process was appropriate in terms of length of time needed to respond, the readability of the survey items and the usefulness of the response format. The feedback from the pilot study confirmed the suitability of the questionnaire use in the current study.

Data collected from 134 nurses were analysed to check the validity and reliability of the NCIT in terms of factor structure and internal consistency reliability. Principal axis factoring with varimax rotation was used to check the structure of the 21-item three-scale NCIT questionnaire. During the factor analysis, items that did not meet specified criteria were omitted to increase the discriminant validity of the scales. The remaining 12 items (four items in each of three scales), without exception, had a factor loading of at least 0.40 on their *a priori* scale and no other scale. The percentage of the total variance extracted with each factor varied from 9.97% to 38.62% for the three scales, with the total variance accounted for being 61.80%. The eigenvalues varied from 1.20 to 4.64 for the different scales. The Cronbach alpha reliability, used as an index of internal consistency, ranged from 0.77 to 0.83 for the three scales.

The data collected from 134 nurses were used to investigate whether differences existed between younger nurses (those younger than 35 years) and older nurses (those 35 years or older) in terms of their attitudes towards information technology.

The results of MANOVA, (with the three attitude scales as the set of dependent variables and the age group as the independent variable) indicated that nurses in the older age group held more positive views of the Benefits of Information Technology and the Need for Information Technology and associated skills in Nursing than their younger counterparts. In contrast, nurses in the younger age group considered there to be more pitfalls associated with the use of information technology in nursing than did their older colleagues.

To investigate relationships between nurses' personal skill rating and their attitudes, simple correlations were used. The results indicated that the personal skill ratings of nurses were statistically significantly ($p<0.05$) related to all three of the attitude scales. These findings suggest that the more highly that nurses rated their skills in using information technology, the less positive they felt about the benefits of information technology to patient care and the need for IT and associated skills in nursing. Moreover, the results indicated that nurses with higher skill ratings were more likely to highlight possible pitfalls associated with the use of information technology in nursing.

To help to understand factors that influence nurses' attitudes towards information technology, the survey results were used along with analyses of interviews with nurses. The results of the survey indicated that, generally, nurses felt that using information communication technology improved the quality of health care, communication and patient care overall. Interviews with nurses suggested that there were three main perceived benefits to using information technology in health care, namely, improved quality of patient care, improved communication between nurses and other health care staff, and a reduction in paperwork that saved nurses' time and left more time for patient care. For example, through the improved communication associated with using information technology, laboratory staff could alert medical staff about low or abnormal results so that the patient's treatment could be attended to as soon as possible. The benefits of information technology were considered to be more acute in isolated settings. In these situations, when communication and information technology was available, information and clinical support from city hospital specialists and consultants were readily accessible to the medical, nursing and other clinical staff in rural and remote health care settings.

Nurses who responded to the survey also identified pitfalls related to the use of information technology in nursing practice and patient care. Analysis of the qualitative information suggested that many nurses had a degree of apprehension with respect to the increased reliance in using information technology to provide nursing care, because they feared the loss of nursing jobs, increased nurses' workloads, the violation of patient privacy, and issues related to confidentiality and de-personalisation of patient care. Interviews with nurses indicated that, in many instances, a lack of suitable access was a deterrent to using information technology. The lack and limited availability of hardware was also of concern. In some cases, nurses complained that some aspects of working with the computerised systems were not user-friendly and, as a result, they wasted much time that could be used more productively for patient care. Other nurses, especially those in remote and rural Western Australia, portrayed negative attitudes and perceived that there were inefficiencies and degradation in nursing practice that could be attributed to multiple issues such as workload, lack of experience and expertise and outmoded equipment that needed upgrading. A lack of technical support and expertise was another problem.

The survey revealed that the use of information technology and nursing informatics was considered to be important, as was the skill that was required to use it effectively. Interviews indicated that nurses generally felt that they were under pressure to use information technology effectively. The independent nature of their work, however, left many nurses dissatisfied with the level of training and support offered to help them to achieve this.

Overall, analysis of the registered nurses' responses in the comments sections and interviews provided valuable insights into nurses' attitudes concerning the impact of information technology on patient care. Also, some Western Australian nurses had concerns about the implementation of clinical applications, insufficient training being provided, data insecurity, and additional workload associated with the need to use computers.

Chapter 5

SUMMARY, DISCUSSIONS AND IMPLICATIONS

5.1   Introduction

This chapter summarises the research reported in this thesis. It begins by recapping the study's purposes, research objectives and questions, methodology, and ethical assurances. Results and implications are provided for each of the research objectives. Additionally, limitations of the study are outlined. The chapter concludes with some practical implications of the findings and recommendations for future research.

Nurses in the 21st century are faced with the challenges of exhibiting competent information technology skills along with nursing skills in a highly technical world. Nursing informatics and the use of information technology to support the work of the nurse are essential parts of modern nurses' jobs and nursing educators at universities are faced with the challenge of preparing nurses for the increased use of information technology skills in nursing education.

The overarching aim of the study reported in this thesis was to identify factors that influence Western Australian registered nurses' attitudes towards the use of computers, information technology and informatics in their daily nursing activities and to examine how the information technology or informatics education received at nursing institutions was transferred to the work environment. To this end, the study sought to:

1. To develop and validate a survey to assess nurses' attitudes towards the use of technology in hospitals in Western Australia;

2. To investigate whether the attitudes of registered nurses towards information technology in the workplace are related to their personal IT skill ratings;

3. To investigate whether nurses' attitudes differ for nurses who less than 35 years and those who are 35 years and older; and

4. To identify the factors that influence registered nurses' attitudes towards the use of information technology and nursing informatics within nursing practice in Western Australia.

This chapter is organised under the following headings:

- Synopsis of the Findings (Section 5.2);
- Limitations and Recommendations for Future Research (5.3);
- Significance of the Study (Section 5.4); and
- Practical Implications (Section 5.5).

5.2 Summary of the Findings

The key findings of this study were drawn from the experiences of registered nurses in addition to the valuable and informative contributions through formal interviews with clinical educators at two major hospitals and academics from universities in Western Australia. The keys to successful implementation of information technology in nursing are its acceptance and integration into professional nursing practice. The major findings of the study are reported with special reference to each of the research objectives as outlined above in section 5.1.

5.2.1 *Development and Validation of the NCIT*

The first objective of this study was:

> *To develop and validate a survey to assess nurses' attitudes towards the use of technology in hospitals in Western Australia*

The development of the survey involved a multistage approach. First, a review of literature was carried out to identify the characteristics that influence a person's ability to achieve success when using computers and his or her attitudes towards computers. This approach led to the development of a survey, named the Nurses' Computers and Information Technology (NCIT) questionnaire, for use in my study. The NCIT questionnaire drew on two existing surveys, Stronge and Brodt's (1985)

Nurses' Attitudes towards Computers questionnaire (NATC) and Jayasuriya and Caputi's (1996) Computer Attitude and Computer Anxiety in nursing questionnaire (NCATT).

The newly-developed NCIT questionnaire consisted of three parts. The first part involves nurse participants demographic information, including the nurses' age, the area in which they work and the geographical location of their workplace.

The second part consisted of 21 statements that assess three scales: Benefits of Information Technology in Health Care; Pitfalls of Information Technology in Health Care; and the Need for Information Technology Skills and Education in Health Care. Each of the 21 statements was responded to using a five-point Likert-type scale ranging from Strongly Agree to Strongly Disagree. The statements were arranged in cyclic order and included negative or reverse-scored items to guard against passive responses for patient care and nursing education.

Finally, a third section, consisting of two open-ended questions, was included for nurses to express their views and suggestions pertaining to the use of information technology in nursing practice.

Prior to the main administration, the questionnaire was piloted at two public hospitals upon invitation and approval from the Chief Executive Officer and Nurse Director. The pilot study aimed to ensure that the wording and terminology of the various items was clear and unambiguous to ensure that nurses interpreted the individual items in ways similar to the researcher's intention. The pilot study was also an opportunity for the researcher to ascertain whether the five-point response format was meaningful and for nurses to record the time it took to complete the NCIT questionnaire.

Following the pilot study, amendments to the NCIT questionnaire based on feedback and recommendations from the participants were undertaken, and then the questionnaire was distributed to each hospital staff educator to randomly select volunteer nurses to trial the updated questionnaire before being finalised. For ethical reasons, the refined and finalised questionnaire was distributed to 500 randomly-

selected registered nurses by the Nurses and Midwives Board of Western Australia (NMBWA), with a return of 134 complete and usable responses, including 34 respondents who volunteered to be interviewed by providing contact details.

The data collected from 134 registered nurses were analysed to determine the reliability and validity of the NCIT. Once the appropriateness of the data was confirmed, principal axis factoring with varimax rotation was used to check the structure of the 21-item three-scale instrument. During the factor analysis, nine items were omitted because they did not meet the criteria and were found not to assess a unique dimension. The removal of the items increased the discriminant validity of the scales. The remaining 12 items (four items in each of three scales), without exception, had factor loadings of at least 0.40 on their *a priori* scale and no other scale. The percentage of the total variance extracted with each factor varied from 9.97% to 38.62% for the three scales, with the total variance accounted for being 61.80%. The eigenvalue were all above one and varied from 1.20 to 4.64 for the different scales.

The Cronbach alpha reliability coefficient, used as an index of scale internal consistency, was generated separately for each of the three scales. The alpha coefficient was 0.77 for Benefit of Information Technology to Health Care; 0.77 for Pitfalls of Information Technology and 0.80 for Need for Information Technology Skills and Education in Health Care. The results of the factor analysis and the internal consistency reliability scores supported the validity and reliability of the newly-develop NCIT.

5.2.2   *Relationships between Attitudes and Personal Skill Ratings*

The second objective of this study was:

> *To investigate whether the attitudes of registered nurses towards information technology in the workplace are related to their personal skill rating*

To check whether relationships existed between the nurses' attitudes and their personal skill ratings, the data collected from 134 nurses were used. The results of the two-tailed Pearsons correlations indicated that, for all three scales, the associations between attitudes and personal skill rating were statistically significant ($p<0.05$). For one of the scales, Pitfalls of information Technology to Health Care, the relationship was positive, suggesting that the more competent the nurses' rated their skills to be, the more they were likely to highlight the pitfalls of information technology. Conversely, the other two scales, Benefits of Information Technology to Health Care and Need for Information Technology and Skills in Health Care, were negatively related to nurses' personal skill rating. These findings suggested that the more competently that the nurse rated themselves, the more likely they were to view information technology as beneficial or needed.

My study is consistent with other researchers who have found that nurses with more computer skills have more positive attitudes towards the use of the computerised systems (de Veer & Francke, 2009; Huryk, 2010; Moody, Slocumb, Berg, & Jackson, 2004). Further, much published literature indicates that the implementation of any computerised patient information system and electronic health record implementation is dependent on nurses' ability to use the information systems, and that nursing informatics competency for nurses is essential for patient safety and evidence-based practice (Almerud, 2007; Ammenwerth, Iller, & Mahler, 2006; Bakken et al., 2004; Prevost, 2008; Reason, 2000; Ribbons, 1998; Saranto & Leinpo-Kilpi, 1997). Given these findings, that computer literacy among nurses is likely to influence nurses attitudes towards information technology, it follows that the adequate education of nurses, with respect to nurse uptake of information technology, is an important factor to consider.

5.2.3   *Differences in Attitudes to Nursing Informatics Between Younger and Older Nurses*

The third objective of this study was:

> *To investigate whether nurses' attitudes differ for nurses who are less than 35 years and those who are 35 years and older.*

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The data collected from the 134 nurses using the NCIT was used to examine whether differences existed in the attitudes of nurses in different age groups. The two groups of nurses were those who were younger than 35 years of age and those who were 35 years or older. A one-way multivariate analysis of variance (MANOVA), with the three attitude scales as dependent variables and the age group (less than 35 years and 35 years and older) as the independent variable, was used. Older nurses (35 years or older) generally held more positive views of the Benefits of Information Technology and the Need for Information Technology Skills compared to their younger counterparts. In contrast, younger nurses (below the age of 35 years) were opposed to the use of information technology in patient care as they viewed information technology to be a pitfall to nursing. The effect size for age differences for the Benefits of IT scale was 0.36 standard deviations which, according to Cohen (1988), is considered to be a relatively small effect.

My research findings concur with those of other researchers, indicating that older nurses (often with a higher rank and more administrative roles involving the development of policies and management and writing reports, often with limited or no work directly linked to patient care) were more likely to hold positive attitudes with respect to the benefits of information technology than their younger counterparts (Chan, 2007; Eley et al., 2008). In contrast, those nurses who were younger (and therefore more likely to be directly involved with patient care and to be technologically more savvy) tended to have more misgivings related to the use of information technology in healthcare than their senior counterparts. These results reflect past research that also indicates that older and more mature nurses were more positive in their attitudes towards technology than the younger nurses (Alquraini, Alhashem, Shah & Chowdhury, 2007; Bongartz, 1988; Brodt & Stronge, 1986; Burkes, 1991; Chan, 2006; Marasovic, Kenney, Elliott & Sindhusake, 1997). It is interesting to note that, we had originally justified the selection of age groups based on personal skill ratings. These results would suggest that, perhaps, a nurses self-rating of competence in using information might be related to the information technology or types of software programmes that they are exposed to rather than an overall rating (e.g. the older nurses were more likely to use information technology for clerical purposes whereas the younger nurses – who were generally on the ward – were exposed to a range of technologies related to healthcare).

5.2.4   *Understanding Factors that Influence WA Nurses' Attitudes*

The fourth objective of this study was:

> *To identify the factors that influence registered nurses' attitudes towards the use*
> *of information technology and nursing informatics within nursing practice in*
> *Western Australia*

To help understand the factors that influence nurses' attitudes towards the use of information technology and nursing informatics, a mixed-methods design was used. Given that no single method was likely to grasp the subtle variations involved in this study, the mixed-methods approach was considered to be appropriate (Denzin, 2000; Denzin & Lincoln, 1994). Moreover, data from multiple sources and feedback from multiple participants formed the basis of a constructivist inquiry in which perspectives from different realities were sought (Denzin, 2000; Greene & Caracelli, 1997; Guba & Lincoln, 1994).

Therefore, in addition to the quantitative data collected from 134 nurses, important qualitative information was collected through the free-text entries in the comments section of the questionnaire and in-depth interviews with 20 of the nurse participants, three clinical nurse educators and three academics. Analysis of the data indicated trends and provided explanations for trends found in each of the three scales within the newly-developed survey: (1) Benefits of Information Technology to Health Care; 2) Pitfalls of Information Technology to Health Care; and 3) Need for Information Technology and Associated Skills in Health Care.

The results of the survey suggested that, generally, nurses were positive about the benefits of information technology in health care, with the means for individual items in this scale ranging from 3.31 to 4.10. Analysis of qualitative data indicated that nurses viewed the benefits of information technology to be related to improved quality of patient care, improved communication between nurses and other health care workers, and a reduction in paperwork that saved nurses time. These findings are similar to accepted notions that the implementation of information technology

has the potential to improve patient care (Ball, Weaver & Abbott, 2003; Gururajan et al, 2005). The results, however, can be contrasted with those of Eley Soar, Buikstra, Fallon and Hegney (2009) who found that less than half of the nurses in their sample felt that the use of computerisation lead to a reduction in work.

The survey also suggested that nurses felt that there are pitfalls associated with the use of information technology in health care. The mean score for items in this scale ranged from 3.13 to 3.84. Qualitative data revealed that pitfalls included the fear of the loss of nursing jobs, increased nursing workloads, the violation of patient privacy and issues related to the depersonalisation of patient care. These findings are consistent with those of past research, including Ely, Soar, Buikstra, Fallon and Hegney (2009) who reported that the majority of nurses found that the use of a computerised system neither made work easier nor improved patient care.

Finally, in responding to the survey, the majority of the nurses considered their skill level to be either at a beginner (26%) or an intermediate (59%) level. Of the nurses who were surveyed, approximately half (51.5%) had received some sort of training (although not necessarily through work) and half had not received any kind of formal training (48.5%). Interviews with nurses indicate that, on the whole, learning how to use work-related technology was accomplished through the help of colleagues during their shifts. For those nurses who had received some sort of work related information technology training (approximately 39% of the nurses), this training was largely related to the use of computerised clinical systems or application software such as Excel. In general, the nurses whom were interviewed felt that the training related to information technology was insufficient, with more than 70% of the 134 nurses who were surveyed having received less than 1 month of training throughout their employment.

Despite the view that the training in information technology was lacking, nurses generally were of the opinion that there was a need for information technology in nursing. The results of my study supports the findings of a study by the Australian Nurses Federation (Hegney, Eley, Buikstra, Fallon, Soar, & Gilmore, 2007) in which almost 50% of nurses said that information technology was important in terms of nurses' career paths (for example, whether you decide to go into nursing

administration, clinical nursing or perhaps move into another profession). Moreover, Hegney et al. (2007) reported that, on average, training undertaken by nurses was at work during work hours (9.8%) and away from work in their own time (10%), and the proportion of nurses trained by a colleague was 3.4%. Also, nurses who had been in nursing for 10 years or less were likely to have had employer-funded training.

The views of nurses from my study are supported by Kapitzke (2003, p. 40) who argued that there is a presupposition that "information literacy bestows power on those who understand and apply its precepts and standards" and "that in and of itself [information literacy] is a key to prosperity of both the individual and the nation in the new knowledge economy".

5.3   Limitations of the Study

Prior to embarking on this study I consulted with nursing peers and clinical nurse educators and studied scholarly literature about the design of the present study. Despite the best efforts of any researcher, there are still potential limitations related to the design of this study.

Throughout the study, as a researcher, I ensured that nurses were provided with clear information about the procedures of the study. The nurses involved in the survey did so without threat or inducement. To guard against researcher bias to responses during interviews, I established rapport with the interviewees by introducing myself, I explained the interview process, I ensured that the interview was voluntary and not coerced, and I kept the information recorded during the interviews strictly confidential. There was no personal information recorded before, during or after the interview.

The survey was administered to a sample of 134 nurses which appeared to be reasonably representative of registered nurses from the Western Australian nurses' register (of which there are approximately 34,000 nurses). Therefore, despite the range of institutions involved, this limited sample size might not have provided a sufficiently representative cross-section of nurses with adequate experiences and knowledge of the application of information technology in clinical settings. This

could limit the generalizability of findings. Also, the relative smallness of the sample size could have limited the statistical power of significance tests.

The response rate to the newly-developed Nurses Computers & Information Technology (NCIT) questionnaire was approximately 27%, which was considerably lower than anticipated and below the recommended acceptable rate of 40% (Baruch, 1999). The results, therefore, should be interpreted with caution as it is possible that the sample does adequately reflect the attitudes of the majority of registered nurses in Western Australia. Although the limitation of the sample is acknowledged, and results treated with caution, the important qualitative data contributed to the overall insights from this study, which demonstrated major effects as highlighted from the themes and subthemes drawn from the interviews provided by the nurses, clinical educators and academics.

The selection of nurses for interviews was made to ensure that the sample was varied to enhance generalisation. It is acknowledged, however, that a possible further limitation of this study was the voluntary nature of the nurses' participation in interviews. That is, this voluntary sample might have been atypical of the clinical population of interest. It is possible that those who did not volunteer for this study's interview could have revealed different issues and experiences from those who did volunteer. Nurses might have had a number of reasons for not considering participation, including overwork, stress, dislike of computerised patient care systems, lack of time, and indifference to the focus of the research study. Consequently, the interview sample might not have been representative of all nurses using computerised patient care systems; also the computer systems vary considerably between private and public hospital systems.

The homogeneity of the sample of university academics and hospital nurse educators could have restricted the interview data from being transferable to a larger population. Moreover, the small number of previous studies in Western Australia or similar studies in other Australian states could pose problems for conclusive results.

Another limitation was the absence of previous research for allowing comparisons and evaluating the efficacy of the findings of this study of registered nurses in

Western Australia. The answers provided to the research objectives are open to debate and subject to readers challenging explanations with divergent views, and the credibility of the research findings in the eyes of others within the nursing domain in Western Australia can be questioned.

Further, the evolutionary process and the dynamics of change within information technology in health care often cause studies to become obsolete and irrelevant in a short space of time. However, this study still provides a foundation for future research into nursing and the role of informatics and information technology in patient care and safety in Western Australia.

5.4   Contributions of the Study

The present study provides a contribution to the field of nursing which has, traditionally, relied heavily on quantitative research methods. This study, involving a mixed-methods approach, provides an example of how quantitative and qualitative data can be used to provide information about trends and causal explanations. This mixed-methods approach involved a multi-dimensional framework comprised of epistemological, ontological and developmental perspectives for identifying emerging patterns. This approach, with the aid of triangulation theory, provided both confirmation and completeness to my research findings.

The results of my study have the potential to benefit several stakeholders, among them, nurses, nursing educators and academics both at hospitals and university nursing faculties, nurse leaders, hospital administrators and policy makers. These are discussed below.

5.4.1   *Significance for Nurses and Nursing*

My study highlights that younger nurses who had grown up with information technology, recent graduates and postgraduate nurses who recently attended university had been exposed to computers and information technology were relatively confident in using information technology application and clinical information systems at the workplace. Some past research evidence has substantiated

the effectiveness of computer and information literacy for fostering quality and safe care (Bakken, Cook et al., 2004; Institute of Medicine, 2003). Information technology knowledge and skills can assist in preventing or reducing potential health errors, promoting privacy and system security, maximising efficiency and promoting patient care and safety.

However, the majority of nurses in this study criticised the training and development in information technology with which they had been provided. The nurses claimed that training was minimal and inadequate, and this was compounded by barriers to access and deterrents to information technology use. Therefore, my study has some worthwhile implications concerning the need in nursing for better professional development and for overcoming deterrents to effective IT usage.

5.4.2   *Significance for Nurse Educators and Academics*

The significance of my study for nurse educators and academics is that it enables them to better understand the mode and delivery of training in computer and information technology skills for nurses at the workplace. The present-day nurses must be sophisticated in the use of information technologies and must understand how these technologies interface with various health care systems. Therefore, it is imperative that nurse educators and academics incorporate information technologies in their teaching to accommodate nurses' growing need to access the latest health information and have fast access to other health care professionals to meet patient needs (Ammenwerth, Mansmann et al., 2003; Bachman & Panzarine, 1998). Educators can be innovative and focus on the most appropriate and effective ways in the development of training schedules and provide a framework for generic skills and competencies for learning and using clinical information systems applications. They can design and develop several teaching methods to cater for varied learning styles of nurses and elevate nurses' information technology literacy to foster improvements in the provision of high-quality and safe patient care (Fetter, 2009b; Kerrey, 2000). Furthermore, through regular feedback and audits, nurse educators can check on the ease of use and the usefulness of a clinical information system for nurses because, if applications or systems are found to be unfit for the purpose or user-unfriendly or to take nurses away from patient care, nurses will not be motivated to use them (Daley,

Watkins et al., 2001; Darbyshire 2000). Conversely, even if the system is user-unfriendly but useful, nurses will cope with the difficulties and learn to use the system in order to enhance their work performance and provide safe and high-quality patient care (Levett-Jones, Kenny et al., 2009; Yu, 2005).

5.4.3   Significance for Hospital Administrators and Nurse Leaders

I found inequity in the resources available for nurses, particularly in remote and rural Western Australia. With the exception of a few senior managers, nurses in rural and remote areas did not have access to computers and had either missed or not been provided with computer or information technology training.

The significance of the findings from my research for Hospital Administrators and Nurse Leaders is in providing the awareness of communication breakdown. Based on my findings, administrators and leaders could be encouraged to open channels of communications and disseminate global information and news in the health care environment to all employees and not just senior nurses and management. Nurses in this study were of the view that information usually provided to senior nurses and management staff did not always get delivered to the lower levels of the nursing hierarchy. Nurses asserted that, at times, this was attributable to poor access to resources such as computers and printers so that staff could obtain information.

There are indications that information technology can improve the work efficiency of nurses in ways that benefit patients and the health care organisations. Hospital administrators and nursing leaders can enable nurses to use available innovative information technologies to provide health education to patients about their illnesses and prepare them to look after themselves for early-discharge home strategies that can contribute to shorter hospital stays and cost savings for the organisation (Ammenwerth, Mansmann et al., 2003; Ball, Weaver et al., 2003; Bates & Gawande 2003).

In this study many registered nurses were unaware or had not heard of the proposed electronic health record and the initiatives driving the e-health project. Therefore, it would be beneficial for Nurse Directors and Hospital Administrators to involve

nurses in decision making committees in purchasing or developing clinical information systems and applications. Hospital Administrators can direct and secure special funds for nurses' continuing professional development in information technology skills within the nurses' training budget and also allocate funds to fill vacancies for nurse study days since workloads demands can prevent nurses from attending training at the workplace during work hours.

5.4.4   Significance for Policy Makers

Policy makers could use the information from this study to justify funds for additional information technology support staff to provide improved helpdesk support, institute guidelines for purchases of new hardware and software, operational guidelines for testing and co-ordinating expert user testing with the Nursing Director's support, and advice with implementation plans and strategies for new clinical information applications and computer systems in patient care areas (Jha, Doolan et al., 2008; Poissant, Pereira et al., 2005). This study identified problems experienced by nurses and the reasons for the poor uptake of information technology:

5.5   Practical Implications

To provide quality nursing care, nurses need access to the best most up-todate information to develop skills for information retrieval and problem solving. Despite differences in practice environments, the information needs of professional nurses at the point of care seem to be universal. User attitudes influence nurses' levels of information technology adoption and have been found to be critical to successful computerised system implementation (McLane, 2005). Nurses' attitudes towards computerisation are influenced by demographic factors, job rankings, computer experience and working experience (Chan, 2007; Eley, Fallon, Soar, & Buikstra, 2008; Oroviogoicoechea & Watson, 2009).

Butcher (2006) stated: "A unique body of knowledge is a foundation for attaining the respect, recognition, and power granted by society to a fully developed profession and scientific discipline" (p. 116). Nurses use critical thinking in the same way that they apply knowledge, evidence and caring to the nursing process and become

increasingly competent. Today's proactive nurses combine nursing and information technology to improve and seek relevant information to provide safe high-quality patient care.

The nursing profession in Australia has an obligation to know the practice requirements of nurses in various settings and develop pertinent policies to legitimise nurses' practice.

5.6   Recommendations for Future Studies

This study has augmented the ever-increasing amount of research on information technology use in nursing practice and nursing education. The following recommendation for future research is based on insights from of this study.

This study should be replicated with a larger sample and with recent graduates to allow for broader generalization of findings. Because technology changes rapidly, my questionnaire should be updated and items on skills should be updated to reflect current technology such as charting medication.

The findings of my study suggest that improved perceptions of the benefits of technology is significantly and positively correlated with nurses personal skill rating. However, the results also suggested that younger nurses (<35 years) were more likely to highlight the pitfalls of technology. Given that we had anticipated that the younger nurses would have greater skill in technology than their older counterparts, this appears to be contradictory. As the examination of this anomaly was outside of the scope of this study, it is would be desirable for future research to provide a causal explanation for these findings.

My research provides some insight into the implementation of Information (Technology) Systems in clinical practice in Western Australia. Extensive testing and user profiling at all stages of development and implementation of computerised health information systems are needed to ensure that nurses are able to quickly see the benefits of information technology-based systems supporting evidence-based practice.

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5.7   Concluding Remarks

Today the ever-pervasive Internet and telecommunication and information technologies in the wider society have led to many changes in health care and nursing. Given these circumstances, nurses must be sophisticated in the use of information technologies and must understand how these technologies interface with various health care systems. The need for nurses to be well prepared for the use and application of information technology in nursing and future electronic health record-keeping is now paramount. Nurses are required to have efficient access to other health care professionals in order to meet patient needs in multidisciplinary team environments. Educators must show exemplary models for nursing through a variety of examples of innovative uses that improve health care through the use of information technology.

Understanding the factors that influence nurses' attitudes towards and acceptance of information technology prior to the implementation of Computerised Patient Information and Electronic Health Record Systems provides an opportunity to correct misinformation through strategies such as education, communication and system modifications. Given the information technology advancements in health care, a clear understanding of this information is critical. As stated by McLane (2005, p. 87), "Expectations should be carefully managed to prevent disillusionment and resistance, while still kindling enthusiasm about the potential of the system".

REFERENCES

Abbott, P., & Coenen, A. (2008). Globalization and advances in information and communication technologies: The impact on nursing and health. *Nursing Outlook, 56*(5), 238-246.

Abdal-Haqq, I. (1998). *Constructivism in teacher education: Considerations for those who would link practice to theory.* Washington, DC: ERIC Digest.

Ajzen, I., & Fishbein, M. (1980). *Understanding attitudes and predicting behavior.* Englewood Cliffs, NJ: Prentice-Hall.

Al Hashem, A. M. (2003). *Attitudes of nurses toward the use of computerized health information systems in Kuwaiti general & tertiary hospitals and rehabilitation facilities.* Doctoral dissertation, University of Pittsburgh.

Allen, D. (2004). Re-reading nursing and re-writing practice: towards an empirically based reformulation of the nursing mandate. *Nursing Inquiry, 11*(4), 271-283.

Almerud, S. (2007). Beleaguered by technology: Care in technologically intense environments. *Nursing Philosophy, 9*(1), 55-61.

Alpay, L., & Russell, A. (2002). Information technology training in primary care: The nurses' voice. *Computers, Informatics, Nursing, 20*(4), 136 -142.

Alquraini, H., Alhashem, A. M., Shah, M. A., & Chowdhury, R. I. (2007). Factors influencing nurses' attitudes towards the use of computerized health information systems in Kuwaiti hospitals. *Journal of Advanced Nursing, 57*(4), 375-381.

American Nurses Association [ANA]. (2001). *Scope and standards of nursing informatics practice.* Washington, DC: American Nurses Publishing.

Ammenwerth, E., Brender, J., Nykänen, P., Prokosch, H. U., Rigby, M., & Talmon, J. (2004). Visions and strategies to improve evaluation of health information

systems: Reflections and lessons based on the HIS-EVAL workshop in Innsbruck. *International Journal of Medical Informatics, 73*(6), 479-491.

Ammenwerth, E, Graberb, S, Hermannc, G, Burkled, T, & Konigb, J. (2003). Evaluation of health information systems-problems and challenges. *International Journal of Medical Informatics, 71*, 125-135.

Ammenwerth, E., Iller, C., & Mahler, C. (2006). IT adoption and the interaction of tasks, technology and individuals a fit framework and a case study. *BMC Medical Informatics and Decision Making, 6*(3), 1427-6947.

Ammenwerth, E., Mansmann, U., Iller, C., & Eichstadter, R. (2003). Factors affecting and affected by user acceptance of computer-based nursing documentation: Results of a two-year study. *Journal of the American Medical Informatics Association, 10*(1), 69-84.

ANCC. (2009). *Nursing practice, knowledge, attitudes and perceived barriers to evidence-based practice at an academic medical center.* Silver Spring, MD: American Nurses Credentialing Center.

Anderson, G., & Arsenault, N. (1998). *Fundamentals of educational research.* London: Psychology Press.

Appleton, J, & King, L. (1997). Constructivism: A naturalistic methodology for nursing enquiry. *Journal of Advanced Nursing Science, 20*(2), 13-22.

Armstrong, M. (1986). Computer competence for nurse educators. *Image: Journal of Nursing Scholarship, 18*(4), 155-160.

Ash, J., Berg, M., & Coiera, E. (2004). Some unintended consequences of information technology in health care: The nature of patient care information systems-related errors. *Journal of American Medical Informatics Association, 11*(2), 104-112.

Australian Bureau of Statistics. (2005). *Australian social trends – Catalogue No .4102.0.* Canberra, ACT: Commonwealth Of Australia.

Australian Bureau of Statistics. (2007). *Household use of information technology.* Canberra, Australia: Commonwealth of Australia.

Australian Bureau of Statistics (2014). *8146.0 - Household Use of Information Technology, Australia, 2012-13*. Canberra, ACT: Commonwealth Of Australia.

Australian Commission on Safety and Quality in Health Care. (2011). *Electronic medication management systems: A guide to safe implementation.* Sydney: Commonwealth of Australia.

Australian Government. (2007). *National statement on ethical conduct of human research.* Canberra, Australia: National Health and Medical Research Council.

Australian Health Ministers' Advisory Council. (1996). *The final report of the taskforce on quality in Australian health care* (xvi ed. Vol. 62). Canberra, Australia: Australian Government Publishing Service.

Australian Health Ministers' Advisory Council. (2008). *National e-health strategy summary.* Melbourne, VIC: Victoria Department of Human Services.

Australian Institute of Health & Welfare. (2008). *Nursing and midwifery labour force 2005.* Canberra, Australia: Australian Institute of Health & Welfare.

Australian Nursing Council. (2002). *ANC national competency standards for the registered nurse and the enrolled nurse.* Canberra, Australia: Australian Nursing Council.

Australian of Health and Ageing. (2003). *Clinical IT in aged care*. Canberra, Australia: Department of Health and Ageing (DoHA).

Axford, R., & Carter, B. (1996). Impact of clinical information systems on nursing practice: Nurses' perspectives. *Computers in Nursing, 14*(3), 156-163.

Ayres, D., Soar J, & Conrick, M. (2006). Health information systems. In M. Conrick (Ed.), *Transforming health care with technology: informatics in health care*. (pp. 197-211). Melbourne, Australia: Thomson.

Bachman, J., & Panzarine, S. (1998). Enabling student nurses to use the information superhighway. *Nursing Education, 37*(4), 155-161.

Bakken, S., Cook, S., Curtis, L., Desjardins, K., Hyun, S., Jenkins, M., & Soupios, M. (2004). Promoting patient safety through informatics-based nursing education. *International Journal of Medical Informatics, 73*(7-8), 581-589.

Ball, M. J., Hannah, K. J., NewBold, S. K., & Douglas, J. V. (1995). Nursing informatics: Where caring and technology meet. *The American Journal of Nursing, 96*(12), 16-24.

Ball, M., Weaver, C., & Abbott , P. (2003). Enabling technologies promise to revitalize the role of nursing in an era of patient safety. *International Journal of Medical Informatics, 69*, 29-38.

Barnard, A. (1996). Technology and nursing: An anatomy of definition. *International Journal of Nursing Studies, 33,* 433-441.

Barnard, A. G., Nash, R. E., & O'Brien, M. (2005). Information literacy: developing life-long skills through nursing education. *Journal of Nursing Education, 44*(11), 505-510.

Barnard, A., Nash, R., & O'Brien, M. (2005). Information literacy: Developing lifelong skills through nursing education. *Journal of Nursing Education, 44*(1), 505-510.

Bartels, J. E. (2005). Educationg nurses for the 21st century. *Nursing and Health Sciences, 7*, 221-225.

Baruch, Y. (1999). Response rate in academic studies: A comparative analysis. *Human Relations, 52,* 421-429.

Bates, D., & Gawande, A. (2003). Improving safety with information technology. *The New England Journal of Medicine, 348*, 2526-2534.

Bickford, C., Smith, K., Ball, M., Frantz, G., Newbold, S., Panniers, T., & Cortes-Comerer, N. (2005). Evaluation of a nursing informatics training program shows significant changes in nurses' perception of their knowledge of information technology. *Health Informatics, 11*(3), 225-235.

Bond, C. S. (2007). Nurses' requirements for information technology: A challenge for educators. *International Journal of Nursing Studies, 44*(7), 1075-1078.

Bongartz. (1988). Computer-oriented patient care: A comparison of nurses' attitudes and perceptions. *Computers in Nursing 6*(5), 204-210

Booth, R. G. (2006). Educating the future eHealth professional nurse. *International Journal of Nursing Education Scholarship, 3*(1), 1-10.

Bowles, K. (1997). The barriers and benefits of nursing information systems. *Computers in Nursing, 15*(4), 191-196.

Brodt, A., & Stronge, J. (1986). Nurses' attitudes toward computerization in a midwestern community hospital. *Computers in Nursing, 4*(2), 82-86.

Bruce, C. S. (2002). *Information literacy as a catalyst for educational change: A background paper (White paper).* Prague, the Czech Republic: U.S. National Commission on Libraries and Information Science.

Bruce, C. S., & Candy, P. C. (1995). Developing information literate graduates: Prompts for good practice. In D. Booker (Ed.), *The learning link: Information literacy in practice* (pp. 245-252). Sydney, Australia: Auslib Press.

Brumini, G., Koviæ, I., Zombori, Luliæ, I., & Petroveèki, M. (2005). Nurses' attitudes towards computers: Cross sectional questionnaire study. *Croatia Medical Journal, 46*(1), 101-104.

Bryman, A. (2008). *Social research methods* (2nd ed.). New York: Oxford University Press.

Bundy, A. (2004). *Australian and New Zealand Information Literacy Framework : principles, standards and practice* (2nd ed.). Adelaide: Australian and New Zealand Institute for Information Literacy.

Burkes, M. (1991). Identifying and relating nurses attitudes toward computer use. *Computers in Nursing, 9*(5), 190-201.

Butcher, H. (2006). Integrating nursing theory, nursing research and nursing practice. In J.M. Brown, & N.A. Schmidt (Eds.), *Evidence based practice for nurses* (pp. 112-122). St Louis, MO: Mosby.

Carty, B., & Phillip, E. (2001). The nursing curriculum in the information age. In V. K. Saba, & McCormick, K. A. (Ed.), *Essentials of computers for nurses: Informatics for the new millennium.* (3rd ed., pp. 393-412). New York: McGraw-Hill.

Chan, M. (2006). Investigating nurses' knowledge, attitudes, and skills patterns towards clinical management system: Results of a cluster analysis. *Medical Informatics and the Internet in Medicine, 31*(3), 161-174.

Chan, M. (2007). A cluster analysis to investigating nurses knowledge, attitudes and skills regarding the clinical management system. *CIN: Computers, Informatics, Nursing, 25*(1), 45-54.

Cherry, B., & Jacob, S. (2002). *Contemporary nursing: Issues, trends, and management* (2nd ed.). St Louis, MO: Mosby Inc.

Chow, S. K. Y., Chin, W. Y., Lee, H. Y., Leung, H. C., & Tang, F. H. (2011). Nurses' perceptions and attitudes towards computerisation in a private hospital. *Journal of Clinical Nursing, 21,* 1685-1696.

Cohen, L., Manlon, L., & Morrison, K. (2000). *Research methods in education.* Routledge Falmer: London.

Cohen. J. W. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Hillsdale, NJ: Lawrence Erlbaum Associates.

Coiera, E. (1995). Medical Informatics. *British Medical Journal, 310*, 1381-1387.

Cole, I., & Kelsey, A. (2004). Computer and information literacy in post qualifying education. *Journal of Nurse Education, 4*(3), 190-199.

Collins, P. (2006). *Australia's health 2006: The tenth biennial health report.* Canberra: Australian Institute of Health and Welfare.

Commonwealth Department of Education Science and Training. (2002). *National review of nursing education in Australia: Our duty of care.* Canberra, Australia: Australian Government Publishing Service.

Commonwealth of Australia. (1997). *Health on line: A report on health information management and telemedicine.* Canberra, Australia: Australian Government Publishing Services.

Commonwealth of Australia. (2002a). *Electronic decision support for Australia's health sector.* Canberra, Australia: Australian Government Publishing Services.

Commonwealth of Australia. (2002b). *National review of nursing education in Australia: Our duty of care.* Canberra, Australia: Australian Government Publishing Service.

Commonwealth of Australia. (2005). *Productivity Commission Research Report: Australia's health workforce*. Canberra: Media & Publication.

Commonwealth of Australia. (2009). *Australian National Health Care Strategy: 2009 – 2012* (National E-Health Transition Authority Ltd). Canberra, Australia: Australian Government Printing Services.

Corcoran, S. & Graves, J. (1989). The Study of nursing informatics. *Journal of Nursing Scholarship*, *21*(4), 227-231.

Cork, R. D, Detmer, W. M, & Friedman, C. P (1998) Development and initial validation of an instrument to measure physicians' use of, knowledge about, and attitudes toward computers. *Journal of the American medical informatics association, 5*(2), 164-176.

Cornford, J., & Pollock, N. (2003). *Putting the university online: Information, technology and organizational change*. Philadelphia, PA: Open University Press.

Courtney, K. L., Demiris, G., & Alexander, G. L. (2005). Information technology: Changing nursing processes at the point-of-care. *Nursing Administration Quarterly, 29*(4), 315-322.

Creswell, J. (2002). *Educational research: Planning, conducting and evaluating quantitative and qualitative approaches to research*. Upper Saddle River, NJ: Pearson Education.

Creswell, J. (2003). *Research design qualitative, quantitative, and mixed methods approaches* (2nd ed.). Thousand Oaks, CA: Sage Publications.

Creswell, J. (2008). *Educational research* (3ʳᵈ ed.). Upper Saddle River, NJ: Pearson Education.

Creswell, J. (2009). *Research design: Qualitative, quantitative and mixed methods approach.* London: Sage Publications.

Creswell, J., & Plano Clark, V. (2007). *Designing and conducting mixed method research.* Thousand Oaks, CA: Sage Publications.

Cronbach, L. J. (1951) Coefficient alpha and the internal structure of tests. *Psychometrika, 16*, 279-334.

Culler, S. D., Jose, J., Kohler, S., & Rask, K. (2011). Nurses' perceptions and experiences with the implementation of a medication administration system. *Computers Informatics Nursing, 29*(5), 280-288.

Daley, B. J., et al. (2001). Exploring learning in a technology-enhanced environment. *Educational Technology and Society, 4*(3), 126-138.

Darbyshire, P. (2000). User-friendliness of computerized information systems. *Computers in Nursing, 18*(2), 93-99.

Darbyshire, P. (2004). Rage against the machine?: Nurses' and midwives' experiences of using computerized patient information systems for clinical information. *Journal of Clinical Nursing, 13*, 17-25.

Dawes, M., & Sampson, U. (2003). Knowledge management in clinical practice: A systematic review of information seeking behavior in physicians. *International Journal of Medical Informatics, 71*(1), 9-15.

de Vaus, D. A. (1995). *Surveys in social research* (4th ed.). St. Leonards, NSW: Allen & Unwin.

de Vaus, D. A. (2002). *Surveys in social research* (5th ed.). St. Leonards, NSW:

Allen & Unwin.

de Veer, A., & Francke, A. (2010). Attitudes of nursing staff towards electronic patient records: A questionnaire survey. *International Journal of Nursing Studies, 47*, 846-854.

Dee, C., & Stanley, E. (2005). Information-seeking behavior of nursing students and clinical nurses: Implications for health sciences librarians. *Journal of the Medical Library Association, 93*(2), 213-222.

Delgado, C. (2004). Technology in nursing education: Five axioms. *Nurse Educator, 29*(1), 13-14.

della Porta, D., & Keating, M. (2008). *Approaches and methodologies in the social sciences: A pluralist perspective*. New York: Cambridge University Press.

Denzin, N, & Lincoln, Y. (2008). *Collecting and interpreting qualitative materials* (3rd ed.). Thousand Oaks, CA: Sage Publications Inc.

Denzin, N. K. (1978). *The research act: A theoretical introduction to sociological methods.* New York: McGraw-Hill.

Denzin, N. K. (2000). The art and practices of interpretation, evaluation and representation: The practices and politics of interpretation. In N. Denzin & Y. Lincoln (Eds.), *Handbook of qualitative research* (pp. 897- 922). Thousand Oaks, CA: Sage Publications.

Denzin, N. K., & Lincoln, Y. (1994). *Handbook of qualitative research*. Thousand Oaks, CA: Sage Publications.

Department of Health and Ageing. (2008). *WA Health Connect*.   Retrieved January 23, 2010, from http://www.health.gov.au/internet/hconnect/publishing.nsf/Content/wa-1lp

Department of Health and Aging. (2010). *Building a 21st century primary health care system: Australia's first national primary health care strategy.* Canberra, Australia: Australian Government Printing Services.

Department of Health UK. (2001). *National infrastructure service strategic online case (Vol. a).* London, UK: Author.

Department of Health Western Australia. (2006). *Healthy workforce strategic framework.* Perth, Western Australia: Department of Health.

Detmer, W. M., & Friedman, C. P. (1994). *Academic physicians' assessment of the effects of computers on health care* (Proceedings of the 18th Annual Symposium on Computer Application in Medical Care, pp. 558-562). Philadelphia, PA: Hanley & Belfus.

Dillon, T. W., Blankenship, R., & Crews, T. (2005). Nursing attitudes and images of electronic patient record systems. *Computers, Informatics, Nursing, 23*(3), 139-145.

Dillon, T., McDowell, D., Salimian, F., & Conklin, D. (1998). Perceived ease of use and usefulness of bedside-computer systems. *Computers in Nursing, 16*(3), 151-156.

Dragon, N. (2006). Patient Care in a technological Age. *Australian Journal of Advanced Nursing (Online), 14*(1), 16-20.

Dragon, N. (2008). E-health: Leaving the paper trail behind. *Australian Nursing Journal, 16*(1), 22-25.

Eley, R., Fallon, T., Soar, J., & Buikstra, E., (2008). Nurses' confidence and experience in using information technology. *Australian Journal of Advanced Nursing (Online), 25*(3), 23-35.

Eley, R., Fallon, T., Soar, J., Buikstra, E., & Hegney, D. (2008). The status of training and education in information and computer technology of Australian nurses: a national survey. *Journal of Clinical Nursing, 17*(20), 2758-2767.

Eley, R., Soar, J., Buikstra, E., Fallon, T., & Hegney, D. (2009). Attitudes of Australian nurses to information technology in the workplace: A national survey. *Computers, Informatics, Nursing, 27*(2), 114-121.

Elfrink, V. (1996). The information technology frontier: A call for pioneers. *Computers in Nursing, 14*(2), 82-66.

Elfrink, V., Davis, L., Fitzwater, E., Castleman, J., Burley, J., Gorney-Moreno, M., et al. (2000). A comparison of teaching strategies for integrating information technology into clinical nursing education. *Nurse Educator, 25*, 136-144.

Estabrooks, C, O'Leary, K, Ricker, K, & Humphey, C. (2003). Nursing and Health Care Management Issues: The internet and access to evidence how are nurses positioned. *Journal of Advanced Nursing, 42*(1), 73-81.

Fett, M. (2000). *Technology, health and health care.* Canberra, Australia: Commonwealth of Australia.

Fetter, M. (2009a). Collaborating to Optimize Nursing Students' Agency Information Technology Use. *Computers Informatics Nursing, 27*(6), 354-362.

Fetter, M. (2009b). Curriculum strategies to improve baccalaureate nursing information technology outcomes. *Journal of Nursing Education, 48*(2), 78-85.

Field, A. (2005). *Discovering statistics using SPSS*. London: Sage.

Fishbein, M., & Ajzen, I. (1975). *Beliefs, Attitude, intention, and behaviour: An introduction to theory and research.* Reading, MA: Addison-Wesley.

Fullerton, J., Thompson, J., & Lacey, B. (2005). Examining the evidence for the international confederation of mdwives' essential competencies for midwifery practice. *Midwifery, 21*(1), 2-13.

Gallagher, K. (2008). *National e-health strategy summary*. Melbourne, Victoria: Department of Human Services.

Garde, S., Harrison, D., & Hovenga, E. (2005). Skill needs for nurses in their role as health informatics professionals: A survey in the context of global health informatics education. *International Journal of Medical Informatics, 74*, 899-907.

Garrett, B, & Jackson, C. (2006). A mobile clinical e-portfolio for nursing and medical students, using wireless personal digital assistants (PDAs). *Nurse Education Today, 26*(8), 647-654.

Gergen, K. J. (1995). Social construction and the educational process. In L. P. Steffe & J. Gale (Eds.), *Constructivism in education* (pp. 17-39). Hillsdale, NJ: Lawrence Erlbaum.

Gerrish, K., Morgan, L., Mabbott, I., Debbage, S., Entwistle, B., Ireland, M., Taylor, C. & Warnock, C. (2006). Factors influencing use of information technology by nurses and midwives. *Practice Development in Healthcare, 5*(2), 92-101.

Gogler, J., Hullin, C., Monaghan, V., & Searle, C. (2008). *The chaos in primary nursing data: Good information reduces risk*. Melbourne, Victoria: Health Informatics Society of Australia.

Goldman, J., & Hudson, Z. (2000). Virtually exposed: Privacy and e-health. *Health Affairs, 19*(6), 140-148.

Gosling, S., Westbrook, J., & Spence, R. R. (2004). Nurses' use of online clinical evidence. *Journal of Advanced Nursing, 47*(2), 201-211.

Grain, H. (2005). Information systems in the new world: An emerging national approach. *Australian Health Review, 29*(3), 292-296.

Graveley, E., Lust, B. L., & Fullerton, J. T. (1999). Undergraduate computer literacy evaluation and intervention. *Computers in Nursing, 17*(4), 166-170.

Graves, J., & Corcoran, S. (1989). The study of nursing informatics. *Journal of Nursing Scholarship, 4*, 227-231.

Greene, J., & Caracelli, V. (1997). *Advances in mixed-method evaluation: The challenges and benefits of integrating diverse paradigms* (New Directions for Evaluation). San Francisco: Jossey-Bass.

Greene, J., Caracelli, V., & Graham, W. (1989). Towards a conceptual framework for mixed-method evaluation designs. *Educational Evaluation and Policy Analysis 11*, 255-274.

Griffiths P, & Riddington L (2001) Nurses' use of computer databases to identify evidence for practice: A cross sectional questionnaire survey in a UK hospital. *Health Libraries Review, 18,* 2-9.

Guba, E., & Lincoln, Y. (1989). *Fourth generation evaluation.* San Francisco, CA: Sage Publications.

Guba, E., & Lincoln, Y. (1994). Competing paradigms in qualitative research. In N. Denzin & Y. Lincoln (Eds.), *Handbook of qualitative research* (pp. 105-117). Thousand Oaks, CA: Sage Publications.

Gunter, T, Terry, N, Roy, J, & Carver, L. (2005). *The emergence of national electronic health record architectures in the United States and Australia: Models, costs, and questions* (Publication no. doi:10.2196/jmir.7.1.e3). Retrieved 14/9/2012 http://www.jmir.org/2005/1/e3

Gururajan, R., Murugesan, S., & Soar, J. (2005). Introducing mobile technologies in support of healthcare. *Cutter IT Journal, 18,* 12-18.

Hall, J., & Hammond, S. (1998). *What is appreciative inquiry*. Retrieved November 12, 2011, from http://www.thinbook.com/chap11fromle.html.

Hammond, S. A. (1998). *The thin book of appreciative inquiry* (2nd ed.). Plano, TX: Thin Book Publishing Company.

Hannah, K., Ball, M., & Edwards, M. (2006). *Introduction to nursing informatics.* New York: Springer Science.

Harrison, M., Koppel, R., & Bar-Lev, S. (2007). Unintended consequences of cnformation technologies in health care: An interactive sociotechnical analysis. *Journal of the American Medical Informatics Association, 14*(5), 542-549.

Health Department of WA. (2010). *WA Health Strategic Intent 2010-2015*, Perth, Australia: Health Department of WA.

Health Informatics Society of Australia. (2009*). A review of the Australian health informatics workforce.* Melbourne, Victoria: Australian Department of Health and Ageing.

Healthcare Information and Management Systems Society Committee. (2003). *Electronic health record attributes and essential requirements*. Retrieved March, 2013, from http:// www.himssehra.org/docs/EHRVA_application.pd.

Heath, P., & Duncan, J. (2002). *National review of nursing education: Our duty of care.* Canberra, Australia: Department of Education, Science and Training (DEST).

Hebda, T., Czar, P., & Mascara, C. (2005). *Handbook of informatics for nurses and health care professionals.* Upper Saddle River, NJ: Pearson Education Inc.

Hegge, M., Powers, P., Hendricks, L., & Vinson, J. (2002). Competence, continuing education and computers. *Journal of Continuing Education Nursing,* 33(1), 24-32.

Hegney, D., Eley, R., Buikstra, E., Fallon, T., Soar, J., & Gilmore, V. (2007). *Nurses and information technology: Final report*. Canberra, Australia: Commonwealth of Australia.

Hegney, D., Plank, A., & Parker, V. (2003). Nursing workloads: the results of a study of Queensland nurses. *Journal of Nurse Management 11*(5), 307–314.

Heller, B. R., Mills, M. E., & Romano, C. A. (1996). Nursing informatics: Education for a new speciality and career. In B. R. Heller, M. E. Mills and C. A. Romano (Eds.), *Information management in nursing and healthcare* (pp. 288-294). Springhouse, PA: Springhouse Corporation.

Hersh, W. (2009). A stimulus to define informatics and health information technology. *Medical Informatics and Decision Making, 9*(1), 1-24.

Hillan, E. M., McGuire, M. M., & Cooper, M. (1998). Computers in midwifery practice: A view from the labour ward. *Journal of Advanced Nursing, 27*(1), 27-29.

Hobbs, S. (2002). Measuring nurses' computer competency: An analysis of published instruments. *Computers, Informatics, Nursing, 20*(2), 63-73.

Hovenga, E. (1998). Health and medical informatics education for nurses and health service managers. *International Journal of Medical Informatics, 50*(1), 21-29.

Hovenga, E., Hannah, K., McCormick, K., & Ronald, J. (1991, April). *Nursing use of computers and information science.* Paper presented at the Fourth International Conference on Nursing Informatics, Melbourne, Australia. http://www.ausstats.abs.gov.au/ausstats/subscriber.nsf/0/D3D7FAA735DDA645 CA25703B00774A0B/$File/41020_2005.pdf.

Hughes, R. (2003). Clinical practice in a computer world: Considering the issues. *Journal of Advanced Nursing, 42*(4), 340-346.

Hughes, R., & Clancy, C. (2009). Nurses' role in patient safety. *Nursing Care Quality, 24*(1), 1-4.

Hurley, A. C., Bane, A., Fotakis, S., Duffy, M. E., Sevigny, A., Poon, E. G., & Gandhi, T. K. (2007). Nurses' satisfaction with medication administration point-of-care technology. *The Journal of Nursing Administration, 37*(7-8), 343-349.

Hurley, A., Lancaster, D., Hayes, J., Wilson-Chase, C., l, Bane, A., Griffin, M., Warden, V., Duffy, M., Poon, E., Gandhi, T. (2006). The Medication Administration System—Nurses Assessment of Satisfaction (MAS-NAS) Scale. *Journal of Nursing Scholarship, 38*(3), 298-300.

Huryk, L.A. (2010). Factors influencing nurses' attitudes towards healthcare information technology. *Journal of Nursing Management, 18,* 606-612.

Institute of Medicine (2003). *Health professions education: A bridge to quality.* Washington, DC: The National Academies Press.

Institute of Medicine. (2003). *Health professions education: A bridge to quality.* Washington, DC: The National Academies Press.

Institute of Medicine. (2007). *Preventing medication errors.* Washington, DC: National Academy of Sciences.

Jacobs, S., Rosenfeld, P., & Haber, J. (2003). Information literacy as the foundation for evidence-based practice in graduate nursing education: A curriculum integrated approach. *Journal of Professional Nursing, 19,* 320-328.

Jacobson, S., Holder, M., & Dearner, J. (1989). Computer anxiety among nursing students, educators, staff, and administrators. *Computers in Nursing 7*(6), 266-272.

Jayasuriya, R. (1998). Determinants of microcomputer technology use: Implications for education and training of health staff. *International Journal of Medical Informatics, 50*(1), 187-194.

Jayasuriya, R., & Caputi, P. (1996). Computer attitude and computer anxiety in nursing: Validation of an instrument using an Australian sample. *Computers in Nursing, 14*(6), 340-345.

Jayasuriya, R., Milbourne, K., & Tooth, B. (1994, November). *Measuring the attitude of nurses towards use of computers.* Paper presented at HIC1994, Melbourne.

Jha, A., Doolan, D., Grandt, D., Scott, T., & Bates, D. (2008). The use of health information technology in seven nations. *International Journal of Medical Informatics, 6*(77), 848-854.

Johnson, A. (2005). *The New South Wales health privacy guidelines.* Sydney: Australian Privacy Foundation.

Jorgensen, D. L. (1989). *Participant observation: A methodology for human studies.* Newbury Park, CA: Sage.

Kapitzke, C. (2003). Information literacy: A positivist epistemology and a politics of outformation. *Educational Theory, 53*(1), 37-53.

Kenny, A. (2002). Online learning: Enhancing nurse education? *Journal of Advanced Nursing, 38*(2), 127-135.

Kerrey, B. (2000). *The power of the internet for learning: Moving from promise to practice. Report of the Web-based Education Commission to the President and the Congress of the United States of America.* Washington, DC: Web-based Education Commission.

Klotz, J., & Reis, J. (2005). *Exploring computer technology usage amongst remote area nurses in Australia: a preliminary analysis.* Paper presented at the Proceedings of the National Health Informatics Conference East Brunswick, Victoria, Australia.

Kokol P, Zazula D, Brumec V, & Kolenc L. (1999). Nursing Informatics education for the next millenium. *Future Generation Computer System, 15*, 211-216.

Kossman, S. P, & Schneidenhelm, S. L. (2008). Nurses' perceptions of the impact of electronic health records on work and patient outcomes. *Computers, Informatics, Nursing, 26*(2), 69-77.

Krampf, S., & Robinson, S. (1984). Managing nurses' attitudes towards computers. *Journal of Nursing Management, 15*(7), 29-34.

Kvale, S. (1996). *InterViews: An introduction to qualitative research interviewing.* Thousand Oaks, CA: Sage.

Lai, T. Y, Lueng, G. M, & Wong, I. O, Johnston, J. M. (2004). Do doctors act on their self-reported intention to computerize? A follow-up population-based survey in Hong Kong. *International Journal of Medical Informatics, 73*(5), 415-431.

Lee, P., Taylor, G., Meyer, P., Braddock, D., & Broadbent, A. (2008). *Nursing and midwifery labour force 2005: National health labour force.* Canberra, Australia: Australian Institute of Health & Welfare.

Lee, T. (2004). Nurses' adoption of technology: Application of Rogers' innovation-diffusion model. *Applied Nursing Research, 17*(4), 231-238.

Lee, T. (2005). Nurses' concerns about using information systems: Analysis of comments on a computerized nursing care plan system in Taiwan. *Journal of Clinical Nursing, 14*, 344-353.

Lee, T., Yeh, C., & Ho, L. (2002). Application of computerized nursing care plan system in one hospital: Experiences of ICU nurses in Taiwan. *Journal of Advanced Nursing, 39*, 61-47.

Levett-Jones, T., Kenny, R., Van derRiet, P., Hazelton, M., Kable, A., Bourgeois, S., & Luxford, Y. (2009). Exploring the information and communication technology competence and confidence of nursing students and their perception of its relevance to clinical practice. *Nurse Education Today, 29*, 612-616.

Lincoln, Y. S., & Guba, E. G. (1985). *Naturalistic inquiry*. London: Sage Publicaions.

Lincoln, Y., & Guba, E. (2000). Paradigmatic controversies, contradictions, and emerging confluences. In N. Denzin & Y. Lincoln (Eds.), *Handbook of qualitative research* (2nd ed.) (pp 97-129). Thousand Oaks, CA: Sage Publications.

Liu, J., Pothiban, L., Lu, Z., & Khamphonsiri, T. (2000). Computer knowledge, attitudes, and skills of nurses in People's Hospital of Beijing Medical University. *Computers in Nursing, 18*(4), 197-206.

Lium, J.-T., Lærum, H., Schulz, T., & Faxvaag, A. (2006). From the front line, Report from a near paperless hospital: Mixed reception among health care professionals. *Journal of the American Medical Informatics Association, 13*(6), 668-675.

Loh, P, Flicker, L, & Horner, B. (2009). Attitudes toward information and communication technology (ICT) in residential aged care in Western Australia. *Journal of the American Medical Directors Association, 10*(6), 408 - 413.

Lomas, C. (2012). The burden of bureaucracy. *Nursing Standard, 26*(30), 22-24.

Lupiáñez-Villanueva, F., Hardey, M., Torrent, J., & Ficapal, P. (2011). The integration of information and iommunication technology into nursing. *International journal of medical informatics, 80*(2), 133-140.

Maag, M. (2006). Nursing students attitudes toward technology: A national study. *Nurse Educator, 31*(3), 112-118.

Magnusson, L., Hanson, E., & Borg, M. (2004). A literature review study of information and communication technology as a support for frail older people living at home and their family carers. *Technology and Disability, 16*(4), 223-235.

Marasovic, C., Kenney, C., Elliott, D., & Sindhusake, D. (1996). Attitudes of Australian nurses toward the implementation of a clinical information system. *Computers in Nursing, 15*(2), 91-98.

Marasovic, C., Kenney, C., Elliott, D., & Sindhusake, D. (1997). Attitudes of Australian nurses toward the implementation of a clinical information systems. *Computers in Nursing, 15*(2), 91-98.

Mayo, A., & Duncan, D. (2004). Nurse perceptions of medication errors: What we need to know for patient safety? *Journal of Nursing Care Quality, 19*(3), 209-217.

McBride, A. (2005). Nursing and the informatics revolution. *Nursing Outlook, 53*(4), 183-191.

McBride, S., & Nagle, L. (1996). Attitudes toward computers: A test of construct validity. *Computers in Nursing, 14*(3), 164-174.

McCannon, M., & O'Neal, P. (2003). Results of a national survey indicating information technology skills needed by nurses at time of entry into the work force. *Journal of Nursing Education, 42*(8), 337-340.

McCaughan, D., Thompson, C., Cullum, N., Sheldon, T. A., & Thompson, D. R. (2002). Acute care nurses' perceptions of barriers to using research information in clinical decision making. *Journal of Advanced Nursing, 39*(1), 46-60.

McDowell, D., & Ma, X. (2007). Computer literacy in baccalaureate nursing students during the last 8 years. *Computers Informatics Nursing, 25*(1), 30-36.

McKinley, S., Aitken, L., Doig, G., & Liu, J. (2002). National review of nursing education in Australia: Our duty of care. In Commonwealth Department of Education Science and Training (Ed.), *Models of nurse education and training competency, professional expertise and re-entry to the workforce*. Canberra: Australian Government Publishing Service.

McLane, S. (2005). Designing an EMR planning process based on staff attitudes toward and opinions about computers in healthcare. *Computers, Informatics, Nursing, 28*, 85-92.

McNeil, B., Elfrink, V., Pierce, S., Beyea, S., Bickford, C., & Averill, C. (2005). Nursing informatics knowledge and competencies: A national survey of nursing education programs in the United States. *International Journal of Medical Informatics, 74*, 1021-1030.

McNeil, B., Elfrink, V., Bickford, C., Pierce, S., Beyea, S., & Averill, C. (2003). Nursing information technology knowledge, skills, and preparation of student nurses, nursing faculty, and clinicians: A U.S. survey. *Journal of Nursing Education, 42*(8), 341-349.

Merriam, S. B. (1998). *Qualitative research: A guide to design and implementation.* (2nd ed.), San Francisco, CA: Jossey-Bass.

Miller, J., Piper, L., & Tucker, D. (1997). Strategies for getting students on the information superhighway. *Nurse Educator, 22*(5), 40-43.

Mills, M., & Staggers, N. (1994). Nurse computer performance: Considerations for the nurse administrator. *Journal of Nursing Administration, 24*, 30-35.

Moody L. E., Slocumb, E., Berg, B., & Jackson D. (2004). Electronic health records documentation in nursing: Nurses' perceptions, attitudes and preferences. *Computers, Informatics, Nursing, 22*, 337-344.

Moor, J. (1997). Towards a theory of privacy in the information age. *Computers and Society, 27*(3), 27-32.

Morse, J., & Field, P. (1995). *Nursing research: The application of qualitative approaches* (2nd ed.). London: Sage Publication.

Munyisia, E., Yu, P., & Hailey, D. (2011). The changes in caregivers' perceptions about the quality of information and benefits of nursing documentation associated with the introduction of an electronic documentation system in a nursing home. *International Journal of Medical Informatics, 80*(2), 116-126.

Nahm, R., & Posaton, I. (2000). Measurement of the effects of an integrated, point-of-care computer system on quality of nursing documentation and patient satisfaction. *Computers in Nursing, 18*, 220-229.

Nicholl, L. (2002). *Computers, informatics, clinical information and the professional nurse* (2nd ed). St. Louis, MO: Mosby Inc.

Nunnally, J. C. (1978). *Psychometric theory*. New York: McGraw-Hill.

Organisation of Economic Development and Co-operation (OECD). (2007, June). *The future of the internet economy: A statistical profile*. OECD Ministerial Meeting hosted by Communications Commission, South Korea.

Ornes, L., & Gassert, C., (2007). Computer competencies in a BSN program. *Journal of Nursing, 46*(2), 75-78.

Oroviogoicoechea, C., & Watson, R. (2009). A quantitative analysis of the impact of a computerized information system on nurses' clinical practice using a realistic evaluation framework. *International Journal of Medical Informatics, 78*, 839-849.

Pagliari, C., Sloan, D., Gregor, P., Sullivan, F., Detmer, D., Kahan, J. P., Oortwijn, W., & MacGillivray, S. (2005). *What is eHealth (4): A scoping exercise to map the field. Journal of Medical Internet research, 7*(1). Retrieved on January 22, 2013, from http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1550637/.

Parkin, A. (2000). Computers in clinical practice: Applying experience from child psychiatry. *British Medical Journal, 321*, 615-618.

Partridge, H., Edwards, L., & Thorpe, C. (2010). Evidence-based practice: Information professionals' experience of information literacy in the workplace. In A. Lloyd & S. Talja (Eds.), *Practising information literacy: bringing theories of learning, practice and information literacy together* (pp. 273-298). Wagga Wagga, N.S.W: Centre for Information Studies.

Patton, M. (1990). *Qualitative evaluation and research methods* (2nd ed.). Thousand Oaks, CA: Sage Publications.

Patton, M. (2002). *Qualitative research and evaluation method* (3rd ed.). Thousand Oaks, CA: Sage Publications.

Petty, M., Twigg, D., & Young, S. (2002). Ageing of the nursing workforce: Implications for acute care services. *Collegian, 9*(1), 6-7.

Poissant, L., Pereira, J., Tamblyn, R., & Kawasumi, Y. (2005). The impact of electronic health records on time efficiency of physicians and nurses: A systematic review. *Journal of the American Medical Informatics Association, 12*(5), 505-516.

Polkinghorne, D. E. (1992). Postmodern epistemology of practice. In S. Kvale (Ed.), *Psychology and postmodernism. Inquiries in social construction* (pp. 146-165). Thousand Oaks, CA: Sage Publications.

Poon, E. G. (2010). Effect of bar-code technology on the safety of medication administration. *The New England journal of medicine, 362*(18), 1698-1707.

Pope, C., Ziebland, S., & Mays, N. (2000). Qualitative research in health care: Analysing qualitative data. *British Medical Journal, 320*, 114-116.

Porter-O'Grady, T. (2002). A glimpse over the horizon. *Research and Theory for Nursing Practice, 16*(3), 213-214.

Porter-O'Grady, T. (2003). Of hubris and hope: Transforming nursing for a new age. *Nursing Economics, 21*(2), 59-64.

Pravikoff, D., Tanner, A., & Pierce, S. (2005). Readiness of US nurses for evidence-based practice. *American Journal of Nursing, 105*(9), 40-51.

Prevost, S. (Ed.). (2008). *Technology: The interface to nursing educational informatic*. Philadelphia, PA: Elsevier.

Ragneskog, H., & Gerdner, L. (2006). Competence in nursing informatics among nursing students and staff at a nursing institute in Sweden. *Health Information, 23*(2), 126-132.

Ramano, C. (1990). The promise and the perils for nursing and information technology. *Computers in Nursing , 8*(3), 99-104.

Reason, J. (2000). Human error: Models and management *British Medical Journal, 320,* 768-700.

Ribbons, R. (1998). The use of computers as cognitive tools to facilitate higher order thinking skills in nursing education. *Computers in Nursing, 16,* 223-228.

Rosenbloom, S. T., Talbert, D., & Aronsky, D. (2004). Clinicians' perceptions of clinical decision support integrated into computerized provider. *International Journal of Medical Informatics, 73*, 433-441.

Rushton, S. (1996). Integration of information skills into the school curriculum. *Access, 10*(3), 21-23.

Saba., K. (2001). Yesterday, today, tomorrow. *International Nursing Review, 48*(3), 177-187.

Sampson, P. (2009, October). *Supporting skill development through flexible task based design. In Same places, different spaces.* Paper presented at the ascilite, Auckland, New Zealand.

Sandelowski, M. (1995). Triangles and crystals. *Research in Nursing and Health, 18*, 569-574.

Saranto, K., & Leinpo-Kilpi, H. (1997). Computer literacy in nursing. *Journal of Professional Nursing, 25*(2), 377-385.

Sassen, E. (2009). Love, hate, or indifference: How nurses really feel about the electronic health record system. *Computers Informatics Nursing, 27*(5), 281-287.

Scarpa, R., Smeltzer, S. C., & Jasion, B. (1992). Attitudes of nurses toward computerization: A replication. *Computers in Nursing, 10*(10), 72-80.

Schaper, L. (2007). *Scope and definitions: Allied health*. Melbourne, Australia: Health Informatics Society of Australia.

Schluter, J., Seaton, P., & Chaboyer, W. (2011). Understanding nursing scope of practice: A qualitative study. *International Journal of Nursing Studies, 48*, 1211-1222.

Schwandt, T. (1994). Constructivist, interpretivist approaches to human inquiry. In N. Denzin & Y. Lincoln (Eds.), *Handbook of qualitative research* (pp. 118-137). Thousand Oaks, CA: Sage Publications.

Schwirinan, P. M., Malone, J. A., Stone, Nunley, J. V., & Francisco, T. (1989). Computer in nursing practice: A comparison of the attitudes of nurses and nursing students. *Computers in Nursing, 7*, 168-177.

Scollin, P. (2001). A Study of Factors Related to the use of Online Resources by Nurse Educators. *Computers in Nursing, 19*(6), 249-256.

Seaton-Skyes, P. (2003). *Teaching and Learning in Internet Environment in Australian Nursing Education.* (Doctor of Philosophy), Griffiths University, Griffiths, Queensland, Australia.

Shih, F. (1998). Triangulation in Nursing research: Issues of conceptual clarity and purpose. *Journal of Advanced Nursing, 28*(3), 631-641.

Shorten, A., Wallace, M. C., & Crookes, P. A. (2001). Developing information literacy: A key to evidence-based nursing. *International Nursing Review, 48*(2), 86-92.

Simpson, G., & Kenrick, M. (1997). Nurses attitudes toward computerization in clinical practice in a British general hospital. *Computers in Nursing, 15*(1), 37-42.

Simpson, R. (2000). 2020 Vision: Predictions for the next 2 decades in nursing. *Nursing Management, 31*(4), 10-11.

Simpson, R. (2002). The virtual reality revolution: Technology changes nursing education. *Nursing Management, 33*(9), 14-19.

Simpson, R. (2003). Welcome to the virtual classroom: How technology is transforming nursing education in the 21st century. *Nursing Administration Quarterly, 27*(1), 83-86.

Simpson, R. (2005). Practice to evidence to practice: Closing the loop with IT. *Nursing Management, 36*(9), 12-17.

Simpson, R. (2007). Nursing informatics: The economics of education. *Nursing Management. 38*(6), 16-17.

Smedley, A. (2005). The importance of informatics competencies in nursing: An Australian perspective. *Computers, Informatics, Nursing, 23*(2), 106-110.

Steier, F. (1995) From universing to conversing: An ecological constructionist approach to learning and multiple description. In L. P. Steffe & J. Gale (Eds). *Constructivism in education* (pp. 67 – 84). Hillsdale: NJ.: Lawrence Erlbaum Associates.

Steven, J. P. (1992). *Applied multivariate statistics for the social sciences* (2nd ed.). Hillsdale, NJ: Lawrence Erlbaum.

Stockton, A., & Verhey, M. (1995). A psychometric examination of the Stronge-Brodt nurses attitudes toward computers questionnaire. *Computers in Nursing, 13*(3), 109-113.

Stronge J., & Brodt A. (1986) Nurses' attitudes toward computerization in a midwestern community hospital. *Computers in Nursing, 4*(2), 82-86.

Stronge, J., & Brodt, A. (1985). Assessment of nurses' attitudes toward computerization. *Computers in Nursing, 3*(4), 154-158.

Sultana, N. (1990). Nurses attitudes towards computerization in clinical practice. *Journal of Advanced Nursing, 15*, 696-702.

Taylor, P.C. (1994). Collaborating to reconstruct teaching: The influence of researcher beliefs: In K. Tobin (Ed.). *The practice of constructivism in science education* (pp. 267-298), Hillsdale: NJ: Lawrence Erlbaum Associates.

Teach, R. L. & Shortliffe, E. H. (1981). An analysis of physician attitudes regarding computer-based clinical consultation systems. *Computers & Biomedical Research, 14*(6), 542-588.

Teddie, C., & Tashakkori, A. (2009). *Foundations of mixed methods research: Integrating quantitative and qualitative approaches in the social and behavioural sciences*. Thousand Oaks, CA: Sage Publications.

Tennent, B., Becker, K., & Kehoe, J. (2005, September). *Technology-enabled delivery and assessment methods: Are we addressing student expectations and learning preferences?* Paper presented at the Annual Ascilite 2005 conference, Central Queensland University.

Thompson, B. (2001). Significance, effect sizes, stepwise methods and other issues: Strong arguments move the field. *Journal of Experimental Education, 7*, 80-93. Thompson, B. (2004). *Exploratory and confirmatory factor analysis: Understanding concepts and applications.* Washington, DC: American Psychological Association.

Thomson, C. (2004). *The regulation of Health Information Privacy in Australia.* Department of Communication Information Technology and the Arts, Canberra, ACT.

Timmons, S. (2003). Nurses resisting information technology. *Nursing Inquiry, 10*, 257-269.

Tinkler, D., Lepani, B., & Mitchell, J. (1996). *Education and technology convergence: A survey of technological infrastructure in education and the professional development and support of educators and trainers in information*

and communication technologies. Canberra: Australian Government Publishing Service.

Top, M., & Gider, O. (2012). Nurses' views on electronic medical records (EMR) in Turkey: An analysis according to use, quality and user satisfaction. *Journal of Medical Systems, 36*(3), 1979-1988.

Trochim, W. M., & Donnelly, J. P. (2006). *The research methods knowledge base* (3rd ed.). Cincinnati, OH: Atomic Dog.

Turpin, P. G. (2005). Transitioning from paper to computerized documentation. *Gastroenterology Nursing. 28*(1), 61-62.

von Glasersfeld, E. (1987). Learning as a constructive activity. In C. Janvier (Ed.), *Problem of representation in the teaching and learning of mathematics.* (pp. 3-17). Hillsdale, NJ: Lawrence Erlbaum Associates.

von Glasersfeld, E. (1993). Problems of constructivism. In L. P. Steffe and P. W. Thompson (Eds.), *Radical constructivism in action: Building on the pioneering work of Ernst von Glasersfeld (2002)* (pp. 3-7). London: RoutledgeFalmer.

von Glasersfeld, E. (1995). *Radical constructivism: A way of knowing and learning*. London, The Falmer Press.

Wallace, M., Shorten, A., Crookes, P., McGurk, C., & Brewer, C. (1999). Integrating information literacies into an undergraduate nursing program. *Nurse Education Today, 19,* 136-141.

Ward, R., Stevens, C., Brentall, P., & Briddon, J. (2008). The attitudes of health care staff to information technology: a comprehensive review of the research literature. *Health Information and Libraries Journal, 25*, 81-97.

Warren, J., & Connors, H. (2007). Health information technology can and will transform nursing education. *Nursing Outlook, 55*(1), 58-60.

Webster, J., Davis, J., Holt, V., Stallan, G., New, K., & Yegdich, T. (2003). Australian nurses ' and midwives' knowledge of computers and their attitudes to using them in their practice. *Journal of Advanced Nursing, 41*(2), 140-146.

West, R. (1998). *Learning for life: Review of higher education, financing and policy.* Canberra: Department of Employment, Education, Training and Youth Affairs.

Westbrook, J. I., Coiera, E. W., & Gosling, A. S. (2005). Do online information retrieval systems help experienced clinicians answer clinical questions? *Journal of the American Medical Informatics Association, 12*(3), 315-321.

While, A, & Dewsbury, G. (2011). Nursing and information and communication technology (ICT): A discussion of trends and future directions. *International Journal of Nursing Studies, 48*(10), 1302-1310.

Wilbright W.A., Haun D.E., Romano T., Krutzfel T., Fontenot E. *&* Nolan T.E. *(*2006*)* Computer use in an urban university hospital: technology ahead of literacy. *Computers, Informatics, Nursing, 24*(1), 37-43.

Wooding, R. (2001). *National Telehealth Plan for Australia and New Zealand.* Canberra: National Health Information Management Advisory Council.

Woodward, C. (2009). Digital Rx: Obama pushing for paperless prescriptions. *Canadian Medical Association Journal. 180*(8), 806-817.

Yeoh, J. (2000). Nursing information needs: what next? *Health Libraries Review*, 17, 14-16.

Yin, R. K. (2011). *Qualitative research from start to finish*. New York: Guildford Press.

Yu, P. (2005). *Residential aged care workers' computer skill sets and attitudes toward using information systems to manage care.* Wollongong, NSW: University of Wollongong.

Every reasonable effort has been made to acknowledge the owners of copyright material. I would be pleased to hear from any copyright owner who has been omitted or incorrectly acknowledged.

APPENDIX A

Dr Stronge's Letter

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

From: jhstro@wm.edu [mailto:jhstro@wm.edu]

Sent: Sunday, June 03, 2007 3:33 AM

To: jvdall@bigpond.com

Subject:

Veronica,

Please accept this message as permission to use "Nurses' Attitudes toward Computerization" in your study.

Best wishes for success with the project.

James Stronge

P.S. I would have contacted you following your voice message, but I couldn't get the correct email address in the message. Coincidentally, my wife and I are planning to visit Perth and the surrounding area in mid-July. We're looking forward to our first trip to your part of Australia.

APPENDIX B

Dr Jayasuriya's Letter

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

From: Rohan Jayasuriya [mailto:ajayasur@uow.edu.au]

Sent: Thursday, 18 October 2007 13:28

To: Dall, Veronica

Subject: Re: Permission to use NCATT questionnaire

Hi, Veronica,

You have permission to use "Nurses' Attitudes toward Computerization Validation of Instrument" in your study.

If I remember correctly we did not use any theoretical model, but used concepts from other models. First we aggregated all possible items from all the instruments, then selected on the basis of the three components.

Sorry if we had not explained that in the article.

Best wishes and success with your research

Rohan

APPENDIX C

Survey Administered to Nurses

Nurses Computer & Information Technology Questionnaire
Information Technology refers to those systems (programs/ software plus computers) used to process and manage information (Corcoran & Graves, 1989). It includes the use of computer technology and software for word processing, spreadsheets, databases email internet, literature searches, use of clinical and information systems and computer assisted instructions such as simulations.
Part 1 – Background Information
For the following questions, please tick the box that applies to you.
1. Which age group do you belong to? □ 18–25 years   □ 26–34 years   □ 35–45 years   □ 46–55 years   □ over 55 years
2. Your gender: □ Male   □ Female
3. Highest Educational qualification levels attained? □ Nursing Diploma   □ Bachelor of Nursing   □ Master in Nursing □ Master in Education   □ Post-Grad Diploma   □ Sometimes □ Other (specify –e.g. TAFE, BSc in Biomedical Science, BA Teaching)
4. Do you have access to a computer at home?   □ Yes   □ No   □ Sometimes
5. Do you use a computer?   Tick box(es) as appropriate □ At home   □ At work   □ Uni / Tafe   □ Don't use
6. How many hours per week do you use a computer at home? □ None   □ < 1 hour   □ 2–6 hours   □ > 12 hours
7. How many hours per week do you use a computer for work? □ None   □ < 1 hour   □ 2–6 hours   □ > 12 hours
8. Please tick the applications that you have used / or use at work or home or at an educational institution □ Spreadsheet (Excel)   □ E-mail □ Word processing (MS-Word)   □ PowerPoint □ Databases (Microsoft Access)   □ Literature Search □ Computer Assisted Instructions   □ Hospital Info /Clinical Info Systems

9. Did you receive lessons on basic components of a computer e.g. keyboard, mouse, modem, CD/DVD at work prior to using computerized systems □ Yes   □ No If Yes, were these lessons: □ an IT course provided at work   □ part of study course   □ self-taught
10. Have you attended any computer or information technology courses? □ Yes   □ No
11. Length of Computer Course /Information Technology Course attended? □ < 1 month   □ 3– 6 months   □ 6–12 months   □ > 1 year
12. How would you rate your computer literacy skills? □ Beginner   □ Intermediate   □ Advanced   □ None
13 Where do you work? □ Hospital   □ Community   □ Management   □ University
14 Do you specialize in a particular stream? □ Yes   □ No Please specify e.g. surgery, community, intensive care: _____ _____
15.1. How long have you been working as a nurse? □ < 4 years   □ 5–10 years   □ 11-15 years   □ 16–20 years   □ > 20 years
15 2. Which instructional/learning practice or method was used in your studies? □ face to face   □ online web   □ Internet based   □   □ Others   supported   Simulations   (specify)

Appendices

PART 2						
After reading each of the statements below, clearly circle the number that best expresses your view.						
		Strongly Agree	Agree	Neither	Disagree	Strongly Disagree
1	The use of Information Technology will lower the cost of health care.	1	2	3	4	5
2	The use of Information Technology has contributed to nursing job losses within health care organisation.	1	2	3	4	5
3	The use of Information Technology in health care improves the quality of patient care.	1	2	3	4	5
4	Information Technology in health care has improved communication in health care thus benefiting patients and staff.	1	2	3	4	5
5	Information Technology saves time when seeking information regarding patients (for example medical records, pathology results).	1	2	3	4	5
6	The use of Information Technology in health care violates patient privacy and confidentiality	1	2	3	4	5
7	The use of Information Technology in health care increases nursing costs as it increases nurse's workload.	1	2	3	4	5
8	The use of Information Technology in health care will de-personalises nursing care.	1	2	3	4	5
9	The use of Information Technology in health care can reduce paper work completed by nurses.	1	2	3	4	5
10	The use of Information Technology in health care increases nurse's job satisfaction.	1	2	3	4	5
11	The use of Information Technology in health care allows nurses more time to improve patient care.	1	2	3	4	5
12	The use of Information Technology by nurses increases the professional status of nursing.	1	2	3	4	5
13	Information Technology skills are essential for nurses in the 21st century.	1	2	3	4	5
14	Information Technology in health care is needed to improve nursing.	1	2	3	4	5

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		Strongly Agree	Agree	Neither	Disagree	Strongly Disagree
15	The use of Information Technology in nurse education delivery meets student nurses' learning styles.	1	2	3	4	5
16	The use of Information Technology in nurse education improves the quality of teaching methods and student nurses' learning.	1	2	3	4	5
17	The use of Information Technology in nurse education improves the marketability of graduate nurses.	1	2	3	4	5
18	Nurse educators require more formal education to use and teach the application of Information technology in nursing.	1	2	3	4	5
19	Nursing students' computer competency should be evaluated clinically.	1	2	3	4	5
20	Technology Skills are a requirement for lifelong learning.	1	2	3	4	5
21	There is a need for Information Technology within nursing and nursing practice.	1	2	3	4	5

PART 3

1. In your opinion what computer or technology training do you consider essential for nurses to have to enhance their nursing practice.

_____

_____

_____

2. Please write any comment you may have that has not been addressed in the questionnaire. You can attach extra pages if the space provided is insufficient

_____

_____

_____

I take this opportunity to thank you and invite you to volunteer for a face to face interview at a location and time convenient to you. If you would like to participate, please provide your contact telephone number or email address.

Phone: E-mail:

Should you require further clarification on the questionnaire or have any queries, please contact me via E-mail: veronica.dall@postgrad.curtin.edu.au

Thank you.

APPENDIX D

Ethics Approval

From: Christine Howitt [mailto:C.Howitt@exchange.curtin.edu.au]

Sent: Wednesday, August 22, 2007 4:13 PM

To: jvdall@bigpond.com

Subject: Form C ethics approval

Dear Veronica,

This is to confirm that your project titled "The impact of nursing informatics on nursing practice and nursing education: The West Australian nurses' perspective" has ethics approval. The ethics number is SMEC20070019. Please quote this number in all correspondence relating to your research.

Regards,

Christine

Dr Christine Howitt

Science Education Lecturer

Science and Mathematics Education Centre

Curtin University of Technology

GPO Box U1987

Perth Western Australia 6845

Phone: +61 8 9266 2328

Fax: +61 8 9266 2503

Email: c.howitt@curtin.edu.au

APPENDIX E

Nurses Board of Western Australia (NMBWA) Approval

From: RebeccaL@nbwa.org.au [mailto:RebeccaL@nbwa.org.au]

Sent: Thursday, August 07, 2008 11:33 AM

To: John or Veronica Dall

Cc: pauls@nbwa.org.au; Nicolac@nbwa.org.au

Subject: Survey

 Dear Veronica,

Your have been granted permission to access WA registered nurses on NMBWA register. Further to your email to Paul yesterday, please find attached an application form and information relevant to a mail out from the Board. The attachments in your email have been forwarded to the Chief Executive Officer for approval, and I will get back to you when confirmation has been received. In the interim kindly complete the attached and return for processing with the application fee of $50. You will also need to provide us with information relevant to the number of nurses and/or midwives you need to survey so we can work out relevant costs involved and advise you accordingly. Please do not hesitate to contact me if you require further information.

Kind regards,

Rebecca

Rebecca Lazarus-Gomes
Registrations Coordinator
Nurses Board of Western Australia
Email: rebeccal@nbwa.org.au
Tel: [08] 9220-2120 [Direct]
Tel: [08] 9421-1100
Fax: [08] 9421-1022

APPENDIX F

Information Statement

Dear Nurse/Colleague

My name is Veronica Dall; I am a Post Graduate student at Curtin University of Technology in the School of Science and Mathematics Education Centre (SMEC). As part of my PhD, I need to complete a research thesis.

The title of the Thesis - **"The impact of information technology/nursing informatics on nursing practice and education: West Australian Nurses' Perspective"**

The purpose of the study is to describe nurses' attitudes, perceptions and explain nurses' behaviour towards technology and computers, also to identify barriers, issues such as resources, skills that may affect nurses use of computers and technology in their practice. You are invited to complete a questionnaire that will take 10-20 minutes and return it in the enclosed addressed and prepaid envelope. It would be greatly appreciated if you could return the completed questionnaire by 30th September, 2008.

Confidentiality will be maintained at all times. The questionnaires will number 1 – 500 and will be posted by the Nurses and Midwives Board of WA on my behalf and the return to Curtin University. The number on the questionnaire will only be used for follow-up and the number will be given to the Nurses and Midwives Board of WA to send another set of questionnaires should there be a need because of unpredictability of postal services or low return response beyond 30th September 2008.

All completed returned questionnaires will be entered into a draw. The draw will give away five double-pass movie tickets to a Hoyts Cinema. The draw will be conducted at the Nurses and Midwives Board of WA and witnessed by an independent officer.

If you would like the opportunity to participate in a 50-60 minute tape-recorded face-to-face interview or discussion, please provide your contact details on the consent form. You will be contacted by me to make an appointment at a time and place convenient to you. All information collected during the interview will be strictly confidential. You will be offered a copy of the transcript of the interview. I would be grateful if you would comment on whether you believe we have captured your experience.

Data collected will be stored securely at Curtin University for five years. No identifying information will be used and the results from the study will be made freely available to all participants only on request. Due to the sensitive nature of interviews, it may raise some difficult feelings for you. If this happens I will make sure that support is available for you if you desire it. You will be provided with relevant counselling information at the interview and contacted by me one week afterwards. Please note you may withdraw from the project at any time.

The study has been approved by Curtin University Human Research Ethics Committee, approval number SMEC 20070319. Additionally, permission to use five double-pass movie tickets in this research has been obtained. Verification of approval can be obtained either by writing to the Curtin University Human Research Ethics Committee, c/- office of Research and Development, Curtin University Technology, GPO Box U1987, Perth, 6845 or by telephoning 9266 2784.

Associate Professor Heather Jenkins will supervise the research. If you have any queries regarding the research, please contact me directly or Dr Jenkins by phone (08) 9266 7128 or by email at H.Jenkins@curtin.edu.au.

After reading this information sheet and you are willing to participate in this research then please read and sign the accompanying Consent Form and return it in the postage-paid envelope along with your completed survey forms.

I thank you for your consideration and hope you will agree to participate in this research project. Email: veronica.dall@postgrad.curtin.edu.au.

APPENDIX G

Letter to Hospital Executive

Executive Name

Position and Organisation

Date:

Dear Executive

My name is Veronica Suppiah-Dall; I am a registered nurse and am enrolled as a doctoral student at Curtin University of Technology, Bentley Campus, The Science and Mathematics Education Centre (SMEC).

The title of my proposed research is "The impact of Information Technology on Nursing Practice and Nursing Education: West Australian Perspective".

I seek your permission to pilot a survey questionnaire that I would be using as an instrument for data collection for my thesis.

Please may I make an appointment to meet with you and provide details of the questionnaire and the process for the piloting of the questionnaire.

A/Professor Heather Jenkins will supervise the research. Dr Jenkins can be contacted by telephone (08) 9266 7128 or by email : H.Jenkins@curtin.edu.au

If you have any queries regarding the research, please contact me directly by email veronica.dall@student.curtin.edu or Work telephone is 93827171 pager 7489.

APPENDIX H

Letter to Nurses Registration Board

Chief Executive Officer

Nurses Board of Western Australia

Level 1, 165 Adelaide Terrace

East Perth, Western Australia 6004

30 August 2007

Re: Application for access to the Nurses regirtation Database

Dear Chief Executive Officer

My name is *******, I am a registered nurse and am enrolled as a doctoral student at Curtin University of Technology, Bentley Campus, School of Mathematics, Engineering and Commerce.

I seek permission to access the West Australian Nurses Register for a random selection of 600 nurses for my research survey so as to mail out questionnaires to both metropolitan and rural nurses.

The title of my thesis is : The Impact of Information Technology on Nursing Practice and Nursing Education: The West Australian Nurses' Perspective.

Accompanying this letter are the application form, a non refundable fee of $50, Research proposal, Curtin University's Research Ethics Approval, Sample Questionnaire, Information to Participants and Participant Consent Form .

I thank you in advance and wait for your approval.

Yours Truly

Research Student

Curtin student email : *****@postgrad.curtin.edu