THE RELATIONSHIP BETWEEN INFORMATICS IN THE UNDERGRADUATE NURSING CURRICULA AND THE PREPARATION OF NURSES FOR PRACTICE.

Lesley A. Watson
B.H.Sc. (Nursing), R.G.O.N., R.M.

This thesis is presented in fulfilment of
the requirements of the degree of
Master of Health Science

School of Nursing and Midwifery
Faculty of Human Development

Victoria University
Melbourne
2005

ABSTRACT

At a time when quality health care is increasingly dependent on the use of information and computer based technologies (Englebardt & Nelson, 2002), Nursing Informatics, which encompasses the use of such technologies, is of increasing importance as it facilitates practitioners' access to current information on which to base such care. The purpose of this study was to investigate the congruence between the informatics competencies educators believe should be included in the undergraduate nursing curriculum and those identified by newly registered nurses as relevant to their clinical practice.

This two-phased study used the Delphi Technique, a research methodology for determining group opinion. In Phase One a purposively selected group of nurses experienced in the informatics domain generated a list of informatics competencies. In Phase Two a panel of nurse educators and a panel of newly registered nurses reviewed these competencies to establish their relevance to the areas of education and practice.

The outcome of the study was the production of a set of 35 competencies identified as relevant to clinical practice by the newly registered nurses panel. The educator panel produced a set of 47 competencies that they considered were relevant to undergraduate level informatics education and to the preparation for ongoing professional development. Thirty three competencies were considered

relevant by both panels and by doing so established that there was a relationship between the undergraduate nursing curriculum and the informatics practice needs of the newly registered nurse in clinical settings in both Australia and New Zealand.

The responses provided by the newly registered nurse panel suggested they had incomplete information literacy skills, no recognition of the need for their own health protection related to computer use, and they did not see the relevance of engaging in networking with their peers. These are areas that require further consideration. In addition, comments that are related to nursing informatics and provided by the participants have been included to further illuminate their perspectives.

SIGNED STATEMENT

This thesis contains no material that 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 or written by another person except where due reference is made in the body of the text.
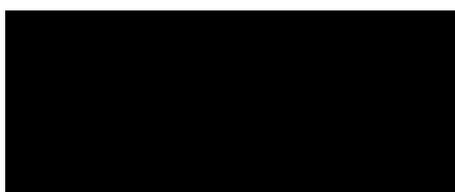
Dated 28th March 2005

ACKNOWLEDGEMENTS

TABLE OF CONTENTS

LIST OF TABLES

CHAPTER 1
Background

Upon this gifted age, in its dark hour,
Rains from the sky a meteoric shower
of facts ... they lie unquestioned, uncombined
Wisdom enough to leech us of our ill
Is daily spun, but there exists no loom
To weave it into fabric
Edna St Vincent Millay (1988)

1.1 INTRODUCTION

Gendron (1994) likens modern nursing to a dynamic form of tapestry by describing the warp of nursing as a background structure involving scientific facts, conceptual ideas, technical skills, contextual knowledge and resources adopted by the profession as they become available and the weft, the application of care and the creative expression of nursing woven on the warp strings of the profession's knowledge base.

The loom to which Millay (1988) alludes has its parallel in nursing informatics, a body of nursing knowledge with no single guiding theory. The purpose of this study was to investigate one aspect of the warp, nursing informatics and the preparation of Australian and New Zealand undergraduate nurses to use nursing informatics when they first become registered practitioners. The combination of these countries was chosen as they have a similar practice philosophy, and an established history of nurses migrating between them.

1.2 THE BACKGROUND TO THE STUDY

Nursing has evolved through changes in its philosophy, practice, and education. Philosophers Reed and Ground (1997, p.151) articulated a nursing model that emphasised the individuality of the client, the social and psychological aspects of health and illness, the nurse as a political being, and nursing practice as becoming independent of medical dominance. Members of the profession may wish to see nursing as autonomous in practice, but there are other factors outside the profession that shape it, in particular the development of information and computer technologies (ICTs).

During the past decade factors affecting nursing in Australia and in New Zealand have included the increased use of information and communication technologies in health care management and the resultant need to educate health professionals to utilise them. Care delivery was modified as contemporary business management practices were used in an attempt to rationalise how health care was provided (Clinton & Scheiwe, 1995). The autonomy previously given to health professionals to direct how health care was delivered was transferred to professional managers (Oakley & Graves, 1995). Currently health care managers in other countries as well as Australia and New Zealand, place great emphasis on ICTs as a means of collecting, storing and analysing health related data to provide optimum client care (Staggers, Gassert & Skiba, 2000). This requires nurses to be computer literate as they are the major collectors of client data. Indeed, the United Kingdom Central Council for Nursing,

Midwifery and Health Visiting, the British nursing regulatory body, requires that on registration, all nurses are competent to record, enter store and organise data essential for care delivery using ICTs (Wishart & Ward, 2002). As yet there are no such requirements for either Australian or New Zealand nurses to demonstrate these capabilities on their registration although the inclusion of the subject of information technology, in undergraduate nursing curriculum of these countries has been promoted during the last decade (Kenny, 2002).

1.1 CHANGES IN NURSING PRACTICE

The integration of ICTs has involved change in some areas of practice. In the hospital setting, monitoring devices to assess the client's oxygenation level, cardiac status, and drug and fluid administration are examples of information technology that are now in common use in areas where students and newly registered nurses apply their clinical skills (Hebda, Czar & Mascara, 1998, Consequently clinical nurses must develop competency in the use of such technologies.

Since ICTs have been applied to health care practices the presence of certain clients in a health care setting may no longer be an imperative (Murray, 1997). Clients in their own homes can use portable devices capable of monitoring health status, when previously an episode of hospitalisation would have been the norm. Personal Digital Assistants (PDAs) are hand held computers that enables nurses visiting clients in their homes to record client assessment and care

given during the visit and transmit the information to the care provider's centralised client information system (Wilson, 1996). PDAs can also contain drug and treatment databases giving nurses instant access to required information without the need to be connected to a desktop or mainframe computer. The advent of videoconferencing between the health practitioner and the client also minimises the need for the client to travel to the health care centre (Flatley-Brennan, 2000). Consequently, nurses are being challenged to adjust to a new type of care, one where they provide care to clients, with whom they may have little or no physical contact, through the medium of ICTs. This suggests that the nurse's future role in health management and education will require effective computer mediated communication skills when dialogue is not 'face to face'.

As the focus of health care has devolved from the hospital setting to the community the need to ensure continuity in client care is now an imperative (Hebda, Czar & Mascara, 1998). The move from storing client information in paper based case notes to electronic format has gained importance as the electronic patient record allows health professionals immediate access to client details irrespective of where that record may be stored (Englebardt & Nelson, 2002).

1.3 THE EFFECTS OF INFORMATION TECHNOLOGY ON NURSING EDUCATION

The information and technology explosion of recent years has affected teaching methods, the undergraduate curricula and location of where nurses learn. There is agreement in the nursing discourse that

health care is no longer acceptable when based on questionable historic practice (Nilsson, Karjerno, Nordstrom, Krusebrant & Bjorell, 1998), therefore current nursing education aims to develop the undergraduate student's ability to apply evidence-based care and critical thought to their practice. The Nurses Board of Victoria (2002) promotes the ethos of the nurse being a self-motivated, independent learner who accepts the need to have up to-date knowledge of nursing practice. Currency of knowledge is a necessity based on the premise that information relevant to nursing practice may be outdated within five years (Dertouzos, 1997). Educators need to encourage students to foster the concept of life-long learning so they can build on their professional development and stay current in their knowledge of what is accepted nursing theory and acceptable practice.

The utilisation of information based learning strategies such as computer-assisted learning is considered to enhance knowledge skills of critical thought and clinical decision making (Ribbons, 1998) and foster independent learning (Jeffries, 2001). A search of the Internet shows a worldwide trend of universities offering continuing education programs through the medium of web based learning programmes. Such programmes provide the learner with the flexibility of whom they select as their educational provider and where and when they study. This mode of learning necessitates graduates having generic qualities that will enable them to adapt to technical changes as they continue to learn, using a medium that is in a state of ongoing development. This educational development suggests that nurse

educators have an obligation to expose undergraduate nursing students to computer-assisted learning.

1.4 THE EFFECTS OF INFORMATION PROLIFERATION

Nursing is further affected by the *knowledge society*, a paradigm that Drucker (1995) identifies as placing much value on information technology and the knowledge derived from its use. To be effective in such a society, a nurse needs to expand their scope as a *knowledge worker*, a professional who is able to acquire and use theoretical and analytical knowledge in highly sophisticated ways, as well as developing significant physical or manual skills (Sorrels-Jones & Weaver, 1999).

While information-supporting technologies have proliferated, so has the amount of available information they generate. To work effectively within the knowledge society demands that a nurse can use computer technology as a means of information acquisition, a prerequisite for the generation of knowledge. Being information illiterate, (not having the ability to utilise technology to access information even at an elementary level) is therefore considered by Jones (1997) as a serious impediment to survival as a knowledge worker. (p. 379).

If nurses are to practice with current nursing knowledge they need to be able to source up to date information. Nurses need to be information literate at least to the level of knowing how to discriminate useful from useless information and to apply appropriate

search strategies to elicit relevant information for their studies and clinical practice (Bruce, 1995). The outcome of undergraduate preparation for registered practice was called into question when Graves, Amos, Huether, Lange and Thompson (1995) and Saranto and Leino-Kilpi (1997) found in their respective studies that not all nurses were information literate.

In response to the increasing encroachment of technology into routine client care Sandelowski (1997) recommends the need for the nurse to be aware of how to use technology in a way that will promote nursing and the client's best interests and to be aware of the disadvantages of computer-based technologies. Developments in the technologies that support information utilisation have enabled faster access to the Internet, with the incorporation of sound and graphics with text. A reduction in computer costs has seen an increase in personal computer use in addition to business applications. The Australian Bureau of Statistics identified that in November 2000, 37% of Australian households had access to the Internet with the same percentage of New Zealand households found following the 2001 New Zealand census. These numbers are expected to increase. As information is increasingly kept in digitised format and available through the Internet, consequently the public has access to information that could never have been anticipated prior to the inception of the Internet. Nurses and other health professionals can no longer regard themselves as the gatekeepers of health related information. Clients are becoming adept at accessing the Internet to discover health

information for themselves that they may, or may not, be able to interpret correctly. Spitzar (1998) urges nurses to be aware of the need to be as knowledgeable as their clients about Internet-based health care information and to be able to critique its worth again reflecting the need to be information literate.

1.5 THE DEVELOPMENT OF NURSING INFORMATICS

Knowledge about the theory and practical application of ICTs in health care has given rise to the interdisciplinary domain of health and medical informatics (Parry, Breton, Abernethy, Cockcroft, & Gillies, 1999). This domain is a synthesis of computer, decision, cognitive, information and management sciences incorporating core knowledge applicable to the disciples of public health, clinical medicine, nursing, and dentistry (Masys, Flatley-Brennan, Ozbolt, Corn, & Shortcliffe, 2000). As each health related discipline has identified their specific informatics practices and areas of interest, sub-sets within health and medical informatics have evolved (International Medical Informatics Association, 1999). Nursing informatics rests on two premises, the first of which is the existence of nursing related data that can be described in a manner that allows it to be manipulated by computer programs to produce new information and knowledge. The second premise is that nursing data is unique to the profession (Flatley-Brennan, 2000). Nursing informatics is therefore a sub-set of health and medical informatics to which nurses are keen to establish their own particular contribution to improve society's health and to deliver

quality health care, though access to, and communication of information within health care.

1.6 THE DEFINITIONS OF NURSING INFORMATICS

Turley (1997) believes there is less congruence in how nursing informatics should be defined. This is evidenced by the numerous definitions that can be found in the nursing literature.

An early definition identifies nursing informatics as based in nursing practice:

> 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 health care
>
> (Graves & Corcoran, 1989. p.227).

Since that time many definitions of nursing informatics have evolved. Lewis, Watson and Newfield (1997) reflect the need for evidence-based practice and the integration of information technologies into nursing set in a knowledge society in their definition

> Information technology in nursing is an approach to the health care environment that integrates nursing, information, and media sciences to identify, select, gather, store, process, retrieve and convey knowledge in the delivery of nursing care, linking research sources and findings to nursing practice, and applying instructional resources in nursing and patient education (p.188).

In his 1997 analysis of informatics development, Turley suggests that a comprehensive definition may not be achievable as the perspective of some scholars is that informatics is based on the importance of the computer to nursing. For others (Ryan & Nagle,

1994; Goossen, 1996) it is the data required to analyse nursing actions that should be the central concern in informatics. Turley (1998) also identifies that scholars may take the view that the management of health information systems is of fundamental concern in nursing informatics or place importance in the need to establish the optimum way for nurses to benefit from the knowledge society. As a result of his analysis, Turley (1998) proposes a model of informatics that adds cognitive science to computer, information and nursing sciences. This would appear to be in response to his endeavours to understand how humans develop knowledge and what information is necessary to support nursing practice.

Further to this there is divergence between the view held by some nurses that nursing informatics is necessary to all nurses and that held by others who see it as a specialty within nursing (American Nurses Association, [ANA], 2000).

The numerous definitions and differing perspectives of what should receive prime consideration in informatics demonstrate that the scope of the domain is wide. While some nurses develop their level of informatics to that of specialisation (Canavan, 1996; ANA, 2000) requiring a far deeper knowledge of informatics than the newly graduated nurses, the fact remains that to some degree, all nurses require to be information and computer literate.

1.7 JUSTIFICATION FOR THE STUDY

Australian educators (Conrick & Foster, 1995) and more recently M^{C}Kenna and Ribbons (2000) have identified that ICTs are now incorporated into the care of clients in the general ward areas, exposing students to the need to learn and apply these technological innovations. Information technology is so pervasive that it can be claimed that nurses who are neither computer nor information literate are compromising their duty of care to utilise current accepted nursing knowledge (Wallace, Shorten, Crookes, M^{C}Gurk & Brewer, 1999). It is therefore in Nursing's interest that its students are introduced to nursing informatics so they can develop an awareness of, and the ability to critically analyse how client-based information is used, how technology can be integrated into clinical care and to identify and articulate nursing requirements to managers of health care delivery systems who may have little or no knowledge of the complexities of nursing practice. While educators have provided opinion of what should be included in the curriculum, there is a lack of recently published research to show that what is taught in the undergraduate nursing studies is what is required to meet the practice needs of nurses working in a situation where they need to utilise ICTs.

Australian educators (Chu & Thom, 1993; Axford & M^{C}Guinness, 1994; and Conrick & Foster, 1995) have expressed concern that undergraduate nursing programmes do not always develop the student's competence to utilise information technology and are still heavily biased towards meeting the needs of health care

administrators who see clinical nurses' role as a gatherers and depositors of data into computer based clinical information systems rather than preparing the student to develop a wider appreciation of what informatics has to offer nursing. To date there is no published research to suggest that the situation has changed since these studies were undertaken. This poses the question of how well educators prepare future registered nurses to work in the knowledge society.

The last published study to determine the extent of the nursing informatics inclusion in the undergraduate curricula offered by Australian universities was carried out by Chu and Thom in 1993; no comparable studies have been undertaken in New Zealand. The New Zealand Ministry of Education did identify informatics related nursing competencies, but as these were generated in 1989 they are unlikely to address the full spectrum of today's practice requirements.

Neither the Australian Nursing Council; the Nurses Board of Victoria, who updated their course accreditation guidelines late last year; nor the New Zealand Nursing Council (NZNC) have explicitly included computer or information literacy within their respective competency requirements, although student access to computer technology is a requirement for accreditation within both the Australia and New Zealand undergraduate nursing programmes. Further, NZNC's strategic review of nursing education carried out in 2001 identified that undergraduate nursing education requirements for the year 2010 will need to address nurses' ability to apply information

technology and information literacy to their practice and the National Review of Nursing Education commissioned by the Commonwealth of Australia in 2002 recommends that lifelong learning be undertaken by all nurses. Therefore, it is timely that this study is carried out to determine which competencies are required to apply nursing informatics in newly registered nurses' clinical practice.

1.8 THE AIMS AND OBJECTIVES OF THIS STUDY

It is crucial that the education of future registered nurses prepares them to utilise ICTs as a means of benefiting their professional practice and meeting their clients' needs. Conrick and Foster (1995) suggest this may not be happening. Therefore this research aimed to gain an understanding of the opinions held by those directly involved in the teaching and clinical application of nursing informatics to identify which informatics competencies should be addressed in the undergraduate nursing curriculum so the relationship between the informatics content of that curriculum and the practice needs of newly registered nurses could be determined.

1.9 THE STRUCTURE OF THE THESIS

This thesis is presented in six chapters. This first chapter has provided an overview of current trends within nursing that are directly related to the use of computer and information technologies in clinical practice and undergraduate education. The justification and aims of the research are presented.

14

Chapter 2 presents an analysis of literature that is relevant to the preparation of undergraduate nurses and the application of nursing informatics in the clinical practice of newly registered nurses. Chapter 3 presents the conceptual framework and the justification for its use in this research. Chapter 4 presents a discussion of the research methodology, how the research was conducted, the study setting, ethical considerations and the methods used to obtain the data and its analysis. Chapter 5 contains the data presentation and analysis while Chapter 6 contains a discussion of the findings, limitations, implications and recommendations generated by this research.

1.10 SUMMARY

In this chapter the research topic was introduced and justification for studying the relationship between the informatics content of the undergraduate nursing curriculum and the requirements for newly registered nurse practice was provided.

While it is clear that the theoretical aspects of Nursing Informatics have been researched, the application of the knowledge of ICTs remains unclear. It is evident that a body of opinion exists that identifies a variance in the knowledge required between different levels of nurses. What has yet to be determined are the competencies newly registered nurses need to demonstrate when utilising ICTs in the clinical setting.

CHAPTER 2
Literature Review

2.1 INTRODUCTION

This chapter presents published work that addresses informatics knowledge provided to the undergraduate student and that may be relevant to the practice needs of clinical nurses. Information pertinent to the generic needs of professionals who function within the knowledge society is presented. This is followed by the presentation of international initiatives, the opinion of subject experts, studies of nursing curricula, course descriptors, content, and where available, curriculum evaluations are identified. The focus then turns to the Australian and New Zealand literature to provide a perspective on current practice needs of newly registered nurses and their educational preparation to use informatics.

The topics of computer literacy, information literacy and health informatics are well addressed within published works and can be seen as interrelated but separate items that need to be considered within nursing informatics. Consequently some authors use the terms *medical* or *health* or *nursing* informatics synonymously; the same applies to *computer* or *information* technology.

2.2 INFORMATICS SKILLS FOR PROFESSIONALS

Working within an information rich society demands that any professional possesses the skills to use ICTs within their scope of professional practice. Evidence of this is found in the existence of the European Computer Drivers License [ECDL]. This license signifies

that the holder has demonstrated an internationally recognised standard of knowledge and skills needed to use the most common computer applications efficiently and productively (ECDL, 1997). Such knowledge and skills are also expected of Australian engineering graduates (Mitchell, 1997, cited in Cribb, 1998), and explicitly required by the British Department of Education and Employment's (1998) curriculum outcomes for teachers. There is an expectation that graduates be computer literate, at least possessing basic word processing skills, the ability to utilise presentation software, e-mail and competency with online and Internet searching. While these generic skills for professional practice form a core of necessary skills they do not reflect the full range of knowledge skills and attitudes required of health professionals.

2.3 THE INFORMATICS NEEDS OF HEALTH PROFESSIONALS

The International Medical Informatics Association [IMIA] provides an international focus for health care informatics development. Recommended core competencies that the IMIA (1999) encourage all health professionals to develop are: an understanding of the rationale for systematically collecting, recording and transmitting quality data; the use of health care coding systems; the electronic health record; electronic communication between health professionals; information literacy; personal development in the use of software applications; management of information systems in health care; and the realisation of the benefits and limitations of using information and communication technology in medicine and health care.

Nursing has specific aspects of informatics application, such as electronic based plans of care, and inquiry that have no direct relevance to other health professionals (Hovenga, 1998). Masys et al. (2000) concur with this assertion. Therefore the core competencies identified by the IMIA are unlikely to address all the informatics needs of nursing practitioners.

2.4 THE SCOPE OF NURSING INFORMATICS

The scope of the nursing informatics domain was defined by the American Nurses Association (ANA, 2000), as encompassing:

> the development of standardised language and vocabulary to describe nursing; the use of technological development to support nursing practice, clients' use of information technology, use of telecommunications for nursing practice, systems evaluation, identification of innovative practices and information needs of nurses in addition to professional practice issues and privacy and confidentiality of data" (para 6).

There are definite opinions expressed by various authors (Grobe, 1994; Mills, Romano and Heller, 1996; Hovenga, Murray, Huynh and Goossen, 1997; ANA, 2000), that the scope of informatics knowledge and application expected of the clinical nurse is different to those of the informatics nurse specialist who requires a deeper and broader knowledge of informatics. These authors arrived at similar conclusions: that the clinical nurse should be a proficient user capable of communicating how the application of ICTs can assist their practice rather than be a developer of informatics applications.

2.5 EDUCATION IN INFORMATICS

To be a proficient user the nurse requires to be educated in the application of informatics. The study of both computer and information science to facilitate the processing and management of data and information is a specific discipline (Skiba, Ronald & Simpson, 1991) that has been of interest to nursing since the 1960's (Aarts, 1994) when computers were first introduced in the health care environment.

A study carried out in America by Bryson (1991) produced many similar results to that of the NZME study. Bryson (1991) also used a quantitative approach to survey 220 North American nurse educators and informatics experts using an interview tool based on the 1981 Minnesota Educational Computer Consortium's seven domains of computer literacy. Theses domains being:

> 1) programming and algorithm skills; 2) skills in computer use; 3) hardware and software principles; 4) major uses and applications principles; 5) limitations of computers; 6) personal and social aspects and 7) relevant values and attitudes.
>
> (Bryson, 1991, p.100).

Bryson's (1991) study identified informatics specific objectives and competencies for nursing degree programmes. No studies have been found that evaluate these competencies; rather they appear to have been widely accepted within the published American literature.

A notable outcome of Bryson's work was the formulation of what defined the computer literate nurse:

A nurse is considered to be a computer literate if he
or she has knowledge about the computer, and is
able to learn by using the computer and is able to use
the computer as an effective tool in the nursing
profession. (1991, p.106)

Computer literacy requires a basic understanding of hardware

and software; how a computer system operates: the concept of

programming; the ability to use computer-assisted instruction

programs for continuing education; and word processing,

spreadsheets, database programs, statistical packages, nursing care

plan generators, and hospital information systems (Bryson, 1991,

p.106).

Bryson's approach to educating nurses suggests a strong focus

on the computer as a machine that needs to be understood rather than

focussing on the effects computers may have on nursing. Subsequent

technological developments and availability of access to the Internet

saw an increasing need to educate nurses to be more than computer

literate, to focus less on the machine and the data it handles, and more

on the information derived from that data. Currently computer literacy

has been subsumed in information literacy (Shaw-Korot, McGraw &

Moore, 2002). To become information literate, Staggers, Gassert and

Skiba (2000) state that professionals need to learn how to access and

critically appraise both information sources and their content.

2.6 INFORMATICS CURRICULA

The international literature describing nursing curricula is

mostly a reflection of informed opinion rather than scientific study.

Grobe (1994) proposed a curriculum model that reflected the need for

baccalaureate prepared nurses to be proficient users of computers. The model contained six key themes; nursing; ethics; confidentiality; informatics; communication and personal development; and was aimed at producing nurses who possessed the skills and competencies required in the use of computerised nursing care plans, research and data analysis, health information systems, information management systems and would also include the core skills expected of the informed user, namely the use of a word-processor, computer assisted learning; spreadsheets; computer system configurations; databases and patient administration systems (p.150). There remains a strong focus on the machine as a tool in Grobe's work

Vanderbeek et al. (1994) identify the nurse's role as that of a critical user providing constructive criticism to improve the use of informatics in the application of management information systems to client care. Nurses require competence in the documentation of nursing, knowledge of data structure, how to locate and assess data and co-ordinate its flow using computer technology in addition to health and safety aspects of the workstation. As a consequence of identifying a proliferation of monitoring equipment in the care of clients and a lack of understanding of the technical aspects of computers as a hindrance to nurses explaining their needs or concerns, Vanderbeek et al. (1994) expanded the concept of nursing informatics to encompass not only information systems but the use of monitoring equipment, advocating that nurses become technicians (p.228).

American educators Travis and Flatley-Brennan's (1998) description of their informatics programme aimed at educating undergraduate nurses in preparation for their role in acute care identifies the objectives of exposing students to the flow of information through the healthcare environment and the ways that ICTs can facilitate that flow. Interestingly, Travis and Flatley-Brennan (1998) state they canvassed major nursing schools to learn what coursework they provided, revealing curriculum content that remained focused on the keyboard skills and programming skills rather than on applying information technology to nursing.

Vanderbeek and Beery (1998) and Bachman and Panzarine (1998) recognise the need to extend the curriculum to include current developments. Vanderbeek and Beery (1998), based their proposed curriculum on the ANA competencies expected of graduates from basic nursing programmes. The course descriptors identified the intent of providing the student with experience of issues and use of health care information management systems. Course content addressed informatics history; the relationship of hospital and computer based systems to clinical bedside practice, research; education and administrative applications. Safety aspects, specifically workstation ergonomics and keyboard use are also included; along with the use of computer networks, e-mail and the Internet, specifically to access health care and health care informatics sites. Bachman and Panzarine (1998) included in their on-line learning programme the objectives of developing the student's understanding of telemedicine, the ability to

communicate with their peers using electronic communicative networking. Ethical issues were also included signifying the need not only to teach the skill but the legal and ethical issues implied by using the internet to transmit clients' information.

Recently, as a result of reviewing the literature on the development of informatics in America and identifying the interdisciplinary nature of health informatics McNeil and Odom (2000) suggested core concepts they believed should be included in the undergraduate nursing curriculum. These concepts include the theory of informatics development and theories of change; the application of informatics to practice; research, education and administration; taxonomies; standardised languages and classification systems; the life-cycle of information systems, roles of health care team members; planning for, implementing, evaluating and upgrading systems; ergonomics in the design of systems; telehealth; careers or roles in health informatics; ethical use of information; maintenance of privacy, confidentiality and security.

2.7 INTERNATIONAL INITIATIVES IN NURSING INFORMATICS EDUCATION

Nurses, like other health care professionals, have yet to accept and use information technologies as basic tools for information management and exchange. Medical students also may not be exposed to informatics education. Hasman and Sosa (1995) conclude that health informatics is not always included in European medical

curricula so that the new generations of graduates are no better informed than many existing professionals.

The Canadian National Nursing Informatics Project recognised the need to reach consensus on a definition of nursing informatics to determine competencies for entry level nurses and specialists, managers, educators and researchers and to identify strategies for basic and continuing nursing education curriculum (Hebert, 2000). In Britain, like America and Canada there is recognition of the necessity to prepare students in higher education to develop the key competencies of communication, the use of information technology and critical thinking as recommended in the 1997 Deering Report. A similar situation exists in Europe. Sermeus and Alaerts (1997) identified that not all European schools of nursing have integrated informatics content into their programmes. These variations in approach suggest that these countries each want to drive their own informatics development.

A survey conducted by Carty and Rosenfeld (1998) on a stratified random sample of American National League for Nursing accredited diploma, associate, baccalaureate, and master programs established variation in the informatics programmes offered. Analysis of the data generated by fifty-five percent (n=190) of the respondents indicated that most of the schools had access to computers and educational software, but the majority of schools lacked a coordinated plan for technology implementation with less than one third of the

schools including nursing informatics either by integrating it into the curriculum or in stand alone courses. Consequently Carty and Rosenfeld (1998) found that not all students were exposed to adequate informatics education in their undergraduate studies even though the National League for Nursing (1997) included computer literacy in their accreditation criteria.

In the opinion of Noll and Murphy (1993, p. 323) the essential aspects that require to be addressed in both the undergraduate and postgraduate curricula regardless of a subject major are the ability to analyse and select relevant information sources; access existing online information sources from nursing and related disciplines; extract, manage and organise data; analyse the nurse's role in protecting data security and data integrity; analyse the impact of nursing information systems; evaluate and use appropriate application software for advanced practice; and demonstrate information transfer between computer systems.

Arnold's (1998) survey of a convenience sample from an American continuing education computer conference mailing list (n=494) found no guidelines for informatics courses except for the content of existing programmes. This study's findings confirmed the most commonly used computer applications were word processing, e-mail and databases, with spreadsheets, hospital information systems and graphics presentation software being used to a lesser extent. Saranto and Leino-Kilpi's (1997) study of 20 Finnish participants who

were either nurse managers, educators, students or patients, identified that nurses required knowledge to operate computerised patient monitoring equipment as well as the computer applications that Arnold's study participants identified.

The American National Advisory Council for Informatics in Nursing Education and Practice (1997) also promotes a core curriculum that includes word processing, spreadsheets, databases, bibliographic retrieval, e-mail, the use of the Internet and graphics presentation software.

Therefore the literature presents a picture of diversity of opinion about the range of informatics knowledge expected of the newly registered nurse with more emphasis being given to the computer software application than developing practitioners' abilities to critically reflect on the effects informatics application may have on nursing care.

2.8 CURRICULUM EVALUATION

There is little literature that explores outcomes of curricula compared to published works that express what informatics curricula should address and what is available. Vanderbeek and Beery (1998) provide evidence of student satisfaction with the programme but offer no evidence of evaluation of student learning. Marini (2000), who like Vanderbeek and Beery (1998) used the ANA competencies as a framework for their curriculum, equated outcome success with the amount of time the students spent working with a computer to

complete course work. Saranto, Leino-Kilpi and Isaoho (1997) found 62 % of the Finnish students who participated in their study felt they did not have adequate informatics skills for their future jobs. These students preferred tuition from information technology teachers rather than nurse educators whom they considered to be less knowledgeable. Saranto's 1998 study of graduating students (n=373) from eight Finnish polytechnics found that students had only basic computer skills. These studies measured effectiveness in terms of student satisfaction and perceived mastery, rather than actual knowledge application.

Graveley, Lust and Fullerton (1999) surveyed students' perceptions of their computer literacy skills following computer education using self-paced instruction manuals. Their study findings showed that 50% of the students did not perceive themselves as computer literate. This was a small study, not representative of other schools and therefore not generalisable. Interestingly this study did not mention the use of information literacy while others have.

Bachman and Panzarine's (1998) study findings identified the need for nurses to be information literate as well as computer literate. This study used a non-equivalent pretest - posttest control group design. The findings identified that students exposed to on-line learning had higher skills and knowledge than the comparison group who were educated by traditional teaching methods. A further study by Verhey (1999) of undergraduate nursing students (n = 287), also

found positive benefits of integrating information literacy skills into an undergraduate programme.

Thede (1998) posted a questionnaire on nursing list servers with the aim of identifying the opinions of interested Internet users about what should be included in informatics in an undergraduate curriculum. Usable replies (n = 301) were obtained. Thede's (1998) study findings suggested the addition of the use of telehealth related competencies to the core competencies generated from other studies.

Thede (1998) found that respondents were not in agreement about the inclusion of basic Microsoft Windows® and mouse skills, such as resizing windows, navigating from window to window, dragging and dropping, survival computer skills, organising files into folders (directories), backing up files; basic word processing skills, such as editing, cutting and pasting.

Some nurses who took part in Thede's study felt that students should enter nursing school knowing these basic skills. Vanderbeek and Beery (1998) also expected students to have prior learning in computer use. The findings of earlier studies by Gassert and M^{C}Dowall (1995) and Pearson (1996) contradict this stance, revealing that the assumption that students enter the programme with basic computer literacy skills is contestable. Gassert and M^{C}Dowall (1995) found low levels of computer literacy skills in students entering an American undergraduate programme, stating "schools need to continue providing a way for students to obtain computer literacy

skills" (1995, p.137). Pearson's (1996) descriptive study of computer knowledge among one group of first year Bachelor of Nursing students (n = 39) in one New Zealand Polytechnic found that 39% had no computer knowledge on entry to the programme. Although not generalisable because of the lack of representiveness of the student population, it does identify that a number of students were not computer literate in that they lacked basic skills.

Similarly, a survey of 150 Irish nurse educators by Sinclair and Gardner (1997) found beginning students varied in their levels of computer literacy. This study found that the educators expected that when student nurses complete their preparation for registration they should be able to demonstrate knowledge, skills and attitudes relevant to the tools of ICTs. Particular student needs which the educator participants in Sinclair and Gardner's study identified as most important were, producing coursework using word processing skills; storage and retrieval of data; creating their own [student] files and using computer assisted learning (CAL) packages. These findings were similar to those identified by Department of Education and Employment (1998) as essential in today's work environment. By implication, Sinclair and Gardner (1999) expect a nurse to utilise the tools of ICTs at the level of a general user (rather than as a network or system manager) and to be aware of the importance of legislation related to informatics; password protection and the general security of equipment. The development of the students' information literacy

skills and an appreciation of how ICTs can be used for their continuing professional development were also highlighted.

Staggers, Gassert and Curran (2002), having perceived that there was a need to develop a comprehensive list of competencies for American nursing, used the Delphi technique to survey informatics nursing experts (n = 79) with the aim of determining and differentiating informatics competencies required by four levels of American nurse practice (beginning, experienced, informatics nurse specialist and informatics developer). This identified that the many competencies determined as desirable by previous studies remained valid for beginning nurses. Specifically, being able to use a computer for administrative, communication and documentation purposes, monitoring clients and accessing decision support software were seen as necessary skills. Knowledge of informatics in relation to privacy and security, the impact of informatics and information systems was also required for beginning nurse practice.

It is evident that students are expected to demonstrate basic computer skills and a need to develop these for skills for clinical practice as well as academic work skills.

2.9 ELECTRONIC METHODS OF EDUCATIONAL DELIVERY

Computer Assisted Learning (CAL) and Computer Based Education (CBE) are both terms used to describe the application of ICTs to educational delivery. There is an implicit assumption that students who use computer-based modalities will be encouraged to

develop the learning style required of an independent lifelong learner by providing the student with the opportunity to self-pace their learning (Graveley, Lust & Fullerton, 1999). This form of educational delivery uses instructional software, presentation media software, interactive television or audiovisual conferencing, electronic mail and virtual reality (Mallow & Gilje, 1999). Among the benefits of using CAL is the provision of simulated clinical practice, allowing students to develop their skills in a safe environment prior to caring for clients. Ribbons' (1998) study in the development of higher orders of metacognition found that an instructional database could serve as a *cognitive template* for clinical decision making. Bachman and Panzarine (1998) supported CAL as beneficial to providing students with individualised learning but whether it is superior to other forms of instruction is questioned by Mallow and Gilje (1999); Parry, et al. (1999); and by Green, Jenkins, Potter and Davies (2000).

With the current availability of the Internet and electronic communication, nurses are increasingly involved in information retrieval and sharing using electronic media, locally, nationally and internationally via the Internet. Reports of the merits of using the Internet as a teaching tool are few. Nursing literature suggests there is increasing use of the Internet to deliver courses with the intent of enhancing learning, however it has been identified by Mallow and Gilje, (1999); Salmon, (1999); and Billings (2000) that little has been undertaken to verify its effectiveness as a learning medium. However, Leasure, Davis and Thievon (2000) following a study of examination

results of two groups of nursing students, one group exposed to traditional teaching methods (n = 48) and the other group who participated in Internet based learning (n = 18), determined that there was no difference between students exposed to web-based learning and students who attended tuition in the class room setting.

2.10 INFORMATION LITERACY

The information needs of the nurse practitioner are usually those related to specific initiatives in the delivery of care, evidence based practice and personal professional development (Bird & Roberts, 1998). As a profession situated in an information rich society, there is a need to understand how nurses seek information to determine if they are indeed information literate.

To be information literate requires successful searching skills that further require computer literacy, information management and clinical understanding to be able to make use of the information (Parry, 1999). Higher education encourages students to be more analytical of their nursing knowledge and actions through the use of critical thinking strategies and reflective practice techniques (Gullifer, 1995; Smith & Norris, 1995). According to Bruce (1995), the vast amount of information accessible through information technology, and the Internet in particular, requires students to also develop the information literacy skills of knowing how to discriminate useful from useless information and apply appropriate search strategies to elicit relevant information for their studies and clinical practice. Tietze &

Huber, (1995, p.37) also make the point that "these trends point to a need for nurses to become involved in electronic information retrieval, management and dissemination". Nevertheless nursing literature suggests that information literacy is not always considered a necessary competency for nurses (Graves et al., 1995). Saranto and Leino-Kilpi (1997) found 70% of the study participants (graduate nurses) were incapable of carrying out their own literature searches; consequently they had to rely on others to do searches for them.

Pearcey (1995) supports previous reports that nurses have difficulty in accessing and appraising published research, either because they do not have access to journals and libraries, or because they have not been taught how to find and appraise research. Rasch and Coghill (1999), in a descriptive study of American nurse practitioners (n = 275), found 64% had access to computers, of those 66% used email and 58% accessed the Internet. Russell and Alpay (2000) found that practice nurses in one area of England (n = 119) primarily used computers to enter client data into medical records, only 27% of the participants could use the Internet to find health information and only 14% could find research articles.

At a time when nursing is striving to promote evidence based clinical practice, it is disturbing to note that some nurses remain computer and information technology illiterate. Consequently these nurses are restricted in their access to current nursing knowledge.

What is evident from these studies is the lack of uniformity in what the authors consider necessary as core informatics knowledge.

2.11 AUSTRALIAN AND NEW ZEALAND LITERATURE

As this study is centred on nursing informatics in Australia and New Zealand it is pertinent to explore the literature originating from these countries.

The introduction of formal informatics education within Australia and New Zealand is more recent than in other countries, beginning in the 1980's (M^{C}Kay & Griffin, 1989; Honey, 1991), with present day curricula founded on earlier studies and modified in what this researcher considers to be an ad-hoc manner as new technologies have evolved.

In 1989, the New Zealand Ministry of Education used a quantitative research approach to survey nurse educators, administrators and nursing informatics-aware clinicians (n = unspecified) to identify an informatics curriculum that could be adopted nationally. The intention was to promote computer literacy within New Zealand nursing. The study findings resulted in the formulation of national guidelines that included identified areas of core informatics competencies applicable to students and provided examples of how to integrate these competencies into undergraduate curricula. However, no published evidence of their application has been found.

There is little published work by New Zealand nurses that illuminates the state of informatics undergraduate education or practice needs of the newly registered nurse in relation to informatics in that country. Following the publication of the Ministry of Education's (1989) guidelines for teaching informatics, Honey (1991) and M^{C}Closkey and Burr (1992) and published a discussion on the challenges of teaching computer skills; Boyce (1993) described the introduction of an information system to the hospital setting; Keene (1993) described a patient management system. Henderson and Deane (1993) assessed satisfaction with computer training; Pearson (1996) investigated the computer literacy of entrants to a nursing programme. Lakeman (1997) studied Internet usage among mental health nurses then repeated the study in the year 2000. Lakeman and Murray (2000) investigated computer mediated communication.

The paucity of New Zealand literature makes it difficult to establish current trends in informatics application and education in that country. The same cannot be said of Australian nurses.

There is a thread of continued dissatisfaction with the nursing informatics content of the Australian undergraduate curriculum dating back to the study by Chu and Thom published in 1993. Much of the literature is critical of the lack of progress in identifying and integrating informatics at a depth that will actually be effective for students to develop enough of an understanding to at least have an appreciation of what informatics may offer nursing.

Chu and Thom's (1993) descriptive study of thirty-eight of the forty five schools of nursing found deficits in Australian nursing undergraduate curricula that reflected inconsistency in approach to informatics, stating that:

> The content of the informatics programs in both undergraduate and postgraduate nursing curriculum were mainly focused on computer literacy, and to a lesser degree health information systems and nursing information systems. Much less emphasis was placed on areas of health information requirement analysis and specifications, implementation and management of nursing systems, network and data communications. Education and research application, social and industrial implications of computers also did not receive much attention (p.47).

Chu and Thom's (1993) study also found diversity in length of time (four to fifty two hours) devoted to informatics in undergraduate programs. In 1994, Axford and M[C]Guinness (1994) also expressed concern stating, "The move to IT has focussed educators on computer literacy itself at the expense of this broader information framework" (p.8). A year later, Conrick and Foster (1995) recognising the increased use of informatics in health care also expressed concern about informatics education stating:

> Although these changes are visible and health care workers are becoming more accustomed to using technology as a support tool, education in the area is lacking. In many undergraduate curricula informatics is not addressed as an integrated component of the curriculum. (p.44).

Cheek and Dotskatsch (1998) also questioned the effectiveness of nursing informatics education in Australia by suggesting that students' needs to develop informatics competencies cannot be met

when the [then] current curriculum focuses on the technological tools of their trade, therefore, graduates possess little knowledge of information science and management technology in practice, and again in 1998 Cheek and Dotskatsch (1998), state:

> it is a our experience that nursing students are becoming more computer literate, i.e. technically competent. However they continue to have problems identifying, defining, analysing and articulating the nature of the information needs. Students also have difficulties judging the appropriateness and value of a variety of information sources. (p.247).

2.12 THE PRACTICE NEEDS OF CLINICAL NURSES.

The informatics practice needs of registered nurses working in the acute care setting have been identified. Carter and Axford (1993) carried out a two-part study, surveying ten subject experts and compared their findings with those of a group of registered nurses who were computer novices. This study aimed to establish the necessary content of a curriculum that addressed computer training. In the first part of the study a three-round Delphi study was undertaken to collect and organise expert opinion and to identify group consensus on the specific knowledge and skills necessary for a registered nurse to use computers in their practice. The second part of the study utilised a questionnaire answered by 64% of 150 randomly selected registered nurses based in Melbourne who were novice computer users. The novices were asked to rate the items identified by the experts as either essential or non-essential to their practice. The findings indicated that the novice computer users had little appreciation of the purpose of informatics, ergonomics, and

consequently, their safety in using computers nor did they have an understanding of the type of software they used as part of their work. A later study by Axford and M^{C}Guinness (1994) produced similar findings of curriculum inadequacy, adding weight to the findings of Carter and Axford (1993) and Chu and Thom (1993). It was also the opinion of Conrick and Foster (1995) that registered nurses were not adequately prepared to use informatics.

Carter and M^{C}Guinness (1997, p.432) describe the graduate diploma curriculum presented at one major Australian University. The diploma content addressed the use of the computer as a personal tool and included word processing; database and spreadsheet use; using the computer as a professional tool; the identification of data elements specifications and technical requirements of health care systems. Both Conrick and Foster (1995) and Carter and M^{C}Guinness (1997) describe attempts to overcome a perceived gap between the teaching of informatics theory and its application to practice by providing students with the opportunity to apply informatics during their clinical experience through the use of a simulation of a health management system.

Information technology has required that nurses are also literate in the use of information. Ribbons (1998, p.223) states that "minimum requirements for graduating students may now include the need to demonstrate the ability to identify appropriate user needs for data and information; an ability to access complex databases; knowledge of

data retrieval techniques and Boolean algebra" and that "students need to move to using computers as a means of knowledge construction rather than knowledge reproduction" (p. 224). Ribbons expected students to demonstrate information literacy as did Cheek and Dotskatsch (1998) who make an important point when they argue that the priority is not just to equip health care professionals with the technical skills to use the Internet and find the information that they want, but also to ensure that health care professionals have what they call information literacy skills, i.e. the ability to critically assess what they find.

2.13 CURRICULUM CONTENT OF AUSTRALIAN UNDERGRADUATE PROGRAMMES

The extent to which Australia or New Zealand nurses are information literate is open to question. Chye (1996) surveyed Australian undergraduate nursing students of one major university to determine students' informatics literacy using a semi-structured, self-administered questionnaire This survey, completed by 25% of the study population of 600, showed that there was indeed a deficiency in informatics proficiency levels of undergraduate nursing students. Computer literacy was found to facilitate students' use of the library catalogue as respondents who had no prior experience with computers rated themselves as *novices* in using the catalogue. Only 5% rated themselves as *proficient*. Students made little or no use of computer assisted instructional programmes, with respondents reflecting little or no knowledge of their purpose. Eighty per cent of participants (n=124)

indicated that they had never received any education about the use of computers or nursing information systems, nor had they received education about them when on clinical placement, while 74 (48%) respondents indicated that they had used computers during their clinical placements. The most common informatics activities undertaken by students during clinical placements was entering data and retrieving patient records.

Garland, Anderson and Noyes (1998) found that students when presented with information by the traditional method of a lecture developed a deeper comprehension of the lecture topic than the students who were given the same Internet based information. This does not reflect findings of a later comparative study by Lockyer, Patterson and Harper (1999) who reported a study based at Wollongong that involved students (n=62). Participants were not nurses but involved in undergraduate studies of a health related discipline. The study aimed to examine the effectiveness of newly designed tutorial activities within the different learning environments, by measuring the observed learning outcomes and reported student perceptions. The study findings supported student preference for Internet use, 83% felt the web-based tutorials helped them to understand the subject matter as effectively or more effectively than class tutorials. Educators need to be aware of the historic nature of how clinical nurses gather information. A small study by Rowe (1996), found that New Zealand clinical nurses (n=20) relied on colleagues, journals and textbooks to provide information about client

related matters. Participants were not regular library users (Rowe, 1996). These findings mirror an American study by Rasch and Cogdill (1999) that surveyed 300 North Carolina nurses and identified the most used information sources as being supervising physicians, reference manuals and textbooks. Journal articles were not frequently used. These nurses do not appear to realise that communication technology offers them another means of gathering information.

2.14 THE CONTEMPORARY INFORMATICS NEEDS OF THE NEWLY REGISTERED NURSES

Identification of the newly registered nurse's practice needs should provide an indication of what should be included in undergraduate nursing curriculum. Many studies centre on the lived experiences of nurses making the transition from student to staff nurse rather than focussing on skills. Boxer and Kluge (2000) used a questionnaire to study 206 newly registered medical and surgical nurses in the Sydney area to determine clinical skills performed frequently and those they considered essential. The study findings were that using e-mail, computers; paging systems and client monitoring equipment were essential skills.

Pelletier (1995) studied newly registered nurses' clinical experience with computerised monitoring equipment by surveying graduate nurse participants (n = 245) from across Australia. Computer use in nursing was not seen as important but Pelletier (1995) does not elaborate the topic. Holloway's (1999) New Zealand study asked thirty-three senior clinicians to record the skill levels expected of

newly registered nurses by providing descriptions of the most important skills and competency levels included no reference to any form of nursing informatics. The findings of these studies suggest that informatics had a low profile in the clinical needs of the newly registered nurse and are not reflective of the findings of Boxer and Kluge (2000). If, as the nursing literature suggests, client monitoring devices are becoming commonplace in nursing care then it is imperative that research is carried out to determine the competencies necessary to integrate these devices into nursing practice.

2.15 CONCLUSION

It would appear that nurse educators have accepted ICTs as part of nursing but have yet to verify their effectiveness. Researchers have identified inconsistencies in the content of undergraduate curricula and the inability of nurses to use informatics to maximum effect.

The literature is predominately generated by educators using a quantitative approach. Few studies have sought the opinion of clinicians who are responsible for client care. The views of new graduate nurses have been subject to many studies that focus on their transition from student to registered practitioner as they attempt to practice the "ideal" in the reality of the work setting. Information exists about the informatics need of postgraduate nursing students, however the actual informatics workplace practice needs of new graduate nurses have not been well explored. While documented evidence exists that shows educators and other experienced nurses

have developed their opinions about what nurses need to know of informatics, the literature suggests that such opinions may be at variance with those held by the new graduate. These findings beg the question, what knowledge, skills and attitudes of informatics do newly registered nurse clinicians actually require to work in an information intensive society?

2.16 SUMMARY

This chapter has identified that the international literature shows that the scope of the informatics domain within nursing is considerable and the manner in which informatics activities are described varies considerably. Cheek and Dotskatsch (1998) found it difficult to provide a precise definition of information literacy stating that "the information literacy pattern changes depending on the perspective of the person rotating the kaleidoscope" (p. 244). Available literature that addressed nursing informatics, presents a similar difficulty in defining the competencies for beginning nurse practice. The literature suggests a picture of core competencies that have been generally accepted as necessary for the nurse to function effectively in the "knowledge society", surrounded by a penumbra of other non-core competencies that are perceived to be necessary, dependent either on the participants' opinions or the focus of the particular studies.

What is less clear is how important the array of skills and knowledge revealed by the many overseas based studies are to the

clinical practice of nurses in Australia and New Zealand. The lack of recent research into the opinions of Australian and New Zealand newly registered nurses regarding informatics competencies they employ in practice provides justification for asking such a question so the needs of future nurses can be adequately addressed.

Therefore the following questions required an answer and provided the impetus for this study:

1. Which informatics competencies do informatics experts believe undergraduate nurses need to demonstrate and newly registered nurses need to use?

2. Which nursing informatics competencies do educators believe should be addressed in the undergraduate nursing curriculum?

3. Which informatics competencies do newly registered nurses believe they require for their clinical practice?

4. What if any are the differences between the opinions of the educators and the newly registered nurses about which informatics competencies are relevant?

CHAPTER 3
Competencies

3.1 INTRODUCTION

To facilitate the study aim there was a need to determine the nursing informatics knowledge and skills needed by the undergraduate nursing student in preparation to function as a registered nurse. Nursing practice is complex, calling on clinicians to utilise theory in conjunction with practice knowledge in sometimes complex clinical situations. Consequently the totality of nursing practice is very difficult to identify with any precision, and as evident from the literature review, there is much evidence of a theoretical base to nursing informatics but little evidence of what is required in the application of ICTs by clinical nurses in their day to day client care. One way of interpreting the full composition of nursing practice is through the analysis of the competencies required of a nurse to successfully practice as a professional. As identified in Chapter 2, the use of competencies has been applied to studies of nursing informatics, so it is not a novel way of identifying the constituents of practice. However, these studies are historic and as a consequence the competencies require review to identify any changes that have resulted from developments in technology or evolution of attitudes that postdate those studies.

3.2 COMPETENCIES AS STANDARDS OF PRACTICE

Internationally many nurses have identified practice standards. The reasons for this are numerous. Cheek, Gibson and Gilbertson

(1995, p.29) suggest nursing professionals identify standards as a response to the application of economic rationalisation to health care, an outcome of which caused the nursing contribution to health care to be analysed in terms of work output and therefore required some means of evaluating practice. Further reasons for developing nursing standards include a need for autonomy; to describe professional practice from within the profession rather than have it imposed by others sources (Storey, 1998); to differentiate their practice from other health professionals; to recognise the professional's accountability to clients; and as a means of self evaluation of individuals within the profession (Sutton & Arbon, 1994). An alternative view of the importance of identifying standards of practice is that they can serve as "defining statements about a profession or work role which can be used to assist credentialing" (M^{C}Allister, 1998, p.131), when nurses transfer their registration from one regulatory body to another.

The bodies responsible for regulating the registration of professional nurses in Australian and New Zealand have each published competency-based standards of practice expected of registered nurses. Such standards, while being the minimum requirements do set a base for judgments about entry to, and progression within, the profession by providing explicit statements of what a nurse needs to be able to do to practice successfully as a professional. Hager (1993) argues that competency standards cannot cover every facet of practice and requires the understanding that it cannot be expected that beginning practitioners be experts because

they lack experience. However, Hager contends that what can be achieved in using competency standards is a clear statement of what is considered to be important in competent performance in that profession, stating, "to point out that professional work is complex is simply to require that valid standards need to take account of this complexity" (1993, p.5).

3.3 COMPETENCE, COMPETENCY AND COMPETENCIES.

To practice competently, nurses must demonstrate that they possess a set of relevant attributes such as knowledge, abilities, skills and attitudes. These attributes that jointly underlie competence, are often referred to as competencies (Hager, Gonczi & Oliver, 1996). So a competency is a combination of attributes underlying some aspect of successful professional performance.

Competencies are also conceived as descriptors of professional activity and according to Hager (1993) fall into three types or approaches. The first approach focuses on competencies that describe the performance aspects of practice as tasks and sub-tasks. The second approach analyses the knowledge, skills and attitudes required by the individual to be a competent professional. The third approach integrates attitude and performance necessary to perform professional tasks.

The standards of practice expressed by Australian and New Zealand regulatory bodies adopt the third of Hager's approaches, depicting professional nursing as a series of generic statements about

domains of practice, each with specific competencies and sub-competencies. Standards, domains and competencies are couched in fairly broad terms rather than in particular attributes. The need to use broad descriptors is a reflection of the difficulty in being precise about nursing, a practice that is complex. Context is also important, as is time. The currency of a competency is not indefinite as nursing is dynamic, altering in accord with innovation in practice from within and outside the profession. The evolution and integration of information technology into nursing is a case in point.

Analysis of the practice standards required for initial entry to the nurses' register identifies that the meanings attributed to competencies by the Australian and New Zealand nurses' regulatory authorities are semantically different although the intent in applying competencies to describe nursing is similar.

The Australian Nursing Council (ANC, 2000) released their requirements for registration in May 2000, identifying four generic domains of practice and defining competence as "the combination of skills, knowledge, attitudes, values and abilities that underpin effective and/or superior performance in a profession/occupational area" (p. 27); a competency unit as representing "a major function/functional area in total competencies of a registered nurse in a nursing context representing a stand alone function which can be performed by the individual" (ANC, 2000, p.27).

The NCNZ in its guidelines for admission to the register published in 2002 defines competence as "effective performance in a defined area of practice"; competency as a defined area of skilled performance and competencies as "descriptive statements which can be assessed and which reflect the intent of a competency in terms of performance, behaviour and circumstance" (2002, p.36).

The NCNZ guidelines (2002) do not specifically identify that nurses need to be computer and information literate but it can be argued that it is implied in the generic competency "Professional Judgment" that states in the generic performance criteria that it is expected that the nurse is able to "make nursing judgments based on current nursing knowledge, research..." (p.10), or from the ANC (2000) competencies unit 6, "values research in contributing to developments in nursing and improved standards of care" (p.15). A degree of information literacy is necessary to obtain and find relevant research reports and literature containing up to date nursing knowledge. Computer literacy is implied in the ANCI competency Unit 12 which states that the nurse demonstrates communication competencies by communicating effectively with individuals and groups when "technology appropriate to the type of communication is selected" (p.23). The fact that these standards are not explicitly directed at the use of ICT's suggests that the registration bodies have yet to consider the competencies required for nurses to work in a knowledge society and that it is now timely to do so.

Hager (1993) contends that what can be achieved in using competency standards is a clear statement of what is considered to be important in competent performance in that profession. To be meaningful to a practice based profession identification of competencies should rest on direct observation of what has been achievable in actual practical situations rather than on theoretical or idealised notions. This is exactly what Benner (1984) did.

3.4 BENNER'S THEORY OF HOW PRACTITIONERS DEVELOP

This study also integrates another way of identifying the expected level of functioning as contained in Benner's (1984) theory of practice development. Benner explored nursing actions, formulating a developmental model of nursing practice in response to the position that a "lack of charting of our practices and clinical observations deprives nursing theory of the uniqueness and richness of the knowledge …" (Benner, 1984).

Benner (1984) used an inductive approach, employing surveys, interviews on critical incidents and participant observation, to identify levels of competency and role development through an analysis of clinical practice. This approach integrated both attributes and performance of clinical practice into a recognisable framework of practice.

Based on a model of skills acquisition developed by Dreyfus and Dreyfus, Benner identified that nurses develop their expertise through experience thereby producing a qualitative difference in

practice between practitioners as they gain clinical experience. The first stage of Benner's model of role development is the beginning practitioner, the novice, who is limited in some of their practice abilities as they rely on rules and regulations on which to base their practice. The second stage is that of the advanced beginner who is the developing greater self-awareness, and consequently, awareness of the limitations of their practice. The third stage of Benner's model, the competent practitioner, is reached when the nurse is considered to have developed an increasing sense of mastery and is better equipped to see patterns in recurrent situations, while in the fourth stage of the model, the proficient practitioner, the nurse is developing an holistic view of situations, and a deeper confidence in professional practice. The fifth stage is that of the expert whose practice is based on accrued knowledge and intuitive links between situations and ways of responding to them.

Benner's (1984) competencies differed qualitatively from the informatics competencies referred to at the start of this chapter because those competencies were identified from the deductive approach to research. Benner (1984) took the inductive approach to uncover the meaning and knowledge associated by nurses in clinical practice that when expressed as competencies implied a meaning that was readily recognisable by clinicians. While Benner's (1984) competencies were not prescriptive they portrayed nursing in a form recognisable to its practitioners. "Once described however, they are clear to those who share the same background meaning. That is, the

52

participants who share their knowledge and experience base can understand them" (Benner 1984, p.40). Identification was therefore dependant on professional judgment.

This study, like Benner's, calls on participants to identify competencies through the use of their professional judgment by identifying what is relevant in certain application of informatics. The newly registered nurses who participated in the panel were considered to be at Benner's *competent* stage having had the clinical experience to develop technical skills in applying informatics to practice and to then recognise the impact of informatics application to their practice and therefore to articulate the informatics competencies required for their practice. Nursing educators are required by the respective nursing regulatory bodies to have sufficient subject knowledge to be accepted as experts.

3.5 COMPETENCIES AND NURSING EDUCATION

Confusion and debate occurs in the understanding of how competencies are used within the education of nursing students (Pearce & Trenerry, 2000). Competency based education (CBE) in its original form used the construct of competencies to teach tasks to non-professional workers. It used a reductionist, outcomes focused approach to delineate attributes of a specific task and had its philosophical roots in mastery learning. The reservations expressed by M[c]Allister (1998) and Winskill (2000) that competency-based education in its reductionist approach to performance analysis of

clinical practice has no place in Australian nursing are typical of those opposed to the application of CBE within nursing. Nursing is an applied discipline whose practice involves people as givers and receivers of that practice and as such is complex and difficult to reduce into discrete tasks that can be inferred to have any constancy in either time or place. The shortcoming of the reductionist form of competencies is the importance given to the demonstrable nature of the competency and the underestimation of the need to assess the intent or qualitative aspects that underlie the action. In their original inception, work-focused competencies were not designed for undergraduate education.

Educators who advocate the use of CBE in nursing believe the concept of competencies should be holistic rather than atomistic and describe tasks in professional practice as "intentional actions" because professional actions are not discrete nor independent, involving several competencies simultaneously (Hager, 1993). CBE is also perceived as an effective teaching method that fosters in learners, attitudes that they should be self directed and independent in acquiring knowledge and skills, the basics of lifelong learning, while exposing all students in specific programmes of learning to the same opportunities because "critical elements of learning are defined and standardised for all learners" (Bechtel, Davidhizar, & Bradshaw, 1999, p.184).

CBE has value in developing practical skills and, while it has yet to be proven to be effective, has also been advocated as a means of minimising the disparity produced by differing expectations of what a nurse should be capable of at initial registration (Lester 1995). The resulting gap exists because educators want to enable the future nurse to be a self motivated lifelong learner while employers want the newly registered nurse to be able to perform effectively and efficiently as soon as possible. In the practice-based discipline of nursing, task based competencies do have their place. "Their [competencies] appeal lies quite legitimately in the greater confidence inspired by someone who can demonstrate their competence in practice rather than simply espouse knowledge" (Lester, 1995, p.4).

While generic competencies provide a picture of what registered nursing practice should be, they fail to delineate specific intentional actions that student nurses need to perfect prior to registration; for example the administration of certain drugs, or the maintenance of asepsis during wound dressings. The reductionist approach provides means of the identifying components that students need to accomplish to achieve the competence expected of registered nurses.

Benner's (1984) study recognised the developmental aspect of clinical practice placing competence in the middle of her novice to expert continuum. According to Benner (1984), competent people have two to three years of practice and have developed the ability to consciously plan the actions, but lack flexibility and speed at that

stage of the growth. Though competence is primarily a notion associated with demonstration of performance, its effectiveness is also dependent on relevant knowledge associated with the skills hence also recognising the theoretical basis to practice (Garish 1992).

CBE may be useful in testing tasks but a major shortcoming is that a reductionist approach to competencies has a tendency to be prescriptive, producing numerous competency items that could lead to a checklist mentality (Hager, Gonczi & Oliver 1996). The main criticism levelled at competencies used in standards of practice is that they can be too broad and not expressed with sufficient precision to avoid ambiguity and are inadequate when testing knowledge and understanding (Gonczi, Hager, & Oliver, 1990), so are difficult to measure. This difficulty is reflected in the lack of literature exploring assessment using a holistic approach to CBE. Only one Australian source, (Piercey, 1995) attempts to identify why norm referencing assessments are not comprehensive enough for assessing broad competencies and counters the argument that measurement is difficult by suggesting that assessors could use the assessment tools of observation of practice, analysis of critical incidents, case studies, journaling and the nurse's self-evaluation of their clinical competencies.

However it can be countered that using a reductionist approach to determine required knowledge is valid. Coles (2000), building on Habermas's (1971) Theory of Knowledge Development, identifies

knowledge development as a three stage process, which has parallels in Benner's Theory of Professional Development in that Coles' foundation or first stage, known as Strategic Judgement which is centred on the development of practice based on following the rules and procedures laid down by others to achieve a predetermined end. This would relate to Benner's Novice and Advanced Beginner stages. Coles' second stage, Practical Judgement, where decisions involve choices guided by the practitioner's view of what is good, would be equivalent to Benner's Competent Practitioner. The third of Cole's stages is Professional Judgement, where freedom of action is guided by the practitioner's questioning of accepted actions and which involves critical thinking is similar to Benner's Proficient and Expert stages.

Competency based approaches can describe either the general or the particular of nursing practice. Both have merit, one recognising the particular, the building blocks, the foundation for developing knowledge leading to advanced competency in practice, the other addressing the need for broad competencies to cover the complexity of nursing practice. The definition of competency used for this study needed to recognise "the intentional act" in all its facets. Tschudin's (1992, p.53) definition of competency as "a state of having the knowledge, judgment, skills, energy, experience and motivation required to respond adequately to the demands of one's professional responsibilities" was used as it encompassed the critical aspects necessary for professional practice.

3.6 CONCLUSION

Determining a set of nursing informatics competencies was expected to identify the standard required for entry to the profession and to help educators verify the necessary informatics content in the undergraduate curriculum. The framework for this study was therefore based on the concept that informatics applied in clinical nursing can be described and demonstrated as competencies and draws on professional judgment to identify these competencies; and the work of Benner (1984) and Coles (2000) who differentiate between developing and expert practitioners.

CHAPTER 4
Methodology

4.1 INTRODUCTION

It is critical that the undergraduate curriculum addresses the competencies required by newly registered nurses when in clinical practice. As presented in the literature review, there are differing opinions about the levels of nursing informatics competencies required in particular positions within nursing. It has been identified that there is no recent literature that identifies informatics competencies required of newly registered nurses or those included in the Australia or New Zealand undergraduate curriculum. It is therefore important to the profession in both these countries, to determine such competencies so a relationship between the informatics content of the undergraduate curriculum and practice needs of newly registered nurses can be established.

Consequently this study was designed to answer the following questions:

1. Which informatics competencies do informatics experts believe undergraduate nurses need to demonstrate and newly registered nurses need to use?

2. Which nursing informatics competencies do educators believe should be addressed in the undergraduate curriculum?

3. Which informatics competencies do newly registered nurses believe they require for their clinical practice?

4. What if any are the differences between the opinions of the educators and the newly registered nurses about which informatics competencies are relevant?

Contained in this chapter is the rationale for choosing a descriptive quantitative research design in which the Delphi Technique was applied to answer these questions is presented. The methods of recruitment and participant details are provided. Ethical considerations including informed consent, confidentiality and the researcher's role are addressed. The procedure for data collection is then described, followed by the methods of statistical analysis, and procedures for promoting rigour within this study are outlined.

4.2 THE RESEARCH APPROACH

To answer the research questions the study required an approach that would identify nursing actions in such a way that these actions could be measured and compared. The conceptual framework selected for the study was based on the premise that research can produce new knowledge and the assertion that competencies can describe nursing actions and intent in the practice setting (as theorised by Benner in 1984) and are therefore transferable to the learning experience of undergraduate nurses.

Knowledge is socially constructed (Habermas, 1995; Coles, 2000), therefore it can be argued that it is only through experience in either the educational or the clinical setting that the actual practice needs of the newly registered nurse can be compared. The study was therefore designed to survey specific groups of nurses who possessed subject knowledge of nursing informatics and were willing to provide opinions, based on professional judgment, about informatics

competencies from their varying group perspectives. A comparison between groups could then be made and a decision about the relevance of the informatics content of the current undergraduate curriculum to actual clinical practice of newly registered nurses inferred.

As discussed in Chapter 3, competencies can be expressed in both reductionist and holistic terms. The reductionist approach, where nursing actions are analysed and deconstructed into component parts or competencies that are context free, is suggestive of the scientific objective view described by Doordan (1998, p.95) as assuming "that reality can be objectively measured and observed, independent of historical, social or cultural contexts". To rely entirely on an objective, quantitative approach would allow for statistical analysis of the collected data to achieve the study aim but not permit nurses to express the subjective nature of their opinions, thereby restricting the type of data available for analysis (Roberts & Taylor, 1998). The necessity of undertaking a comprehensive approach by collecting both objective and subjective data is supported by the philosophical stance adopted by Habermas, that cognitive constructs (concepts, values and beliefs) are shaped by the individual through experience and cannot be disregarded. How cognitive constructs are disseminated within society is the subject of his Theory of Moral Consciousness and Communicative Action (1990) in which Habermas uses the concept of "considerateness" to explain how the individual can meet their own needs yet interact through communication with others. It is this

interaction set in a particular context that can allow discourse to develop until a shared acceptance of agreed action is reached.

Communication, when conforming to the *Rules of Discourse*, provides that every contributor will have the right to speak, to question or introduce an assertion and not be prevented from stating their opinion and is therefore valid (Sumner, 2001). Habermas's (1990) work posits, "that all discourse is limited to a specific context which requires a shared understanding. Each participant is speaker, addressee/listener and observer, and each can respond rationally or with cognitive objectivity, and this includes utilizing factual or prepositional knowledge; as well as expressively or from the subjective emotional perspective."

The methodology selected for the study, therefore, had to embrace both the objective stance to identify consensus of opinion and subjective stance to determine the nature of nurses' opinions; and data had to be managed in a way that would facilitate communication as a means of facilitating group agreement about competencies and allow comparison to be made between specific groups of participants. A descriptive survey design that could establish the answer to which informatics competencies were relevant to the undergraduate curriculum and newly registered practice was deemed necessary to achieve the purpose of the research.

4.3 THE DELPHI TECHNIQUE

This research method was chosen as the most appropriate, as it is an information gathering strategy that adopts elements of both inductive and deductive research paradigms. This technique enlists knowledgeable participants and uses repeated rounds of a questionnaire to facilitate group discussion so the topic under study can be developed and measured. It is considered to be the method of choice when the topic being studied can only be described by subjective statements made on a collective basis (Linstone & Turoff, 1975; Proctor & Hunt, 1994). In their analysis of the seminal utilisation of the Delphi, Linstone and Turoff (1975) maintain the technique is useful when the research problem does not lend itself to precise analytical techniques but can benefit from subjective judgments made on a collective basis by a research population that may originate from diverse backgrounds in experience or expertise.

The original inception of the Delphi technique is ascribed to Rand Corporation researchers who designed the technique as tool to forecast the likely effects of atomic warfare on the United States based on the judgment of a panel of experts (Duffield, 1999). Linstone and Turoff (1975), describes the classic application of the technique as following the format of participant recruitment to form a panel, the use of anonymity, iteration of survey responses to facilitate group agreement and statistical analysis of consensus on a given topic.

The process according to Crisp, Pelletier, Duffield, Adams and Nagy (1997) involves identifying the study population then selecting and recruiting the study sample to form a panel of participants willing to deliberate on the study topic. This is followed by development of an initial questionnaire that is posted to the participants. On receipt of the responses to this questionnaire, the researcher's task consists of analysing the resulting data, then developing a second questionnaire that is then sent back to the participants along with information generated by the initial questionnaire. The participants, who do not interact with one another, are expected to reflect on their previous responses and the accompanying anonymous comments collated by the researcher. Further rounds of questionnaires and iteration are used until the researcher identifies group consensus.

A Delphi study can be undertaken using one panel. However this study followed the advice given by Turoff and Hiltz (N.D. p.3) that "a good Delphi survey attempts to tackle the problem from many different perspectives". Consequently this study modified the usual Delphi technique by increasing the number of panels from one to three to provide perspectives from individual panels of nursing informatics experts, nurse educators and newly registered nurses; and by carrying out data collection in two phases. It was therefore anticipated that application of the Delphi technique would allow study participants to deliberate and reach consensus about informatics competencies that should be included in the undergraduate curriculum and those

necessary to registered nurse practice so a comparison between findings of each group could be made.

4.3.1 Advantages In Using The Delphi Technique

There are several advantages in using this technique. The Delphi technique is well recognised for overcoming problems that could arise when a group has face-to-face dialogue. Anonymous responses to each round of questionnaire are fed back to participants so they can reflect on their own and the responses of the group as a whole while participants can deliberate in their own time. This approach minimises the possible jeopardy to the general validity of any study where group members are discouraged from voicing their true opinions because of the peer group pressure (Beech, 1991). Other advantages of the technique are the ability to establish group consensus when participants are geographically dispersed, content validity is promoted because experts or knowledgeable participants identify competencies (Beech, 1999), and the adaptability of the technique to achieve the study aims.

4.3.2 Limitations In Using The Delphi Technique

While promotion of study validity may be the intent behind anonymity, Sackman (1974) questions its use, believing that it may lead to a lack of accountability on the part of the panellists (Sackman, cited in Goodman, 1987, and in Powell, 2003). It has to be noted that any postal survey is subject to lack of respondents' accountability. This study has therefore to rely on each panellist's sense of professionalism and the desire to contribute to nursing's body of

knowledge. Sackman also criticised the Delphi technique as lacking objectivity and therefore not scientific (Turoff and Linstone, 2002, p.559). Sackman's criticism that the Delphi technique was an unscientific method should be countered as it must be seen in its historic context when any study that could not stand scrutiny about generalisability of findings was seen as wanting and the subsequent developments and academic acceptance of qualitative methods of discovery where "People are valued as sources of information and their expressions of their personal awareness (subjectivity) are valued as being integral to the meaning that comes out of the research" (Roberts & Taylor, 1998, p.15).

The fact that variations of technique occur between studies makes it impossible to prove or disprove the credibility of the technique in general. Any evaluation of the technique must therefore be restricted to a single study and how thoroughly it is used to answer the research question.

4.3.3 Previous Use Of The Delphi Technique Within Nursing Research

Nursing's acceptance of the Delphi technique as a valid research tool is evident in the many research reports published in peer reviewed nursing journals. Researchers have used this technique to study such diverse topics as British nurse educators' perceptions of their preparation to teach Project 2000 courses (Crotty, 1993); to establish consensus on curriculum content (Williams & Webb, 1994a); educational and research priorities of nurses practicing in rural and

remote areas of Australia (Bell, Daly & Chang, 1997); and to draw up a skills inventory for assessing nursing competencies (Love, 1997). Examples of research studies centring on nursing informatics that have also utilised the Delphi technique are the European based study by Goosen, Epping and Dassen who in 1997 studied which nursing information systems should be included in a client's electronic based health care record; and Saranto and Leino-Kilpi's study to identify the information technology syllabus for Finnish nurse education that was also published in 1997. Australian based studies are notably those of Carter and Axford (1993) who researched novice registered nurse computer use; and the study by Pelletier, Nagy, Mitten-Lewis, Duffield and Crisp (1995) that explored the beliefs of cardiac educators and cardiac nurse clinicians about the use of computer technology in client care.

4.4 THE SCOPE OF THIS STUDY

The initial intent was to limit the study to a survey of Australian and New Zealand nurses. These two countries were chosen because nursing literature has generally shown that education and practice in these countries are similar. Further, the governments of both countries honour the Trans-Tasman Mutual Recognition Agreement that includes nursing registration (Hager, Gonczi & Oliver, 1996), and there is a history of nurses migrating between the two countries. An invitation (Appendix B) posted on both NURSERES and Nrsing_L listservers was used to obtain study participants by posting invitations to join Phase One of the study. The study scope was revised for the

Phase One so that North American nurses could be included. This decision was made to ensure that the first panel had sufficient participants as no New Zealand nurse and only one Australian nurse volunteered to participate. Further, it has to be recognised that much of the nursing informatics knowledge is generated in the United States of America and is likely to have influenced the teaching and application of informatics in Australia and New Zealand given the globalisation of nursing knowledge (Holt, Barrett, Clark & Monks, 2000).

4.4.1 The Study Population

There are no published studies that establish the size of the nursing population in Australia and New Zealand who apply the domain of informatics to clinical practice, nor with the exception of the Australian study by Chu and Thom (1993), the extent to which all educational institutes expose undergraduate nursing students to the domain. What is certain is the existence of nurses' professional knowledge of, and experience within, the domain of nursing informatics, the fact that the application of information technology is expected of any professional (Tietze & Huber, 1995). This certainty was the *raison d'etre* of this study.

4.4.2 The Study Sample

Quantitative research usually uses heterogeneous samples, randomly selected to aid generalisability of results and to minimise possible selection bias (Beanland, Schneider, LoBiondo-Wood & Haber, 1999). This approach could not be applied to this study, as it

required a purposive, homogeneous sample of experts who would be able to respond to the research questions. Dempsey and Dempsey (2000) define a purposive sample as:

> A type of non-probability sampling in which subjects are selected because they are identified as knowledgeable regarding the subject under investigation. The investigator establishes certain criteria thought to be representative of the target population and deliberately selects subjects according to these criteria (p. 110)

This approach recognises the underlying assumption of the Delphi technique, that to provide an opinion about the study topic, a participant requires substantial knowledge for their opinion to be judged worthwhile (Wicklein, 1993, p.1050) and that the collective views of many are usually more credible than the opinion of one (Helmer, 1983). Delphi uses the concept of experts as panel members (Crisp et al., 1997).

The exact meaning implied by the word "expert" is according to M[c]Kenna (1994) open to debate, so this study restricted the use of the concept of an expert to the panellists who contributed to Phase One, all of whom professed extensive knowledge of informatics. The concept of an expert was replaced with that of a knowledgeable individual for the Phase Two panellists. This was done to differentiate between the phases and panels rather than the depth of subject knowledge of each participant.

Data source triangulation, a method described by Polit, Beck and Hungler (1997) as countering the bias incurred by the use of

purposive sampling was considered necessary to the study as there was no way of predetermining the number or type of nurse who would volunteer to participate. To this end three panels were considered necessary. This decision was made to increase the validity of the findings and is supported by Lang (1998) who advocates the recruitment of diverse a group as possible to a Delphi panel.

Ideal panel size is dictated by the study scope yet there is debate about the optimum composition of a Delphi panel. Reports of panel size vary from seven to over one thousand (Helmer, 1983; Reid, 1988; Wicklein, 2000). This study recruited twelve panellists to each of the educator and the newly registered nurse panellists so met Turoff's criteria of adequate panel size (1975, p.86). Difficulty in recruitment restricted the size of the expert panel to seven. The implications of this are discussed in Chapter 6.

4.4.3 Participant Selection Criteria

The selection criteria were individual to each panel. Phase One of the study required a panel of informatics experts able to identify informatics competencies they believed were necessary to the undergraduate curriculum and newly registered nurse practice. Criteria for inclusion in the expert panel required that they were nurses who were not currently engaged in nursing education in either Australia or New Zealand. By applying Benner's (1984) model of expert development, the decision was made to determine further inclusion eligibility of the expert panel as a minimum of five years experience

of utilising nursing informatics. The expert panellists' contribution to the study ceased following identification of a list of informatics competencies that was subsequently used in the questionnaires distributed during the first round of the Phase Two of the study.

Two panels were recruited for Phase Two of the study. Nurse educators have prime responsibility for ensuring student nurses are prepared for practice as registered nurses, so it was axiomatic that one panel consisted solely of nurse educators who had opinions about the informatics content of the undergraduate curriculum. Nurse educators employed in publicly listed institutions offering undergraduate nursing programmes in either Australia or New Zealand were sought. Only one representative from any one institution was recruited, so no single education provider was disproportionately represented.

In addition to the educator's panel, a panel of newly registered nurses was recruited. These nurses were expected to be in their third year of clinical practice having gained initial registration in either Australia or New Zealand at least two years prior to the start of the study and were willing to provide opinions of which informatics related competencies are used in their clinical practice. Benner's (1984) model of expert development was also used as criteria for eligibility to this panel. The rationale for the specified time period being that Benner and Wrubel (1989) had identified this length of time as necessary to allow any new practitioner to become less task-orientated and consequently better able to identify a more

comprehensive picture of what their practice involved. In addition, the rapid speed of informatics-related technology development precluded using nurse practitioners of more than three years clinical practice, as time is a significant factor in the currency of a curriculum.

4.5 ETHICAL CONSIDERATIONS

Victoria University Human Research Ethics Committee gave approval for the study prior to any participant recruitment (Appendix A). Research involving human subjects can only be carried out when participants are advised of the study's intent and any implication in volunteering to be a participant fully explained as enshrined in the Nuremberg Code. Each participant was supplied with an information sheet that contained the purpose of the research, and how it would be carried out, together with a consent form (examples of each can be found Appendix C), and given time to allow him or her to consider whether they would participate. Those signing the consent forms and returning them to the researcher were taken to be active participants. While the participants gave informed consent, they were at liberty to withdraw from the study at any time. The researcher did not contact those who had received but chose not to return completed consent forms as this could be interpreted as coercion.

The study was considered to pose minimal risk to the participants as defined by Polit, Beck and Hungler (2001, p.461) as being "no greater than ordinarily encountered in daily life...". By its nature the Delphi technique cannot provide total participant

anonymity, as the researcher must be able to identify individual participants so the iterative process that is critical to the development of group consensus, can be conducted. Consequently confidentiality must be safeguarded. Feedback necessary to the iterative process was presented to participants in a way that they could not identify each other. Where communication with participants during the study used email, all e-mail addresses and correspondence were kept on a computer to which password protection was applied and known only to the researcher. Hard copies of questionnaires and consent forms were kept in a locked room during the data collection phase. In this thesis, confidentiality is assured by omitting any identifying information when reporting individual responses.

Following the study all data in paper format or recorded on floppy disk format was kept in a locked cupboard and data stored on computer disk was accessed by a password known only to the researcher. Access to data was restricted to the researcher, the assistant, and the supervisor. Following completion of the thesis all data related to the study will be stored in safe keeping for a minimum of five years at the St. Albans Campus of the School of Nursing and Midwifery, Victoria University.

Ethical considerations also encompass the researcher's role. There is little information on the researcher's role during a Delphi study other than ensuring that panellist selection is based on those who can provide the relevant data (Everett, 1993). The researcher

endeavoured to protect the data during the iterative process by analysing participants' responses in an objective manner (Crisp et al, 1997, p. 118) and by employing an independent assistant to also analyse anonymous data as a method of ensuring that researcher bias did not occur by arbitrarily applying levels through personal interpretation.

This study generated comments from the expert panel about students' access to computers while on clinical placement. While these comments that were not directly relevant to consensus about informatics competencies the fact that the situation exists is worthy of comment as students need to practice their skills. Therefore by taking the ethical approach of beneficence it was necessary to highlight the experts' comments by including their concerns as a recommendation in Chapter 6

No pre-tested and valid Australian or New Zealand data collection tools were available, necessitating the development of tools for both phases of the study. Questionnaires were identified as the most appropriate form of data collection tool as they provided a cost effective way of collecting data from geographically dispersed participants, and excluded the possibility of interviewer bias (Dempsey & Dempsey, 2000). However, there are no methods of data collection that are totally without problems (Beanland, Schneider, LoBiondo-Wood & Haber, 1999). Interviews and questionnaires are equally susceptible to "social desirability" a threat to accuracy where

responses to questions are made to make a favourable impression rather than reflect the truth (Beanland et al, 1999, p. 306). It is also recognised that questionnaires do not allow the depth of questioning offered by face to face interviews, to overcome this all questionnaires contained open-ended questions that allowed panellists freedom to comment further on competencies, or provide additional ones. A potential pitfall identified by Linstone and Turoff (1975) is over-structuring the Delphi, as it is likely to prevent panellists from contributing a broad range of items that could be related to the study topic. To overcome this, open-ended questions were used as a strategy to ensure the panellists generated ideas about the study and not the researcher that could, according to Williams and Webb, (1994b), unintentionally influence the type of consensus that emerges in the way which the questionnaire material is designed. It is through this "essentially democratic process that the Delphi Technique aims to facilitate a group opinion or judgment that can claim to be representative" (Goodman, 1987, p.739).

Additional comments are included as these are important as they serve as "a basic source of raw data in qualitative inquiry, revealing respondents' depth of emotion, the ways they have organised their world, their thoughts about what is happening, their experiences, and their basic perceptions." (Patton, 1990, p. 24).

4.6 PHASE ONE

4.6.1 The Purpose Of Phase One

The purpose of Phase One was to answer the first research question, *Which informatics competencies do informatics experts believe undergraduate nurses need to demonstrate and newly registered nurses need to use?*

To determine the list of competencies for use in Phase Two, it was essential that the study participants, rather than the researcher determine the relevant competencies. This was important to the researcher, whose experience as an educator in nursing informatics could unintentionally bias the study findings by deciding competency development.

4.6.2 Recruitment of Subject Experts

Invitations to become panellists for this phase were posted on two listservers, NURSERES and Nrsing-L. The invitations for experts (Appendix B) to participate in the study produced twenty-two responses, all occurred within a five-week period. Thirteen of the replies were from nurses who registered interest in the study but did not meet participant criteria; two were from educators who subsequently participated in Phase Two of the study. The original intent was to confine study participants to Australian and New Zealand nurses, but only one Australian nurse met the criteria to participate in the expert panel. Several responses from nurses who lived in the United States of America had been received so the decision to include them in the study was made. This decision being

based on their willingness to provide their professional opinion founded on their experience of informatics coupled with the probability as expressed by Holt et al. (2000), that the widespread dissemination of nursing knowledge found in the American nursing publications may well colour the education and practice of nurses in both Australia and New Zealand. While it would have been ideal to have used only Australian and New Zealand experts it was necessary to revise the criteria in order to allow the study to proceed.

Seven completed consent forms were returned, six by airmail with one expert choosing to use electronic format together with an encrypted signature to provide their consent to participate. During this preliminary stage of the study it was determined that six of the participants could open e-mailed attachments in Microsoft Word© format and the seventh required e-mailed attachments to be sent as text files. Following receipt of completed consent forms (an example of which can be found in Appendix C), the first questionnaire (Appendix D) was posted to each panellist.

4.6.3 Round One

This first questionnaire was designed to obtain data that would establish the credibility of the participants as subject experts by obtaining responses that outlined their nursing experience, their age group and the number of years of experience in Nursing Informatics. Further questions were open ended and asked the subject experts to list the Nursing Informatics competencies they considered necessary

for a newly registered nurse clinician and which should be taught in undergraduate nursing curriculum. To provide reference points for the panellists the questionnaire included two definitions. A competency being defined as "a state of having the knowledge, judgment, skills, energy, experience and motivation required to respond adequately to the demands of one's professional responsibilities" (Tschudin, 1992, p53). Nursing informatics being defined 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 health care" (Graves & Corcoran, 1989, p. 227).

Prior to issuing the second round, the questionnaire was piloted by two nurse educators to determine face validity by evaluating the readability and clarity of content (Beanland et al., 1999).

4.6.4 Round Two

As the Delphi technique dictates, successive questionnaires are not subject to further piloting as the panellists control the questionnaire content. The second questionnaire (in Appendix D) was composed of competency statements derived from the first questionnaire and served the purpose of identifying any difference in their relevance to either the undergraduate curriculum or to newly registered practice. The experts were asked to rate each competency (using a five point Likert scale ranging from (1) Strongly disagree; (2) Disagree; (3) Undecided; (4) Agree; to (5) Strongly Agree). To be

accepted as relevant to the study, a competency had to be rated on the Likert scale as (4) Agree or (5) Strongly Agree.

Several statements, made in response to questions three and four of the first questionnaire, were pertinent to informatics yet content analysis failed to identify specific competencies within them. Question three asked panellists to list the nursing informatics competencies considered necessary for the newly registered nurse clinician, and question four asked which nursing informatics competencies should be taught in the undergraduate curriculum. These statements were included in phase one, second questionnaire (Appendix E) to provide the subject experts with the opportunity to reflect on them and identify specific competencies inferred by them.

4.6.5 Round Three

A refinement of the second round questionnaire was used for the third round (Appendix F), making no differentiation between curriculum and newly registered nurse competencies as statistical analysis showed this to be unnecessary. Each panellist was provided with information to enable him or her to reflect on the anonymous responses of panellists gleaned from the previous round.

The involvement of the initial panel ceased after three rounds of questionnaires because group consensus as to the informatics competencies required for either undergraduate curriculum inclusion or use for newly registered nurses had been achieved.

4.7 PHASE TWO

4.7.1 The Purpose Of Phase Two

The purpose of Phase Two was to answer the research questions:

2. Which nursing informatics competencies do educators believe should be addressed in the undergraduate curriculum?

3. Which informatics competencies do newly registered nurses believe they require for their clinical practice?

4. What if any are the differences between the opinions of the educators and the newly registered nurses about which informatics competencies are relevant?

Phase Two aimed to establish relevant informatics competencies based on the list generated by the subject experts. This was done through the participation of two panels, one a panel of nurse educators, and the other of newly registered nurses and the administration of two rounds of questionnaires to each. At no time were the findings of one panel conveyed to the other, so the findings of each panel could be compared with the other.

4.7.2 Recruitment Of The Educator Panel

The nurse educators were recruited by letters outlining the study intent that were sent to the fifty Heads of Schools of Nursing in Australia and New Zealand in publicly listed institutions offering nursing programmes. Contact was based on information obtained from the Information Officer of the Australian High Commission in Wellington (personal communication) and personal knowledge of the New Zealand based nursing programs. These letters (example contained in Appendix H) were posted along with information sheets,

consent forms and prepaid return addressed envelopes. All subsequent communication was by e-mail following receipt of signed consent forms. Ten other panellists joined the two educators who responded to the initial posting on the Nrsing-L list server. Seven were New Zealand educators and five were Australian.

4.7.3 Rounds Issued To The Educators Panel

The aim of the first round was to issue a questionnaire to nurse educators to confirm competency statements relevant to the undergraduate curriculum and encouraging identification of further competencies. The Likert scale used during Phase One was used again and comments invited giving panellists opportunity to identify new competencies. The second round followed the format of the previous round, providing panellists with feedback about the responses from the previous questionnaire and asked the educators to again rate each competency so group consensus could be identified.

4.7.4 Recruitment Of The Newly Registered Nurse Panel

To achieve a sufficient number of newly registered nurse panellists an invitation was posted using the List server Nrsing -L, and journal advertisements (Appendix G) placed in the Australian Nurses Journal and its New Zealand equivalent, Kai Tiaki and Nursing Careers Allied Health. The response was non-existent, so letters of invitation were sent to Directors of Nursing of fifty randomly selected hospitals from both countries (Appendix H). This produced four Australian and eight New Zealand participants who contributed to the

study by corresponding using traditional postal methods rather than e-mail as some participants did not have access to e-mail.

4.7.5 Rounds Issued To The Newly Registered Nurse Panel

The aim of the first round questionnaire issued to newly registered nurses was to confirm relevance of the competency statements they believed necessary to their practice and encouraging identification of further competencies. The questionnaire format was a duplicate of that sent to the educators. As with the educators panel, the second round repeated the format of the previous round but with the addition of new competencies obtained from previous responses of the newly registered nurses. This was the final round of questionnaires as consensus of opinion about the relevance of the competencies was achieved.

4.8 METHODS OF DATA ANALYSIS

Three methods of data analysis were employed: content analysis described by Sarantokos (1998, p.279) as "a documentary method that aims at a qualitative and/or quantitative analysis of the content of texts, pictures, films and other forms of verbal, visual or written communication; descriptive statistics to "describe and synthesis the data" (Polit et al., 2001, p.331); and inferential statistics to "draw conclusions" about data. (Polit et al., 2001, p.343).

The responses to the open ended questions of first questionnaire issued in Phase One were subjected to content analysis to obtain competency statements. "Content analysis can establish either

manifest or latent meaning in the presented text" (Sarantokos, 1998 p.283). This study centred on the manifest or visible surface text that could be identified as being data in the form of words or phrases that inferred or represented competency statements relevant to nursing informatics. Latent coding which seeks to uncover underlying meaning of word use was not employed, as the responses from the subject experts were insufficient for this type of analysis.

Other forms of analysis were also employed as a Delphi study usually uses statistical analysis to identify consensus. How that analysis is applied varies between studies (William & Webb, 1994b). Crisp et al., (1997 p.117) criticised researchers for not being more explicit stating that "unfortunately, consensus is often treated as a given by researchers, with little discussion of what is intended", and definitions when they are provided, extend from "true consensus to majority rules". Statistical identification of consensus is often achieved by using the mean or mode score (Mead (1992), cited in Williams & Webb, 1994a), or by establishing the degree of agreement or measures of variance. M[c]Kenna's (1994) critique of the technique suggests accepting a 51% agreement among respondents (p.1222), while Goosen, Epping and Dassen (1997) used 75% agreement. Approaches taken by researchers also vary in whether they predetermine measure of consensus prior to data collection or allow the collected data to dictate how consensus should be identified. Defining a statistical value of consensus prior to the study commencing is recommended to address the bias that could follow

when researchers apply a personal interpretation of consensus following data collection (Williams &Webb, 1994b, p.184).

Crisp et al. (1997, p.117) advocate stability of response as the true means of identifying consensus, believing it to be a more convincing approach than relying on the measures of central tendency.

> it is the stability of the group response which should receive more attention than the apparent consensus which may mask a bimodal or flat response distribution.....it would therefore seem that where consensus is implied with the mean or median variation of items between rounds being given, it is not only insufficient but also potentially misleading (Goodman, 1987, p.733).

Therefore this study used mode that identifies the most frequent responses (Roberts & Taylor, 1998, p.291) to determine relevance of a competency. A Mann-Whitney U test, an inferential statistical test, is used to determine if the scores obtained from the two data sets differ significantly from each other (Hicks, 1990, p.148). Justification for using this test was determined by the following conditions for the test being met:

1. The data sets in this study were from two groups
2. Ordinal data type was used
3. The assumption of normality could not be assured
4. There was missing data, but a need to retain the participant's responses data.

This test was applied to the data to measure if a difference in opinion between competencies relevant to undergraduates or registered nurses existed in the second questionnaire responses of Phase One. During Phase Two the mode value for each competency

and any change in the respective panel's percentage agreement on the relevancy of each competency were used to judge stability of results.

4.9 RELIABILITY AND VALIDITY OF THE STUDY

Face and content validity of the questionnaire used in the study were determined through the use of both subject experts and knowledgeable nurses to identify and rate the competencies, and through the utilisation of repeated rounds (Whiting, 1994). While the potential for bias in the design of the questionnaires and processing of results may compromise the veracity of the study findings, iteration provides a means of establishing any possibility of diverse interpretations and the use of a Likert scale provided uniformity of measure. Cronbach's Alpha (Polit et al., 2001) was applied to the third questionnaire of Phase One to measure internal consistency.

When consensus about the relevance of each competency is achieved, it can be argued that there is evidence that the identified competency is valid, in that the panellists both identified and agreed on the competency.

Phase Two of the study was designed to achieve consistency in data collection as recommended by Grey (1994), so used the same initial questionnaire administered simultaneously to nurse educators and newly registered nurses. Any additional competencies identified during assessment of the responses were not relayed to the other panel so that competencies specifically identified by either group could be further explored and be considered unique to the group. Additional

estimates of reliability were not considered appropriate to the Delphi

techniques (Dalkey, Rourke, Lewis, & Snyder, 1972).

Questionnaires or individual questions that are either not

completed or returned by participants are a disadvantage of posted

questionnaires (Barker, 1996; Barribal & White, 1999). This is

particularly true in Delphi studies (Linstone & Turoff, 1975). While

non-returns cannot be overcome entirely, actions to minimise this

were taken by inclusion of postage paid return addressed envelopes

when corresponding with the newly registered nurse panel and, where

appropriate, e-mailed reminders were used as encouragement when

initial non return occurred in the expert and educator panels.

Consideration was made about whether responses made by

participants who subsequently withdrew should be used in the

accumulated data analysis of subsequent rounds. Only one researcher

provided direction on retention of data following participant mortality,

stating, "In order to provide continuity, a person's judgments on a

previous round were used whenever he or she could not respond to a

particular round (Ludlow, 1975, cited in Linstone, H. A. & Turoff. M.

(1975).

Further, it is acceptable to utilise data from participants who

withdraw from the study because the nature of data in a Delphi study

deals with subjective data that cannot always be analysed to determine

predictability as Mitroff and Turoff (1975) argue:

The probability used is of the personal or subjective type; it can be interpreted as a "degree of confidence". Scientists and engineers are brought up on a different kind of probability - frequency of occurrence, i.e., the limit of the ratio of a number of successes to the total number of trials as the latter approaches infinity. Thus the frequency type of probability assumes repeatability of the experiment (e.g. tossing a coin). But the subjective probability has meaning even if an event can occur only once (p.7).

It was therefore decided that given the likelihood of participant withdrawal, all data generated from participants who did not continue to contribute to successive round would be used as to not to do so would invalidate the results of earlier rounds.

4.10 SUMMARY

This chapter has described the rational for the study design and why modification to the Delphi format was undertaken. The study was carried out in two phases; the first involved a panel of experts and the other, two panels; one of nurse educators and one of newly registered nurses. Details of participant criteria, panel recruitment and administration of the data collection tools were also presented.

CHAPTER 5
Data Presentation

5.1 INTRODUCTION

This chapter focuses on the presentation of the data generated during the two phases of the study. In Phase One, a panel of subject experts completed three rounds of questionnaires aimed at identifying the nursing informatics competencies they considered either relevant to the undergraduates' learning or to newly registered nurse practice. The aim of the first questionnaire in Phase One was two fold; to collect demographic data to establish the panellists as informatics experts, and to generate a list of competency statements, through the application of content analysis. The second and third questionnaires of this phase allowed the subject experts to refine and identify the relevance of the competencies generated by their responses to the first questionnaire.

The aim of the Phase Two was to generate data from the responses to a questionnaire (Appendix H) based on the competencies identified from Phase One that was posted independently to a panel of nurse educators and a panel of newly registered nurses. Both panels were asked to comment on the relevancy of these competencies from their perspective and to provide group opinion about further competencies identified by individual members of their respective panel. Data generated by each panel during this phase was compared to establish the relationship between the informatics content of the

undergraduate curricula and the informatics practice needs of the newly registered nurse.

5.2 PHASE ONE - THE EXPERT PANEL

5.2.1 Round One

The expert panel consisted of seven nurses who submitted their signed consent forms. Prior to the e-mail posting of the first questionnaire, it was established that of the seven experts, six could open e-mailed attachments in Microsoft Word© format and the seventh required e-mailed attachments to be sent as text files.

All panellists (n=7) completed the first questionnaire giving a response rate of 100 per cent. Three closed questions were asked to obtain demographic data and confirm panel members' credibility as subject experts. Data returned established that there was a wide range in age (as shown in Table 1) and in years of experience (shown in Table 2).

Table 1
Phase One: Expert panellists distribution of ages

Age Range	Number of panellists
31-40	1
41-50 years	3
51-60 years	2
Chose not to disclose age	1

Table 2 *Phase One: Expert panellists' years of informatics experience*

Years of informatics experience	Number of Panellists
5 - 6	3
11 - 15	1
16 - 20	3

Two panel members were academics, two were health care informatics consultants, a health care computer systems vendor employed one, another was involved in nursing administration and the last was a clinician. None were new to informatics, so were accepted as experts. The general information given by the subject experts identified the composition of the panel as heterogeneous, with no group seen to outweigh the opinions of the rest of the panel. This is a critical point in aiding validity of any of the competencies identified by the experts.

Questions three and four, which were open-ended, asked the subject experts to list the nursing informatics competencies they considered necessary for a newly registered nurse clinician and which nursing informatics competencies should be taught in undergraduate nursing curricula. The use of open ended questions was employed specifically to avoid the potential pitfall identified by Linstone and Turoff (1975), namely that over-structuring the Delphi may prevent respondents from contributing a broad range of items that could be related to the study topic.

As mentioned in Chapter 4, two definitions were provided as reference points for the panellists to consider when formulating their responses to these questions. One was Tschudin's (1992, p.53) definition of competency and the other was Graves and Corcoran's (1989) seminal definition of nursing informatics.

5.2.2 Round One Responses

The responses varied in depth. Some panellists provided detailed responses, while others were concise. All responses to questions three and four were read and words and phrases related to informatics were highlighted, then entered into a Microsoft Access 97© database so repetition in the occurrence of words or phrases could be established. (they are presented in Appendix J). Content analysis can be subject to coder bias (Sarantokos, 1998) therefore the researcher followed the recommendations of Hasson, Keeney and M^{C}Kenna (2000), undertaking only minor editing of panellists' wording. In addition to these steps, the independent reviewer assessed the veracity of the coding process and agreed with 90% of the researcher's coding, exceeding the identified acceptable level of 80% agreement (Sarantokos, 1998, p.282). Analysis of the responses to questions three and four identified forty-seven competency statements, separated into five groups to aid the readability of successive questionnaires. These are presented in Table 3.

Table 3   *Phase One – Round One*
Competencies derived from experts responses to their first questionnaire

---

Group 1 Elementary Computer Use

1.1   Demonstrate knowledge the keyboard layout

1.2   Demonstrate knowledge of the GUI (Graphic User Interface)

1.3   Demonstrate the ability to turn computer on/off

1.4   Demonstrate the ability to format (floppy) disks

1.5   Recognise there are different types of operating systems

1.6   State the difference between client/server and desktop stand alone programs

1.7   Recall the meaning of computer terminology

1.8   Demonstrate the ability to use various pointer devices - mouse, light pen, touch screen roller ball

1.9   Recognise compatibility issues related to hardware and data

1.10   Apply the basics of portable computer solutions

Group 2   Commercially Available Software

2.1   Recognise which word processing program they use most often

2.3   Demonstrate the ability to use word processor with accuracy and speed

2.4   Demonstrate the ability to use spreadsheets

2.5   Demonstrate the ability to use a relational database

2.6   Demonstrate the ability to use a statistical program

2.7   Demonstrate the ability to use graphics presentation programs

2.8   Describe what scheduling package are able to do

2.9   Examine the real worth of the hardware or software

Table 3 Phase One – Round One (continued).
Competencies derived from experts responses to their first
questionnaire

Group 3   Information transmission and retrieval

3.1   Describe the use of network login procedures

3.2   Demonstrate the ability to communicate using email

3.3   Demonstrate the ability to access information using Internet

3.4   Describe the use of local computer networks

3.5   Apply search techniques to target a search, including Boolean operators i.e. and, or, not

3.6   Demonstrate knowledge of how to ask the right questions

3.7   Distinguish the difference between data and information on nursing problems

3.8   Use collegial networking

3.9   Demonstrate ability to complete a literature search using a database (e.g. CINAHL or MEDLINE)

3.10   Demonstrate ability to use electronic resources to locate current information on nursing problems

3.11   Question what is presented to gain knowledge of functionality and mastery requirements

3.12   Describe use of a hospital information system

3.13   Demonstrate the ability to access a hospital information system

3.14   Critically analyse the changes occurring as a result of an increased use of informatics

3.15   Demonstrate a knowledge of telecommunications, artificial intelligence, robotics and system applications that can support clinical practice to include telemetry

3.16   Describe the use of clinical information systems

Group 4   Data Protection

4.1   Assess opportunities and challenges that informatics brings to health care - security, privacy, confidentiality

4.2   Analyse issues of privacy and confidentiality of information

4.3   Analyse the need for standards affecting development of electronic patient records

4.4   Use strategies designed to maintain patient confidentiality and data integrity

4.5   Recognise language and need for consistency in nursing

4.6   Apply the basics of portable computing solutions

94

Table 3 Phase One – Round One (continued)
Competencies derived from experts responses to their first
questionnaire

Group 5   Knowledge of Health Care Monitoring Systems

5.1	Demonstrate a knowledge of telecommunications, artificial intelligence, robotics and system applications that can support clinical practice
5.4	Demonstrate knowledge of types of information systems a nurse may encounter
5.5	Demonstrate knowledge of basic processes involved in, for example, charting a medication in an automated system
5.6	Know the use of clinical information systems – Patient records care planning
6.1	Demonstrate general knowledge of the various career tracks taken by nursing informaticians and importance of these roles to the advancement of practice and development of clinical applications to support end users.
6.2	Demonstrate an appreciation of the integration of technology and the impact of reengineering and restructuring on roles in all aspects of wellness and disease state management
6.6	Recognise the need for utilising the available technology

This group was subsequently split into two groups: Competencies 6.1, 6.2 and 6.6 were considered to be relevant to Group Six Implications of Information Technology Use and the Nursing Profession.

The numbering reflects that applied to the final list generated at the end of Phase One.

The second questionnaire (Appendix E) issued to the expert panel contained all the competencies identified from the first round on which both the researcher and the independent reviewer agreed. Experts were asked to use a five point Likert type scale (1 = strongly disagree; 2 = agree; 3 = undecided; 4 = agree; 5 = strongly agree) to indicate their opinion about the relevance of the identified competency statements and whether they should be included in the undergraduate curriculum or were required for newly registered nurses practice. Relevance was predetermined to be a mode of either 4 or 5. Asking for comment following each of the five competency groups and for

individual competencies encouraged the provision of further comments related to the study.

Also included in the second questionnaire were five statements made in response to the first questionnaire that on content analysis, had failed to yield specific competencies and on which the independent reviewer and the researcher had not reached agreement; coupled with a request to consider which additional competencies were inferred by the phrase "basic computer skills". These were included in the second questionnaire to provide the subject experts with the opportunity to reflect on these statements and identify if they inferred any specific competencies. In this way, the iterative process, integral to the Delphi technique was met.

The return rate for this round was again 100%. Of the seven subject experts, four provided opinion on relevance of the competencies to both the undergraduate curriculum and newly registered nurse practice, with the remaining three subject experts differentiated their responses. The Mann-Whitney U test of the responses (Appendix J) found no significant difference between the combined panel response to the undergraduate and newly registered nurse competency statements using the standard cut off point of $p <= 0.05$ for claiming the results as statically significant (Hicks, 1990, p.152).

5.2.3 Round Two: Reworded and Rejected Competencies

Suggestions from various panellists resulted in rewording of the following competencies:

Health management was added to the competency (5.4) *Demonstrate knowledge of types of [health management] information systems a nurse may encounter*. This was done to focus the competency on the study parameter.

Utilisation of a scheduling package was reworded to (2.8) *Describe what scheduling packages are able to do*. The expert who suggested the rewording queried the level of knowledge required by a newly registered nurse, and frequency of use of scheduling software suggesting that they only needed to know what such software was capable of doing.

(4.3) *Analyse the need for standards affecting development of electronic patient records* was changed to (4.3) *Recognise the need for standards affecting development of electronic patient records*. This rationale for the rewording again reflected the lesser depth of knowledge required of informed users rather than expert users of informatics.

The word real was removed from the competency (2.9) *Examine the [real] worth of the hardware or software* as the term real was considered subjective.

The competency (4.5) *Recognise language and need for consistency in nursing* was reworded to (4.5) *Appreciate language and need for consistency in describing nursing actions* to minimise misinterpretation of its meaning.

Feedback from panellists resulted in the removal of two competencies. The first, (1.10) *Apply the basics of portable computer solutions* was the only competency that the experts identified as open to varied interpretation. Some panellists believed it focussed on the use of telemetry that was addressed by rewording the competency (3.15) *Demonstrate a knowledge of telecommunications, artificial intelligence, robotics and system applications that can support clinical practice* to include telemetry. The second competency to be removed was (3.16) *Describe the use of clinical information systems* as such information systems are addressed in the competency (5.7) *Demonstrate knowledge of types of health management information systems a nurse may encounter.*

5.2.4 Round Two: New Competencies

Responses to the open-ended question asking the subject experts for further competencies and specifically which competencies were inferred by the generic term "basic computer skills" produced eleven new competency statements. These new competencies, presented in **Error! Reference source not found.**, were added to the competency list used in round three.

Table 4   *Phase One - Round Two: New Competencies derived from responses to the 2ⁿᵈ Questionnaire*

1.10	Demonstrate how to obtain a printout of a file
1.11	Demonstrate the ability to clear printer paper jams
1.12	Demonstrate the ability to change a printer toner or ink cartridge.
1.13	Demonstrate the ability to access files or folders on both hard and floppy disk drives.
1.14	Demonstrate how to create folders or directories.
1.15	Demonstrate the ability to save files on a disk drive.
1.16	Describe the use of spreadsheet software
1.17	Describe the use of word processor does
1.18	Describe the function of video/sound cards
2.2	Demonstrate the ability to install an "off the shelf program" onto a hard drive
6.3	Describe what computers can and cannot do at the present and the potential changes likely to be caused by computer use

The experts were unable to identify any further competencies from the five statements included for further consideration. However, some experts provided comments related to specific competencies while others chose to comment on informatics in general.

5.2.5 Round Two: Experts' General Comments

The concern of one expert about nurses' lack of understanding about many aspects of software is evident in their comment that many nurses have difficulty differentiating between software applications and operating systems or that various versions of the same software did not offer the same functions.

While the experts considered that knowledge of commercial software was relevant for nurses, several experts identified that, as users of the software rather the subject experts, neither undergraduate or newly registered nurses would require a detailed knowledge of

spreadsheets, databases and statistical programmes but the overall concepts should be a part of the knowledge exposure of the undergraduate student.

Knowledge of what a word processor can do was, in the words of one expert, "essential to the performance of nursing duties since most hospital information systems are based on word processing skills". Being able to communicate using terminology associated with computer use was also considered as essential:

> I am a Nurse, I communicate extensively with programmers to help understand the workflow of a hospital environment. At the same time, I must learn their language. Nurses need to be involved in Informatics and systems development. The Universal Language issue is only a small part of the considerations. Articulating the 'Real world' hospital and nursing needs is the bigger issue. Care Map, Critical Pathway, etc... Nurses must get beyond the terminology and be able to explain the process.

The ability to utilise electronic data transfer was recognised as important. This included a belief that there is an implication that "on-line" would include the access to and ability to communicate using e-mail while in the opinion of another expert, all nurses needed to know about utilising distance learning modes for ongoing professional development.

Many of the experts' statements identified competencies that were applicable to both undergraduate curriculum and practice needs of the newly registered nurse, suggesting that the only difference was one of depth of knowledge. Overall, the comments from the experts

suggested a lack of belief that nurses were effective users of information technology.

5.2.6 Round Three

In Phase One five experts responded to round three (71% response rate). Reminders were sent to the two experts who did not respond (panellists 3 and 5) but they made no further communication.

The third questionnaire used in Phase One (an example of which is contained in Appendix F) included feedback on group response to the second questionnaire. All competencies identified as relevant, together with the new competencies derived from the previous questionnaire responses were included in this, the final questionnaire completed by the subject experts.

Following feedback from the experts, a review of the competency grouping necessitated formation of a sixth group, *Implications of information technology use to the nursing profession*, and reorganisation of the contents of groups 4 and 5. No expert contested these new groupings. Further, this questionnaire differed from the previous one not only with the reworded and new competencies, and the additional group, it also asked the experts to provide individual responses to competencies without differentiating between the undergraduate curriculum or newly registered nursing practice as statistical analysis of the second questionnaire responses using the Mann Whitney U test showed this to be unnecessary. The

experts reached consensus on 49 of the 52 competencies. Individual

panellist responses are presented in Table 5.

Table 5 *Phase One - Round Three Results of the expert panels 3rd questionnaire*

Competencies	Panellists					Mode	Agreement
	1	2	4	6	7		
Group 1 Elementary Computer Use							
1.1 Demonstrate knowledge of the keyboard layout	5	5	4	5	5	5	100%
1.2 Demonstrate knowledge of the Graphic User Interface	5	5	4	5	5	5	100%
1.3 Demonstrate the ability to turn computer on/off	5	4	4	5	5	5	100%
1.4 Demonstrate the ability to format a floppy disk	5	4	4	5	5	5	100%
1.5 Recognise there are different types of operating systems	4	4	4	4	5	4	100%
1.6 State the difference between client/server and desk top stand alone programmes	5	4	3	4	5	5	80%
1.7 Recall the meaning of computer terminology	5	5	4	5	5	5	100%
1.8 Demonstrate the ability to use various pointer devices - mouse, light pen, touch screen roller ball	4	5	4	5	5	5	100%
1.9 Recognise compatibility issues related to hardware and data	4	4	3	4	5	4	80%
1.10 Demonstrate the ability to obtain a printout of a file	5	5	4	5	5	5	100%
1.11 Demonstrate the ability to clear printer jams	5	5	2	4	5	5	80%
1.12 Demonstrate the ability to change a printer toner or ink cartridge	5	5	4	4	5	5	100%
1.13 Demonstrate knowledge of how to access files or folders on both hard and floppy disk drives	5	5	4	5	5	5	100%
1.14 Demonstrate knowledge of how to create folders or directories	4	4	4	4	5	4	100%
1.15 Demonstrate the ability to save files on a disk drive	5	5	5	5	5	5	100%
1.16 Demonstrate knowledge of what a spreadsheet does	5	5	5	4	5	5	100%
1.17 Demonstrate knowledge what a word processor does	5	5	5	5	5	5	100%
1.18 Describe the function of video/sound cards	4	4	3	2	4	4	60%

Table 5 Phase One - Round Three (continued) Results of the expert panels 3rd *questionnaire*

Competencies		Panellists					Mode	Agreement
		1	2	4	6	7		
Group 2 Commercially Available Software								
2.1	Recognise which word processing program they use most often	5	5	4	5	5	5	100%
2.2	Demonstrate the ability to install an "off the shelf program" onto a hard drive	5	4	4	4	*	4	80%
2.3	Demonstrate the ability to use a word processor with accuracy and speed	5	5	5	5	4	5	100%
2.4	Demonstrate the ability to use spreadsheets	4	5	4	4	4	4	100%
2.5	Demonstrate the ability to use a relational database	4	4	1	4	4	4	80%
2.6	Demonstrate the ability to use a statistical program	4	4	1	4	5	4	80%
2.7	Demonstrate the ability to use graphics presentation programs	4	5	4	5	5	5	100%
2.8	Describe what scheduling packages are able to do	4	4	5	4	5	4	100%
2.9	Examine the worth of the hardware or software	4	5	5	4	5	5	100%
Group 3 Information transmission and retrieval								
3.1	Describe the use of network login procedures	5	4	4	5	5	5	100%
3.2	Demonstrate the ability to communicate using email	5	5	5	5	5	5	100%
3.3	Demonstrate the ability to access information using Internet	5	5	5	5	5	5	100%
3.4	Describe the use of local computer networks	5	4	4	5	5	5	100%
3.5	Apply search techniques to target a search, including Boolean operators i.e. and, or, not	5	5	5	5	5	5	100%
3.6	Demonstrate knowledge of how to ask the right questions	4	5	5	5	5	5	100%
3.7	Distinguish the difference between data and information	4	5	5	5	4	5	100%
3.8	Use collegial networking	5	5	5	5	5	5	100%
3.9	Demonstrate the ability to complete a literature search using a data base (e.g. CINAHL or MEDLINE)	5	5	5	5	5	5	100%
3.10	Demonstrate the ability to use electronic resources to locate current information on nursing problems	5	5	5	5	5	5	100%
3.11	Question what is presented to gain knowledge of functionality and mastery requirements	4	5	4	4	5	4	100%

Table 5
Phase One - Round Three (continued) Results of the expert panels 3rd
questionnaire

Competencies	Panellists					Mode	Agreement
	1	2	4	6	7		
Group 4 Data Protection							
4.1 Appreciate opportunities and challenges that informatics brings to health care - security, privacy, confidentiality	4	5	5	5	5	5	100%
4.2 Analyse issues of privacy and confidentiality of information	5	5	5	5	5	5	100%
4.3 Recognise the need for standards affecting development of electronic patient records	4	5	5	5	5	5	100%
4.4 Use strategies designed to maintain patient confidentiality and data integrity	5	5	5	5	5	5	100%
Group 5 Knowledge of Health Care Monitoring Systems.							
5.1 Demonstrate an elementary knowledge of telemetry, telecommunications and system applications that can support clinical practice	2	4	5	2	5	2	60%
5.2 Describe use of a hospital information system	5	5	4	5	5	5	100%
5.3 Demonstrate the ability to access a hospital information system	5	5	*	5	5	5	100%
5.4 Discuss the types of (Health Management) information systems a nurse may encounter	5	5	2	5	5	5	80%
5.5 Describe the basic processes involved in, for example, charting a medication in an automated system	5	5	3	5	5	5	80%

Table 5
*Phase One - Round Three (continued) Results of the expert panels 3rd
questionnaire*

Competencies	Panellists					Mode	Agreement
	1	2	4	6	7		
Group 6 Implications of information technology use to the nursing profession							
6.1 Identify the various career tracks taken by nursing informaticians and importance of these roles to the advancement of practice and development of clinical applications to support end users	2	4	4	2	4	4	60%
6.2 Critique the integration of technology and the impact of reengineering and restructuring on roles in all aspects of wellness and disease state management	4	4	5	4	5	4	100%
6.3 Describe what computers can and cannot do at the present and the potential changes likely to be caused by computer use	4	5	5	4	5	5	100%
6.4 Recognise language and the need for consistency in describing nursing actions	5	4	5	5	5	5	100%
6.5 Critically analyse the changes occurring as a result of an increased use of informatics	4	4	5	4	5	4	100%
6.6 Recognise the need for utilising available technology	5	4	3	4	5	5	80%

1* Missing data – One panellist did not respond [5.3]

2. Because previous round responses differentiated between undergraduate and newly registered nurses and the third round combined them, the previous responses provided by panellists 3 and 5 who chose not to respond to this round were not carried forward.

5.2.7 Round Three Competencies On Which Consensus Was Not Reached

Consensus was set at 75% agreement. While all competencies were deemed to be relevant, three competencies achieved only 60% agreement. A decision was made by the author to retain these competencies for inclusion in Phase Two questionnaires. The rationale for this decision was based on the fact that a mode of 4 was achieved for each of the competencies, signifying that although consensus was absent a majority of the panel considered these competencies to be relevant. *Demonstrate ability to describe the function of video/sound cards* (which was subsequently rejected by both the educators and

newly registered nurses) and also for the competency, *General knowledge of the various career tracks taken by nursing informaticians and importance of these roles to the advancement of practice and development of clinical applications to support end users* (subsequently accepted by the educators and newly registered nurses).

From the responses to the third competency, *Knowledge of telecommunications, artificial intelligence, robotics and system applications that can support clinical practice* it was apparent that there was sufficient polarisation of responses for and against the inclusion of this competency to necessitate rewording of the competency to *Possess an elementary knowledge of telemetry, telecommunications, and system applications that can support clinical practice,* then allow further deliberation about the competency to occur during the Phase Two of the study (subsequently accepted by the educator and newly registered nurses panels). The decision to include these competencies was supported by both the educator and newly registered nurse panels reaching consensus that two of these three competencies were relevant.

5.2.8 Round Three Responses Made About Group 1 Competencies

While there was agreement that the competencies in this group were valid, two of the experts stated that they believed that nurse educators should not need to teach these competencies. The opinions of these experts were that the competencies should be a prerequisite to

undergraduate study or that the competencies should be mastered by independent study.

5.2.9 Round Three Responses Made About Group 2 Competencies

The types of software the experts identified nurses would use were mostly of a generic type readily available for both the commercial and the home user. Although experts agreed that knowledge of commercial software competencies was relevant, it was suggested that undergraduates might not require as deep a level of knowledge as registered nurses.

5.2.10 Round Three Responses Made About Group 3 Competencies

There was total agreement about the need to be able to communicate using email, and to access information using the Internet, the use of networking to share knowledge and the ability to access a hospital information system.

5.2.11 Round Three Responses Made About Group 4 Competencies

Experts were in complete agreement that competencies within this group were relevant.

5.2.12 Round Three Responses Made About Group 5 Competencies

The experts could not reach agreement about the need to know about the use of artificial intelligence, or robotics within healthcare. In the opinion of one expert, this competency was suitable for advanced nurse practitioners and its application confined to particular areas of specialist nursing. The use of artificial intelligence and robotics (as identified by a panel of predominately American nurses) may not

always apply to nursing in either Australia or New Zealand and as the composition of the expert panel reflected a variety of nursing backgrounds. Therefore the lack of agreement could be reasonably expected. Less strength of agreement was evident in the need for nurses to analyse changes resulting from informatics use as this competency was rated at 80% agreement while the other competencies in the group were rated at 100% agreement.

5.2.13 Round Three Responses Made About Group 6 Competencies

Experts were unanimous about the relevance of nurses' need to develop an appreciation of the effects that the use of information and communication technologies may have on nursing both now and how that may affect nursing in the future. Two of five experts disagreed that it was necessary for undergraduates or newly registered nurses to know about the various career tracks and roles taken by nursing informaticians.

5.2.14 Comments Provided With Responses to Questionnaire 3

Questionnaire response again illuminated the difference in the depth of knowledge required by registered nurses compared to undergraduates. Competencies that addressed the use of statistical programmes, the ability to determine the worth of the hardware or software, together with general knowledge of the various career tracks taken by nursing informaticians were seen as necessary, but only at a basic level for undergraduates. One expert suggested that it 'would take some time for someone in practice to develop a deeper understanding of the significance of the role of a nursing

informaticians', while another suggested the same for the competency that addressed the integration of technology and the impact of reengineering and restructuring on roles in all aspects of wellness and disease state management.

Another expert stated the belief that "the use of collegial networking is a necessity to survival in today's corporate and managed care milieu. It's a spin on the 'who you know' not what you know phenomena". This expert went on to say that "most nurses are NOT good networkers by personality type alone and this could be a fabulous addendum to curriculum development ...".

Experts emphasised the need for undergraduate nurses to be aware of more advanced practice and to use nurses with advanced knowledge. "The [undergraduate] nurses need to understand that nursing needs to take the lead in how informatics is shaped to prevent non-nurse informaticians determining our profession's future." The same expert also considered that a universal language to describe and measure nursing was also important, suggesting the integration of competencies into assignments, communication methodologies and research initiatives as well as in practicum settings.

What was noticeable in the statements made by experts was that there was a belief that all students of nursing need to demonstrate the competencies. This position was tempered by the need to differentiate the depth to which they are taught.

5.2.15 Reliability and Validity of the Third Round Questionnaire

As the composition of the third questionnaire of Phase One was to be used in Phase Two, Cronbach's alpha, a test for internal consistency was applied with the result of 0.88, signifying that the questionnaire was reliable as a scale with an alpha value greater than 0.70 is considered to be acceptable (de Vaus, 1991).

Content validity was achieved in view of the fact that, following three rounds of questionnaires, the expert panel reached consensus on fifty of the fifty-three competencies derived from their combined responses to the first questionnaire.

5.2.16 Summary Of Phase One

The aims of this phase of the study have been met. A panel of experts was convened. Demographic data showed the panel had enough years of experience to enable the panel to be accepted as experts and they had been able to reach consensus on a list of competencies they felt had relevance to both undergraduate nursing studies and newly registered nurse practice. This list of competencies formed a questionnaire that had proven reliability and validity, ready for use in Phase Two of the study.

5.3 PHASE TWO

5.3.1 Introduction

The purpose of this phase was to gather data in the form of responses about the relevance of the competencies identified in Phase One, from two further rounds of questionnaires. Two separate panels

were used, one comprising solely of Australian and New Zealand nurse educators and the other Australian and New Zealand nurses who had gained their registration two to three years prior to the study and were, for the purpose of the study, described as newly registered nurses. Data generated by each panel could then be analysed to establish if there was a relationship between the opinions of the respective panels. Identical questionnaires were therefore sent to both panels for the first round, and for the second round the questionnaire format basically remained unchanged except that each panel was provided with new competencies that had been identified from their own responses to the first round.

5.3.2 The Educator Panel

The educator panel comprised of the two educators who expressed earlier an interest in contributing to the study and nine participants who were recruited in response to letters asking the forty-four Heads of Schools of Nursing to inform their staff of the study. Contact with all participants in the educator panel was by e-mail. A total of five Australian and seven New Zealand nurse educators (n = 12) became panellists and completed the first round of Phase Two.

Panellist attrition was 50% leaving three New Zealand and three Australian educators who completed the second questionnaire (n = 6). Two educators indicated they were unable to continue due to personal reasons and the remaining four non-responders ceased contact

although each was sent a reminder that their responses were awaited. This was not unexpected as Delphi studies are susceptible to such attrition as a consequence validity of responses to the second question was not so robust as that of the previous responses from the educators. The educators' responses to both rounds of questionnaire are presented in Table 6 to Table 12.

5.3.3 Educators' Responses To Round One

Educators reached consensus on fifteen of the seventeen competencies contained in the group **Elementary Computer Use**. Consensus was not achieved on the competencies (1.18) *Describe the function of video/sound cards* and (1.9) *Recognise compatibility issues related to hardware and data* as they reached only 57% and 68% agreement respectively.

Of the nine items contained in the competency group **Use of Commercially Available Software**, the panel reached consensus on six. The three competencies which the panel did not reach consensus because each had a low agreement level were, (2.2) *Demonstrate the ability to install an "off the shelf program" onto a hard drive* and (2.9) *Examine the worth of hardware or software*; each of which received an agreement level of 50%, the third competency (2.8) *Describe what scheduling packages are able to do* had an agreement level of 58%.

Consensus was established for the all competencies contained in the groups **Data Protection** and **Knowledge Of Health Care Monitoring Systems.**

Only two of the six competencies contained in the competency group **Implications of information technology use in the nursing profession** did not reach consensus. (6.1) *Identify the various career tracks taken by nursing informaticians and importance of these roles to the advancement of practice and development of clinical applications to support end users* had an agreement of 58% while (6.2) *Critique the integration of technology and the impact of reengineering and restructuring on roles in all aspects of wellness and disease state management* had an agreement of 67%.

5.3.4 Amendments And Additions Suggested By The Educator Panel

The fact that not all panel members were clear about the meaning of the competency (3.11) *Question what is presented to gain knowledge of functionality and mastery requirements* was reflected in the low agreement rate of 67%. In recognition of panellists' comments, the competency was removed and replaced for the second round with the wording (3.11) *Critically analyse the authority and validity of data.*

Educators identified two additional competencies as worthy of inclusion in the second round. These were (6.8) *Act as advocate for those without technical expertise or the techno phobic* and

(6.7) Discuss the ethical/legal implications of informatics in the health sector.

Comments received from panellist feedback suggested that the two competencies *(1.16) Demonstrate knowledge of what a spreadsheet does* and *(1.17) Demonstrate knowledge of what a word processor does* were redundant as the meaning they inferred would be covered by the competencies *(2.4) Demonstrate the ability to use spreadsheets* and *(2.3) Demonstrate the ability to use a word processor with accuracy and speed.* There was considerable response to the latter competency. While the expert panellist who suggested the competency believed both speed and accuracy were necessary in carrying out word processing in the clinical setting educators questioned the use of speed, prompting one educator to comment "what are we training nurses for?" This resulted in the educators being asked if they considered speed in entering data to be of any relevance. If they considered it was not, educators were asked if the word 'speed' should be retained. This is discussed further following the presentation of Table 7.

5.3.5 Educators' Responses To Round Two

At the conclusion of the second round, the Educator panel members reached consensus on 47 competencies. These included 46 of the 52 competencies identified from Phase One. Of the two competencies suggested by this panel following round one, *(6.7) Discuss the ethical/legal implications of informatics in the health*

sector (mode 5 and agreement of 100%) alone was accepted by the panel.

Of the competency statements common to both rounds of questionnaire, consensus was established for three competencies that increased in the level of agreement between rounds. The three were (1.9) *Recognise compatibility issues related to hardware and data* (moved from 67% to 83% agreement); (6.2) *Critique the integration of technology and the impact of reengineering and restructuring on roles in all aspects of wellness and disease state management* (moved from 67% to 75% agreement) and (6.1) *Identify the various career tracks taken by nursing informaticians and importance of these roles to the advancement of practice and development of clinical applications to support end users* (moved from 58% to 75% agreement).

Educators did not reach consensus on seven competencies. Two competencies (1.16) *Describe the use of spreadsheet software* and (1.17) *Describe the use of word processor software* identified by panellist feedback from round one as redundant were rejected as agreement that they were relevant fell to 67% and 50% respectively. The two competencies (1.18) *Describe the function of video/sound cards* (58% agreement) and (2.9) *Examine the worth of hardware or software (50% agreement)* did not reach consensus in either of the two rounds of the questionnaire. The competency (2.2) *Demonstrate the ability to install an "off the shelf program" onto a hard drive* did

increase in the level of agreement (50% to 67%) between rounds but not sufficiently to enable relevance to be demonstrated. The new competency, (6.8) *Act as advocate for those without technical expertise or the techno phobic* (mode 4 and agreement 67%) was also rejected.

The following tables 6 to 12 inclusive show the aggregated responses grouped into (Strongly Agree and Agree) Undecided, and (Disagree and Strongly Disagree) together with the mode and the percentage agreement for each of the two rounds.

The members of the educators' panel reached consensus that fourteen of the seventeen competencies in group one were relevant. The panel responses showed that only one competency, (1.9) *Recognise compatibility issues related to hardware and data* increased in agreement from 67% in the first round to 87% in the second round. Conversely, as can be seen from Table 6, there was a decrease in the percentage agreement for (1.16) *Describe the use of spreadsheet software* and (1.17) *Describe the use of word processor software*. The response to (1.18) *Describe the function of video/sound cards* confirmed their opinion that this was not necessary.

Table 6 *Phase Two - Round Two Educators' Responses*
Group 1 Elementary Computer Use

		1st Questionnaire					2nd Questionnaire				
		Strongly Agree or Agree	Undecided	Disagree or Strongly Disagree	Mode	Agreement	Strongly Agree or Agree	Undecided	Disagree or Strongly Disagree	Mode	Agreement
1.1	Demonstrate knowledge of the keyboard layout	12			5	100%	12			5	100%
1.2	Demonstrate knowledge of the Graphic User Interface	10		2	5	83%	11	1		5	92%
1.3	Demonstrate the ability to turn a computer on/off	12			5	100%	12			5	100%
1.4	Demonstrate the ability to format a floppy disk	11	1		5	92%	11	1		4	92%
1.5	Recognise there are different types of operating systems	11	1		4	92%	11	1		4	92%
1.6	State the difference between client/server and desk top stand alone programmes	11	1		4	92%	11	1		4	92%
1.7	Recall the meaning of terminology associated with elementary computer use	12			5	100%	12			5	100%
1.8	Demonstrate ability to use various pointer devices - mouse, light pen, touch screen roller ball	12			5	100%	12			5	100%
1.9	Recognise compatibility issues related to hardware and data	8	2	2	4	67%	10	1	1	4	83%
1.10	Demonstrate the ability to obtain a printout of a file	12			5	100%	12			5	100%
1.11	Demonstrate the ability to clear a printer paper jam	12			4	100%	12			4	100%
1.12	Demonstrate the ability to change a printer toner or ink cartridge	10	1	1	4	83%	10	1	1	4	83%
1.14	Demonstrate the ability to create folders or directories	11	1		5	92%	12			5	100%
1.15	Demonstrate the ability to save files on a disk drive	12			5	100%	12			5	100%
1.16	Describe the use of spreadsheet software	10		2	4	83%	8		4	4	67%
1.17	Describe the use of word processor software	10	1	1	5	83%	6	1	5	5	50%
1.18	Describe the function of video/sound cards	7	3	2	4	58%	7	3	2	4	58%

(panel size n = 12)

The opinion of one educator was that "the competencies contained in this grouping could even be pre-entry criteria developed

through an introductory course. With the increase in technology availability in the school systems many students will have these skills in the years to come". Another educator queried nurses needing know about printer maintenance believing such knowledge was applicable to a technician's area of work.

Table 7
Phase Two - Round Two Educators' Responses
Group 2 Commercially Available Software

		1ˢᵗ Questionnaire					2ⁿᵈ Questionnaire				
		Strongly Agree or Agree	Undecided	Disagree or Strongly Disagree	Mode	Agreement	Strongly Agree or Agree	Undecided	Disagree or Strongly Disagree	Mode	Agreement
2.1	Recognise which word processor they use most often	12			5	100%	12			5	100%
2.2	Demonstrate the ability to install an "off the shelf program" onto a hard drive	6	4	2	4	50%	8	3	1	4	67%
2.3	Demonstrate the ability to use a word processor with accuracy	10	2		4	83%	9	3		4	83%
2.4	Demonstrate the ability to use spreadsheets	10		2	4	83%	10		2	4	83%
2.5	Demonstrate the ability to use a relational database	9	1	2	4	75%	9	2	1	4	75%
2.6	Demonstrate the ability to use a statistical program	9	1	2	4	75%	10		2	4	83%
2.7	Demonstrate the ability to use graphics presentation programs	9	1	2	4	75%	10		2	4	83%
2.8	Describe what scheduling packages are able to do	7	3	2	4	58%	7	3	2	4	58%
2.9	Examine the worth of hardware or software	6	3	3	3	50%	6	2	4	5	50%

(panel size n = 12)

Educators reached consensus on six of the nine competencies in this group. The inclusion of the speed as part of the ability to use a word processor was rejected.

One educator did not consider the competency (2.2) *Demonstrate ability to install an 'off the shelf program' onto a hard drive* as "really applicable to beginning practitioner's use of clinical software, however is fairly basic skill for home computer use" while another believed it to be a "useful skill to have, especially with stand alone PCs but in organisations with networks, this is a technician function".

Table 8

Phase Two - Round Two Educators' Responses
Group 3 Communication and Information retrieval

		1st Questionnaire					2nd Questionnaire				
		Strongly Agree or Agree	Undecided	Disagree or strongly disagree	Mode	Agreement	Strongly Agree or Agree	Undecided	Disagree or strongly disagree	Mode	Agreement
3.1	Describe the use of network login procedures	11		1	4	92%	11		1	4	92%
3.2	Demonstrate ability to communicate using e-mail	12			5	100%	12			5	100%
3.3	Demonstrate the ability to access information using the Internet	12			5	100%	12			5	100%
3.4	Describe the use of local network computers	10	2		4	75%	11		1	4	83%
3.5	Apply search techniques to target a search, including Boolean operators i.e. and, or, not	11	1		5	92%	11	1		4	92%
3.6	Demonstrate knowledge of how to ask the right questions *	10	1		5	83%	10	1		5	83%
3.7	Distinguish the difference between data and information	11	1		5	92%	11	1		4	92%
3.8	Use collegial networking	11	1		5	92%	12			5	92%
3.9	Demonstrate ability to complete a literature search using a data base (e.g. CINAHL or MEDLINE)	12			5	100%	12			5	100%
3.10	Demonstrate ability to use electronic resources to locate current information on nursing problems	12			5	100%	12			5	100%
3.11	Question what is presented to gain knowledge of functionality and mastery requirements **reworded for second round as** Critique the authority and validity of data *	8	2	1	5	67%	9	2		4	86%

(panel size n = 12)

* Missing data. One panellist did not provide a response.

Consensus, indicated by 86% to 100% agreement, was established on all the eleven competencies within this group. The panel accepted 3.11 *Critique the authority and validity of data* following rewording of the competency to enhance clarity of meaning.

Table 9

Phase Two - Round Two Educators' Responses

Group 4 Data Protection

		1st Questionnaire				2nd Questionnaire			
		Strongly Agree or Agree / Undecided / Disagree or Strongly Disagree	Mode	Agreement		Strongly Agree or Agree / Undecided / Disagree or Strongly Disagree	Mode	Agreement	
4.1	Assess opportunities and challenges that informatics brings to health care - security, privacy, confidentiality	12	4	100%		12	4	100%	
4.2	Analyse issues of privacy and confidentiality of information	12	4	100%		12	5	100%	
4.3	Recognise the need for standards affecting development of electronic patient records	12	4	100%		12	4	100%	
4.4	Use strategies designed to maintain patient confidentiality and data integrity	12	5	100%		12	5	100%	

(panel size n = 12)

Responses for Group 4 competencies showed the complete agreement for each. This grouping was the only one to have all competencies reach such a strong consensus.

Table 10

Phase Two - Round Two Educators' Responses
Group 5 Knowledge of Health Care Monitoring Systems

		1ˢᵗ Questionnaire					2ⁿᵈ Questionnaire				
		Strongly Agree or Agree	Undecided	Disagree or Strongly Disagree	Mode	Agreement	Strongly Agree or Agree	Undecided	Disagree or Strongly Disagree	Mode	Agreement
5.1	Demonstrate elementary knowledge of telemetry, telecommunications, and system applications that can support clinical practice *	9	1	1	4	75%	9	1	1	4	75%
5.2	Describe use of hospital information system	12			4	100%	12			4	100%
5.3	Demonstrate the ability to access a hospital information system	12			4	100%	12			4	100%
5.4	Discuss the types of health management information systems a nurse may encounter	12			4	100%	11	1		4	92%
5.5	Describe basic processes involved in, for example, charting a medication in an automated system *	9		2	4	75%	9		2	4	75%

(panel size n = 12)

* - missing data. One panellist did not give a response to this competency.

Competencies in Group 5 showed stability of results over the two rounds of questionnaires but had a wider spread in degree of agreement. Educators reached consensus about all five competencies in this group.

Educators were aware that some nurses might not need to utilise monitoring systems. The competency (5.1) *Demonstrate elementary knowledge of telemetry, telecommunications, and system applications that can support clinical practice* was seen as specific to certain areas of specialised nursing, prompting one educator to comment:

This technology is usually very specific to clinical areas (i.e. telemetry and cardiology), and therefore not appropriate for all nurses to know all about it. However, I believe a basic understanding of the use of technology is to a certain extent transferable to different settings/different equipment.

Being able to access a hospital information system or utilise automated charting were also considered to be site specific. Educators noted that some health care facilities chose not to allow students the use their information systems nor was automated charting always available, so students may not get the opportunity to demonstrate competency.

Table 11

Phase Two - Round Two Educators' Responses
Group 6 Implications of information technology use to the nursing profession

		1st Questionnaire					2nd Questionnaire				
		Strongly Agree or Agree	Undecided	Disagree or Strongly Disagree	Mode	Agreement	Strongly Agree or Agree	Undecided	Disagree or Strongly Disagree	Mode	Agreement
6.1	Identify the various career tracks taken by nursing informaticians and importance of these roles to the advancement of practice and development of clinical applications to support end users	7	4	1	4	58%	9	2	1	4	75%
6.2	Critique the integration of technology and the impact of reengineering and restructuring on roles in all aspects of wellness and disease state management	8	1	3	4	67%	9	1	2	4	75%
6.3	Describe what computers can and cannot do at the present and the potential changes likely to be caused by computer use	12			4	100%	12			4	100%
6.4	Recognise language and the need for consistency in describing nursing actions	12			4	100%	12			4	100%
6.5	Critically analyse the changes occurring as a result of an increased use of informatics	12			5	100%	12			4	100%
6.6	Recognise the need for utilising available technology*	11			5	92%	11			5	92%

(panel size n = 12)
* - missing data, one panellist did not provide a response.

Agreement on two of the competencies in this group, (6.1) *Identify the various career tracks taken by nursing informaticians and importance of these roles to the advancement of practice and development of clinical applications to support end users* and, (6.2) *Critique the integration of technology and the impact of reengineering and restructuring on roles in all aspects of wellness and disease state management* was not reached until the second round.

The relevance of the competency (6.1) *Identify the various career tracks taken by nursing informaticians and importance of these roles to the advancement of practice and development of clinical applications to support end users* while supported by most of the educator panel, caused one educator to express caution about the relevance of the competency to New Zealand nurses given limited numbers of informatics specialists in that country while a second also commented that nurses "currently [had] limited exposure to people involved in Informatics therefore would not expect high knowledge in this area." but another educator considered all competencies contained in category six should be given priority in postgraduate curricula stating:

> I believe that nurses also need competence in arguing for IT funding e.g., how to construct a cost benefit analysis. There is also a need to identify "nurse sensitive" data and information. This is an extension of the competency of differentiate data from information, mentioned above. It is data that can be directly influenced by the actions of nurses. For example, nurses are primarily responsible for assisting a client to move from a state of dependence to a state of independence. Acuity /dependency data is collected in various forms, but is used to justify staffing levels. It could be used as a clinical decision support tool enabling a nurse to judge the progression of a particular patient towards independence when compared with the average profile of patients with the same diagnosis. There are other examples but the point of my comments is that students should have competency in viewing data through a nursing lens.

Feedback from another expert expressed the need for all nurses to be aware of international initiatives to standardise nursing language.

Table 12

Phase Two - Round Two Educators' Responses

New Competencies

		2nd Questionnaire				
		Strongly Agree or Agree	Undecided	Disagree or Strongly Disagree	Mode	Agreement
6.8	Act as advocate for those without technical expertise or the techno phobic	4	1	1	4	67%
6.7	Discuss the ethical/legal implications of informatics in the health sector.	6			5	100%

(panel size n = 6)

Educators reached 100% agreement that (6.7) *Discuss the ethical/legal implications of informatics in the health sector* had relevance to undergraduate curriculum however (6.8) *Act as advocate for those without technical expertise or the techno phobic* had a mode of 4 but reached only 67% agreement, so was rejected.

The aim of identifying competencies that, in the opinion of the educator panel, should be addressed in the undergraduate curriculum had now been established. They will be discussed further after the presentation of responses made by the newly registered nurses panel.

5.3.6 The Newly Registered Nurse Panel

Correspondence with the newly registered nurse panel was carried out at the same time as that with the educators. Not all newly registered nurses had access to e-mail so contact was carried out by air and surface mail and when necessary by the researcher instigating contact by telephone when clarification of responses was required. Three of the participants were Australian, eight were New Zealand

nurses and one had work experience in both countries. The response rate for round two was 75%. Panellist attrition left five New Zealanders and the three Australian nurses (n=8) who completed the second round. The four nurses who did not respond to the second round were contacted by post or telephone but still did not return their completed questionnaire. The panels' combined responses to both rounds of the questionnaire are presented in Table 14 to Table 20 inclusive, below.

The newly registered nurses were all practicing in a hospital setting, though as Table 13 shows, there was a variety of areas of practice.

Table 13
Work situation of the newly registered nurses

Area of Nursing	Number who completed the first questionnaire	Number who completed the second questionnaire
Medical	4	3
Surgical	3	2
Mental health	3	1
Prison	1	1
Elder care	1	1

5.3.7 Newly Registered Nurse Responses Following Round One

The newly registered nurse group reached consensus that thirty-three competencies identified by the expert panel were relevant and nineteen were not. Additions and alterations at the suggestion of the panellists resulted in two new competencies (1.19) *Demonstrate ability to send a fax* and (1.20) *Demonstrate ability to use computer based learning programs*. Both were included in the second round.

5.3.8 Amendments And Additions Suggested By The Newly Registered Nurse Panel

The competency (3.11) *Question what is presented to gain knowledge of functionality and mastery requirements* was rejected as relevant with an agreement rate of 67%, identical to that recorded by the educator panel. To ensure the panel responses could be compared, the competency was removed and replaced for the second round with the wording (3.11) *Critically analyse the authority and validity of data.*

5.3.9 Newly Registered Nurses' Responses To Round Two

Between rounds one and two there was no change in the number of competencies identified by the expert panel on which the newly registered nurses panel reached consensus. In addition, consensus was reached on the two new competencies suggested by panellists following the first round.

128

Table 14

Phase Two - Round Two Newly Registered Nurses' Responses
Group 1 Elementary Computer Use

		1st Questionnaire					2nd Questionnaire				
		Strongly Agree or Agree	Undecided	Disagree or Strongly Disagree	Mode	Agreement	Strongly Agree or Agree	Undecided	Disagree or Strongly Disagree	Mode	Agreement
1.1	Demonstrate knowledge of the keyboard layout	12			5	100%	12			5	92%
1.2	Demonstrate knowledge of the GUI (Graphic User Interface)*	5	5		3	58%	8	2	1	4	67%
1.3	Demonstrate the ability to turn a computer on/off	12			5	100%	12			5	100%
1.4	Demonstrate the ability to format a floppy disk	7	2	3	4	58%	8	1	3	4	68%
1.5	Recognise there are different types of operating systems	11	1		4	92%	12			4	92%
1.6	State the difference between client/server and desk top stand alone programmes	6	4	2	4	50%	8	1	3	4	67%
1.7	Recall the meaning of terminology associated with elementary computer use	9	3		4	75%	9	2	1	4	75%
1.8	Demonstrate ability to use various pointer devices - mouse, light pen, touch screen roller ball	12			4	100%	11	1		4	92%
1.9	Recognise compatibility issues related to hardware and data	3	8	1	3	25%	6	4	2	3	50%
1.10	Demonstrate ability to obtain a printout of a file	12			4	100%	11		1	4	92%
1.11	Demonstrate ability to clear a printer paper jam	11	1		5	92%	11	1		5	92%
1.12	Demonstrate ability to change a printer toner or ink cartridge	10	2		4	83%	10	2		4	83%
1.14	Demonstrate ability to create folders or directories	10	1	1	4	83%	10	1	1	4	83%
1.15	Demonstrate ability to save files on a disk drive	11		1	5	92%	11		1	5	92%
1.16	Describe the use of spreadsheet software*	4	6	2	3	33%	5	4	2	1	25%
1.17	Describe the use of word processor software*	8	3	1	4	67%	4	3	4	1	25%
1.18	Describe the function of video/sound cards	3	5	4	3	25%	2	5	5	1	8%

(panel size n = 12)
* - missing data – one panellist did not provide a response.

Various members of the newly registered nurse panel considered

the ability to carry out certain competencies within **Group 1**

Elementary Computer Use to be important. As one Newly

Registered Nurse commented, knowledge of the keyboard layout is "essential, especially when having to complete work quickly between patients, procedures or handover". It was also considered essential to know how to turn a computer on or off as various models of computer differed in design and it was considered important to recognise there are different types of operating systems as each hospital may differ in the computer systems used. In contrast, the panel did not reach agreement about the relevance of just describing what the use of spreadsheet and word processing software entails. Nor was it considered relevant for the newly registered nurses to know about video or sound cards.

While competencies related to the use of printers were rated between 83% to 93% agreement, nurses did comment that they expected that during normal working hours, technician help could be used to clear a printer when paper jams occurred or when replacement of printer ink cartridges became necessary.

Some newly registered nurse panellists had not had occasion to format a floppy disk as part of their practice needs, nor was it considered relevant to know that there is a difference between client server and desk top stand alone programmes or to recognise compatibility issues related to hardware and software.

Table 15

Phase Two - Round Two Newly Registered Nurses' Responses
Group 2 Commercially Available Software

		1st Questionnaire					2nd Questionnaire				
		Strongly Agree or Agree	Undecided	Disagree or Strongly Disagree	Mode	Agreement	Strongly Agree or Agree	Undecided	Disagree or Strongly Disagree	Mode	Agreement
2.1	Recognise which word processor they use most often	10	1	1	4	83%	10	1	1	4	83%
2.2	Demonstrate the ability to install an "off the shelf program" onto a hard drive	5	3	4	2	42%	6	1	5	2	42%
2.3	Demonstrate the ability to use a word processor with accuracy and speed	8	2	2	4	67%	8	2	2	4	67%
2.4	Demonstrate the ability to use spreadsheets	5	3	4	4	42%	4	2	6	1	33%
2.5	Demonstrate the ability to use a relational database	3	7	2	3	25%	6	4	2	4	50%
2.6	Demonstrate the ability to use a statistical program	6	3	3	4	50%	7	3	2	4	50%
2.7	Demonstrate the ability to use graphics presentation programs	7	2	3	4	58%	7	1	4	4	58%
2.8	Describe what scheduling packages are able to do	1	8	3	3	8%	4	4	4	4	33%
2.9	Examine the worth of hardware or software	5	5	2	3	42%	3	4	5	2	25%

(panel size n = 12)

This panel did not consider the majority of the competencies in

Group 2 Commercially Available Software to have any relevance to

their practice. The newly registered nurse panellists were all hospital

based and consequently it is considered that their responses reflected

this. Only one panellist recognised that this group of competencies

may have relevance to a practice nurse. As hospital based practitioners

none of the panel of newly registered nurse had needed to install an

'off the shelf program' onto a hard drive, expecting again that

technician help would be available.

Like the educator panel, the word processing competency produced concern about the inclusion of the word "speed". One nurse commented, "speed (the word) [is] often associated with rushing or inaccuracy. While working quickly [is] beneficial, [it] is better to 'get it right' the first time".

Spreadsheet use was not considered a requirement of the panel members, prompting one panellist to comment on her ability to use a spreadsheet, "I can't and don't know any other nurses who have this ability" although there was recognition from other panellists that, for some more experienced nurses such as those undertaking research or applying for funding for an item, it would be a useful competency. The use of a statistical program was also considered irrelevant as was the use graphics presentation programs. As one nurse wrote, "most nurses I know do not have this ability or feel they need it".

Although (2.5) *Demonstrate the ability to use a relational database* did increase in the level of agreement to 50% between rounds, the panel did not reach consensus on the relevance of the competency to newly registered nurses. One panellist' s response was that "Usually this ability can be quickly picked up when working in a setting that has this database" while another panellist recognised that the competency may have relevance to a practice nurse or to an infection control nurse.

Responses to the competency (2.9) *Examine the worth of hardware or software* produced comments that nurses felt they were

132

not consulted, "We don't often get a choice which hardware or software is available and have to use it regardless" and from another nurse, "Its always nice to feel included when trialing new programmes rather than being told, so if we could help or make [it] more user friendly we'd probably adopt it better".

Table 16

Phase Two - Round Two Newly Registered Nurses' Responses
Group 3 Information transmission and retrieval

		1st Questionnaire					2nd Questionnaire				
		Strongly Agree or Agree	Undecided	Disagree or Strongly Disagree	Mode	Agreement	Strongly Agree or Agree	Undecided	Disagree or Strongly Disagree	Mode	Agreement
3.1	Understand the use of network login procedures	9	2	1	4	75%	9	2	1	4	75%
3.2	Demonstrate ability to communicate using e-mail	10	2		4	83%	10	2		4	83%
3.3	Use the Internet to access information	11		1	4	92%	11	1		4	92%
3.4	Describe use of local network computers	7	5		4	58%	8	4		4	67%
3.5	Apply search techniques to target a search, including Boolean operators i.e. and, or, not	10	2		4	83%	10	2		4	83%
3.6	Demonstrate knowledge of how to ask the right questions	12			5	100%	12			5	100%
3.7	Distinguish the difference between data and information	11	1		4	92%	11	1		4	92%
3.8	Use collegial networking	6	5	1	4	50%	8	3	1	4	67%
3.9	Demonstrate ability to complete a literature search using a data base (e.g. CINAHL or MEDLINE)	12			5	100%	12			5	100%
3.10	Demonstrate ability to use electronic resources to locate current information on nursing problems	11	1		4	92%	11	1		4	92%
3.11	Question what is presented to gain knowledge of functionality and mastery requirements **reworded for second round as** Critique the authority and validity of data	8	4		4	67%	8	3	1	4	67%

(panel size n = 12)

Of the eleven competencies contained in **Group 3 Information Transmission and Retrieval**, the panel reached consensus that eight were relevant to their informatics practice.

Newly registered nurses did not accept the need to know about the technical aspects of networks, nor the use of collegial networking as relevant. The panel were also unable to reach consensus that the competency (3.11) *Critique the authority and validity of data* had any relevancy to their practice needs.

Group 4 Data Protection competencies showed stability in levels of agreement between both rounds with consensus being reached on all competencies associated with data protection.

Table 17 *Phase Two - Round Two Newly Registered Nurses' Responses Group 4 Data Protection*

		1st Questionnaire					2nd Questionnaire				
		Strongly Agree or Agree	Undecided	Disagree or Strongly Disagree	Mode	Agreement	Strongly Agree or Agree	Undecided	Disagree or Strongly Disagree	Mode	Agreement
4.1	Assess opportunities and challenges that informatics brings to health care - security, privacy, confidentiality	12			4	100%	12			4	100%
4.2	Analyse issues of privacy and confidentiality of information	12			5	100%	12			5	100%
4.3	Recognise the need for standards affecting development of electronic patient records	11	1		5	92%	11	1		5	92%
4.4	Use strategies designed to maintain patient confidentiality and data integrity	12			5	100%	12			5	100%

(panel size n = 12)

Comments received suggested that implicit in these competencies was an understanding that it was essential to maintain

134

confidentiality and that nurses need to be aware of the legal and

ethical concerns with these particular competencies.

Table 18

Phase Two - Round Two Newly Registered Nurses' Responses
Group 5 Knowledge of Health Care Monitoring Systems

		1st Questionnaire					2nd Questionnaire				
		Strongly Agree or Agree	Undecided	Disagree or Strongly Disagree	Mode	Agreement	Strongly Agree or Agree	Undecided	Disagree or Strongly Disagree	Mode	Agreement
5.1	Demonstrate elementary knowledge of telemetry, telecommunications, and system applications that can support clinical practice	10	2		5	83%	10	2		5	83%
5.2	Describe use of hospital information system	12			4	100%	12			4	100%
5.3	Demonstrate the ability to access a hospital information system	11	1		4	92%	11	1		4	92%
5.4	Discuss health management information systems a nurse may encounter	11	1		4	92%	11	1		4	92%
5.5	Describe basic processes involved in, for example, charting a medication in an automated system	7	4	1	4	58%	9	2	1	4	67%

(panel size n = 12)

Group 5 Knowledge of Health Care Monitoring Systems

competencies also showed stability in levels of agreement between

both rounds with consensus being reached that four of the five

competencies were relevant.

The fifth competency that addressed automated systems was not

considered relevant. It is worthwhile to note that this competency was

evaluated on whether or not the nurses had direct experience of

automated forms of charting or drug administration.

Table 19

*Phase Two - Round Two Newly Registered Nurses' Responses
Group 6 Implications of information technology use to the nursing
profession*

		1st Questionnaire					2nd Questionnaire				
		Strongly Agree or Agree	Undecided	Disagree or Strongly Disagree	Mode	Agreement	Strongly Agree or Agree	Undecided	Disagree or Strongly Disagree	Mode	Agreement
6.1	Identify the various career tracks taken by nursing informaticians and importance of these roles to the advancement of practice and development of clinical applications to support end users	9	3		4	75%	10	2		4	75%
6.2	Critique the integration of technology and the impact of reengineering and restructuring on roles in all aspects of wellness and disease state management	10	2		4	83%	10	2		4	83%
6.3	Describe what computers can and cannot do at the present and the potential changes likely to be caused by computer use	9	3		4	75%	9	3		4	75%
6.4	Recognise language and the need for consistency in describing nursing actions	11	1		5	92%	12			5	100%
6.5	Critically analyse the changes occurring as a result of an increased use of informatics	10	2		4	83%	11	1		4	92%
6.6	Recognise the need for utilising available technology	11	1		4	92%	12			4	100%

(panel size n = 12)

Consensus was reached for all the competencies in **Group 6**

Implications of Information Technology Use to the nursing

profession in both rounds.

The panel did reach consensus about the two new competencies

presented in Table 20. The first was (1.19) *Demonstrate ability to*

send a fax. One nurse considered facsimile machines to be "great for

136

discharge letters or for sending prescriptions to patient's pharmacies",

and that "it was easier and faster if a nurse does not have to rely on

others to do 'faxes' for her/him" The second competency to be

accepted was (1.20) *Demonstrate ability to use computer based*

learning that was seen by one panellist as integral to continuing

professional development.

Table 20
Phase Two - Round Two Newly Registered Nurses'
Responses to the New Competencies

		2nd Questionnaire				
		Strongly Agree or Agree	Undecided	Disagree or Strongly Disagree	Mode	Agreement
1.19	Demonstrate ability to send a fax	7		1	4	86%
1.20	Demonstrate ability to use computer based learning programmes	7	1		4	86%

(panel size n = 8)

5.3.10 Competencies Accepted By Both Panels

At the completion of the second round of questionnaires, 33 of

the original competencies identified by the expert panel in Phase One

had been accepted by both educator and the newly registered nurses

panels as relevant to undergraduate informatics curriculum and to the

practice needs of newly registered nurses. The greatest difference in

panel assessment of competency relevancy was noticeable in the

group **Commercially available software**, with educators reaching

agreement levels that were 23% to 25% higher than the agreement

level reached by the newly registered nurses. Both panels agreed on

the relevance of competencies presented in Table 21 and that

competencies presented in Table 22 were not relevant.

Table 21

Phase Two Competencies Considered Relevant By Both Panels

Group 1 Elementary understanding of computers

1.1 Demonstrate knowledge of the keyboard layout

1.3 Demonstrate the ability to turn a computer on/off

1.5 Recognise there are different types of operating systems

1.7 Recall the meaning of terminology associated with elementary computer use

1.8 Demonstrate ability to use various pointer devices - mouse, light pen, touch screen roller ball

1.10 Demonstrate ability to obtain a printout of a file

1.11 Demonstrate ability to clear a printer paper jam

1.12 Demonstrate ability to change a printer toner or ink cartridge

1.14 Demonstrate ability to create folders or directories

1.15 Demonstrate ability to save files on a disk drive

Group 2 Use of commercially available software

2.1 Recognise which word processor they use most often

Group 3 Communication and information retrieval

3.1 Understand the use of network login procedures

3.2 Demonstrate ability to communicate using e-mail

3.3 Use the Internet to access information

3.5 Apply search techniques to target a search, including Boolean operators i.e. and, or, not

3.6 Demonstrate knowledge of how to ask the right questions

3.7 Distinguish the difference between data and information

3.9 Demonstrate ability to complete a literature search using a data base (e.g. CINAHL or MEDLINE)

3.10 Demonstrate ability to use electronic resources to locate current information on nursing problems

Group 4 Data protection

4.1 Assess opportunities and challenges that informatics brings to health care - security, privacy, confidentiality

4.2 Analyse issues of privacy and confidentiality of information

4.3 Recognise the need for standards affecting development of electronic patient records

4.4 Use strategies designed to maintain patient confidentiality and data integrity

Group 5 Knowledge of health care monitoring systems

5.1 Demonstrate elementary knowledge of telemetry, telecommunications, and system applications that can support clinical practice

5.2 Describe use of hospital information system

5.3 Demonstrate the ability to access a hospital information system

5.4 Discuss health management information systems a nurse may encounter

Group 6 Implications of information technology use in the nursing profession

6.3 Describe what computers can and cannot do at the present and the potential changes likely to be caused by computer use

6.4 Recognise language and the need for consistency in describing nursing actions

6.5 Critically analyse the changes occurring as a result of an increased use of informatics

6.6 Recognise the need for utilising available technology

138

Table 22

Phase Two Competencies considered to be not relevant by both panels

Group 1 Elementary understanding of computers
1.16 Describe the use of spreadsheet software
1.17 Describe the use of word processor software
1.18 Describe the function of video/sound cards
Group 2 Use of commercially available software
2.2 Demonstrate the ability to install an "off the shelf program" onto a hard drive
2.8 Describe what scheduling packages are able to do
2.9 Examine the worth of hardware or software

5.3.11 Competencies accepted by one panel but rejected by the other

Within the group of competencies associated with **Elementary understanding of computers** there were four competencies that the educators considered relevant as each had an agreement rate of either 83% or 92%. In comparison, the newly registered nurses could only reach an agreement level of 67% for (1.2) *Demonstrate knowledge of the Graphic User Interface*; 68% for (1.4) *Demonstrate the ability to format a floppy disk*; 67% for (1.6) *State the difference between client/server and desk top stand alone programmes*; and 50% for (1.9) *Recognise compatibility issues related to hardware and data.*

Consensus about the relevance of five competencies contained in the group **Use of commercially available software** was reached by the educators, but not by the newly registered nurses. Educators rated these competencies at 75% to 83%. Conversely the newly registered nurses did not consider these competencies had relevance to their practice as their level of agreement was only 65% for (2.3) *Demonstrate the ability to use a word processor with accuracy*; 33% for (2.4) *Demonstrate the ability to use spreadsheets*; 50% for

(2.5) *Demonstrate the ability to use a relational database* and

(2.6) *Demonstrate the ability to use a statistical program*; 58% for

(2.7) *Demonstrate the ability to use graphics presentation programs.*

There was a continuance of the pattern of educators reaching consensus on competencies that the newly registered nurses did not. Within the group, ***Communication and information retrieval,*** the educators panel accepted (3.4) *Describe use of local network computers* (agreement of 83%); (3.8) *Use collegial networking* (agreement of 83%); and (3.11) *Critically analyse the authority and validity of data* (agreement of 92%). However the newly registered nurses could only reach 67% agreement for each of these competencies. In the group ***Knowledge of health care monitoring system*** there was one competency on which the newly registered nurse panel reached 67% agreement while the educators reached consensus about its relevance. That competency was (5.5) *Describe basic processes involved in, for example, charting a medication in an automated* system.

The competency (3.11) *Question what is presented to gain knowledge of functionality and mastery requirements* that was reworded following the first round, to (3.11) *Critically analyse the authority and validity of data,* was accepted by the educator panel as relevant but not by the newly registered nurses.

The two new competencies identified by members of the newly registered nurse panel in their responses to round one,

(1.19) *Demonstrate the ability to send a fax* and (1.20) *Demonstrate the ability to use computer based learning programmes* both had responses to round two that showed a mode of 4 and had 86% agreement that the competencies were relevant to their practice.

Although educators identified two new competencies following the first round of Phase Two, only (6.7) *Discuss the ethical/legal implications of informatics in the health sector* that had a response mode of 5, reaching consensus with 100% agreement. The panel did not reach consensus that the competency. *Act as advocate for those without technical expertise or the techno phobic*, as it had a response mode of 4 but achieved only 67% agreement.

5.4 SUMMARY

This chapter has presented the data analysis of responses from three panels of nurses. The subject experts who became the first panel participants answered the first research question, "which informatics competencies do informatics experts believe undergraduate nurses need to demonstrate and newly registered nurses need to use", in Phase One of the study. These experts identified 49 informatics competencies that they determined were relevant to both undergraduate studies and the practice needs of the newly registered nurse.

During Phase Two, statistical analysis showed the educator panel reached consensus on 47 competencies, one of which they suggested in addition to the experts' competencies, and the newly

registered nurses reached consensus on 35, including two not identified by the expert panel. Thirty three relevant competencies on which both panels reached consensus were identified, as were those that both panels agreed had no relevance to either the undergraduate informatics curriculum or the practice needs of newly registered nurses. In addition, six competencies on which both panels agreed as not relevant were identified. The significance of these findings will be discussed in the next chapter.

CHAPTER 6
Discussion, conclusion and recommendations

6.1 INTRODUCTION

This, the final chapter provides a discussion about the competencies which were either accepted or rejected by the educator and newly registered nurse panels. An analysis of the process involved in using the Delphi technique within the study is then provided, followed by a discussion of the study's limitations and strengths. The chapter then concludes with recommendations based on these findings.

6.2 DISCUSSION OF FINDINGS

During Phase One, the answer to the question Which informatics competencies do informatics experts believe undergraduate nurses need to demonstrate and newly registered nurses need to use? was determined by the expert panel when they produced and reached consensus on the relevance of 49 competencies. It was these competencies which the educators and newly registered nurses were asked to consider in Phase Two of the study when they answered the questions, Which nursing informatics competencies do educators believe should be addressed in the undergraduate curriculum? and Which informatics competencies do newly registered nurses require for their clinical practice?. Both educator and newly registered nurse panels reached consensus on the relevance of 33 of the 49 competencies identified by the expert panel. Discussion related to the fourth question, What if any are the differences between the opinions of the experts, educators and the newly registered nurses about which

informatics competencies are relevant? is now presented in group order. Many of the competencies identified as relevant during the study were strongly focussed on the technical aspects of computer use and were similar to those found in previous studies by Bryson (1991); Chu and Thom (1993); and Vanderbeek et al. (1994). At the conclusion of Phase Two the educators accepted a total of 48 competencies as relevant. The newly registered nurse panel accepted 35.

Each competency group is now discussed in group order.

6.3 GROUP 1 ELEMENTARY COMPUTER USE

The educator panel reached agreement that 14 of the 17 competencies identified by the expert panel within this group were relevant while the newly registered nurse panel agreed that 10 were relevant. The content of this grouping contained many of the core competencies required for a basic understanding of how a computer functions, use of a printer and file management. These findings correspond with the study findings of Carter and Axford (1993); M^{C}Neil and Odom (2000); and Boxer and Kluge (2000).

Both panels rejected competencies (1.16) *Describe the use of a spreadsheet* and (1.17) *Describe the use of word processor software*, agreeing that they were redundant as they were implied in the competencies (2.3) *Demonstrate the ability to use a word processor* and in (2.4) *Demonstrate the ability to use a spreadsheet*. The competency (1.18) *Describe the function of video/sound cards* was

rejected because panellists believed such technical knowledge was not necessary.

Ten of the competencies that the newly registered nurses agreed were relevant were also among those considered relevant by the educator panel. The eleventh competency (1.19) *Demonstrate ability to send a fax* was new and originated from the newly registered nurse panel. This competency was also identified in the findings of Saranto and Leino-Kilpi (1997) but was a competency neither the expert nor the educator panel had identified.

Although the educator panel agreed that a nurse should be able to demonstrate competency (1.2) *Demonstrate knowledge of the GIU (graphic user interface)* the newly registered nurse panel did not. It is important to note that this was not a term with which many of the newly registered nurse panel were familiar, requiring the researcher to provide a definition of the term as part of the iterative process following the first round of their questionnaires. This allowed the panellists to make an informed decision to reject the competency.

Other competencies which were not considered relevant to their practice and subsequently rejected by the newly registered nurse panel were (1.4) *Demonstrate the ability to format a floppy disk*, (1.6) *State the difference between client/server and desk top stand alone programmes*, and (1.9) *Recognise compatibility issues related to hardware and data*. In contrast the educator panel accepted these competencies as relevant.

Why the newly registered nurse panel rejected competencies accepted by the educators' panel may rest in the fact that, as users of hospital information systems, the newly registered nurses expect to be able to enter data quickly, expecting the system to be set up in such a way that they can enter data without having to know about the technical aspects of the system or the type of software they are using. Whatever the reason, these findings run counter to the suggestions of M^{C}Neil and Odom (2000) that nurses need to know about what lies behind the screen and keyboard of information systems.

Data security should be of paramount importance in any system containing health information (Hebda, Czar & Mascara, 1998). It is doubtful that the ability to format a floppy disk would be necessary or permissible in the clinical setting for reasons of network security. The use of floppy disks in a hospital management system could jeopardise data protection as data could be copied for unauthorised use. Nonetheless it is advisable for a nursing student to possess knowledge of how to format a floppy disk on their personal computer or in non–hospital environments.

Some participants in both the expert and educator panels agreed that the Group One competencies were relevant for basic computer use, but questioned the need to include them in an undergraduate curriculum. This position is reflected in the findings of Thede (1998), and Vanderbeek and Beery (1998). Although educators see many of these competencies as basic, it cannot be assumed that all new nursing

students have received recent education in computer use. The findings of a New Zealand based study (Pearson, 1996) identified that not all undergraduate nursing students have used a computer prior to the start of their studies and as identified by Sinclair and Gardiner (1999), when students did possess such knowledge, there was variance in their degree of computer literacy. To overcome problems of varying computer experience among beginning students, some of the expert and educator panellists in this current study suggested that the competencies in this group be achieved either as a prerequisite for nursing studies or from self directed learning modules.

Acceptance of the need for lifelong learning was evident in the registered nurse panel's acceptance of (1.20) *Demonstrate the ability to use computer based learning programs.* This was a new competency developed by a newly registered nurse panellist and was not something either the expert or the educator panel remarked about in any of their responses although educators have previously identified this as a necessary skill (Sinclair & Gardner, 1997).

Competencies within this group had a technical base and seemed to be more acceptable to the educator panel. It can also be argued that all the competencies in Group One are skills expected of any novice user, as these competencies require little advanced knowledge of computer use. As such these competencies are not specific to nursing yet they are required as foundation skills on which nursing informatics is built. If the nurse does not possess these basic computer skills they

will be unable to use electronic resources to locate information thereby limiting their ability to remain current in their nursing knowledge.

6.4 GROUP 2 COMMERCIALLY AVAILABLE SOFTWARE

There was a marked contrast in opinions of the phase two panels about the relevance of the competencies within this group. The educators agreed on the relevance of (2.1) *Recognise which word processor is used most often,* (2.3) *Demonstrate the ability to use a word processor with accuracy,* (2.4) *Demonstrate the ability to use a spreadsheet,* (2.5) *Demonstrate the ability to use a relational database,* (2.6) *Demonstrate the ability to use a statistical programme* and (2.7) *Demonstrate the ability to use graphics presentation software.* These were identified as relevant competencies in the study findings of Carter and M^{C}Guinness (1997) and M^{C}Neil and Odom (2000). However the newly registered nurse panel agreed that only one competency (2.1) in this group was necessary to their clinical practice.

It was also obvious from the comments received that some of the newly registered nurse panel did not fully understand the term relational database, so again the iterative process which is integral to the Delphi Technique (Crisp, 1997) provided a means for educating them about differences in database construction.

The software available to the general public is usually supplied with step-by-step installation instructions so competency

(2.2) Demonstrate the ability to install "off the shelf software" would be expected of anybody using a privately owned computer. Further, installation of new software on to a hospital information system or in the academic environment is likely to be restricted to specific personnel in order to protect the computer network. To allow anyone other than those employed to run a management information system to install such software could place the data in jeopardy by the possible introduction of computer viruses. So it was not surprising that both the educator and newly registered nurse panels rejected this competency.

Within this competency group, why is there such disparity between the panels? In seeking a reason for this, it must be recognised that the educator panel may have a different view of what is relevant to the preparation of a future registered nurse than the view held by the newly registered nurses. The newly registered nurses' responses are opinions about the relevance of competencies to their clinical practice. They were not asked about application of previously derived knowledge to nursing activities outside their work environment; for example, ongoing education.

Comments from the educator panel members identified that statistical analysis software "was necessary for research in practice" but cautioned that the level of programme "needs to be defined and suited to UG [undergraduate] course". Educators are preparing students for foundation and future development of their professional lives. Educators are also equipping students with the means to

demonstrate current knowledge though the use of computer and information technologies as a way of assessing the undergraduate's knowledge level through assignment work (Saranto & Tallberg, 1997).

6.5 GROUP 3 INFORMATION RETRIEVAL AND COMMUNICATION

There were two foci within this group, the first related to the knowledge and use of local networks for accessing client information. A rejection on the part of the newly registered nurse panel of competency (3.4) *Describe the use of local network computers* suggests once again, that they did not see the relevance of technical knowledge underlying their actions.

The second focus was on acquiring and disseminating electronic based data. Both panels recognised the need for information literacy skills as they agreed on the relevance of competencies (3.3) Use the Internet to access information, (3.5) *Apply search techniques to target a search, including Boolean operators i.e., and, or, not* as identified by Ribbons (1998): competency (3.9) *Demonstrate the ability to complete a literature search using a database (e.g. CINAHL or Medline)* and (3.10) *Demonstrate the ability to use electronic resources to locate current information on nursing problems.* However the newly registered nurses did not reach consensus about (3.11) *critique the authority and validity of data*, implying that collectively they were less certain of the relevancy of this skill. This finding is cause for concern as nursing is striving to promote the

application of evidence based practice and critical thought to nursing actions. This has further implications as the Health Practitioners' Competency Assurance Act 2003, which was recently approved by the New Zealand Parliament, requires registered nurses in that country to prove their competence by maintaining currency of knowledge something that requires information literacy and lifelong learning as also recommended by the Review of Nursing Education commissioned by the Commonwealth of Australia (2002). Evidence based practice also requires that nurses are able to source relevant information and analyse it critically (Bird & Robert, 1998). It would be expected that nurse educators would agree about the relevance of all the competencies in this group, as indeed they did. The newly registered nurse panel did not accept the use of collegial networking as relevant although the Australian members of the panel did rate the competency as relevant indicating a national difference which New Zealand nurses need to consider. Clinical nurses have yet to develop a culture of information sharing as evidenced in the study findings of Higgins (1991) and Boxer and Kluge (2000). The fact that the educator panel could see the relevance of electronic based networking may well be a reflection of an academic environment, which has been exposed to the use of email for a longer period of time than clinicians and have a philosophy of knowledge sharing and networking (Anthony, 1997).

The findings of the newly registered nurse panel show that its members accepted the need to obtain information from various

sources. Panel agreement that using search strategies was relevant suggests that they are now able to search but their rejection of competency 3.11 suggests the possibility that they are not able to critically evaluate what they find.

Group three competencies again show a reluctance on the part of the newly registered nurse panel members to accept the need to know what technical aspects lie behind what they do when they interact with a computer.

6.6 GROUP 4 DATA PROTECTION

Both the educator and newly registered nurse panels reached consensus that all competencies in this group had relevance. These findings are similar to those reported by McNeil and Odom (2000), that the maintenance of privacy, confidentiality of client information and data security are essential. Nurses appear to have a well-developed sense of the need to protect client confidentiality; a theme that is also evident in the published work of Saranto and Leino-Kilpi (1996) and Bachman and Panzarine (1998). It is also enshrined in the Australian Nursing Council's Code of Ethics (2002) in Value Statement 4.4, which states "Nurses have an obligation to adhere to legislative guidelines limiting access to personal records (whether paper or electronic)".

6.7 GROUP 5 KNOWLEDGE OF HEALTH CARE MONITORING SYSTEMS

Five competencies in this group addressed information systems necessary for recording interventions and analysing health care.

Interestingly the newly registered nurse panel ascribed more relevance than the educator panel. To (5.1) *Demonstrate elementary knowledge of telemetry, telecommunications, and systems that can support clinical practice.*

Competency (5.5) *Describe basic processes involved in for example, charting a medication in an automated system,* was the only one in the group on which the newly registered nurse panel was unable to reach consensus. Many newly registered nurses stated that they had not experienced of this type of automated system in their practice. An explanation for the newly registered nurses rejecting this competency may be found in the suggestion by Ngin's (1993) that nurses value the use of computers in nursing but only insofar as they are capable of meeting the nurses' clinical needs.

6.8 GROUP 6 IMPLICATIONS OF INFORMATION TECHNOLOGY USE IN THE NURSING PROFESSION

Earlier work by Chu and Thom (1993) and Cheek and Dotskatsch (1998) criticised the curriculum content of Australian undergraduate programmes for not addressing information science and management technology in practice. The findings of this study suggest that little has changed. Both panels may have reached consensus about the competencies in this grouping deeming them to be relevant, however these competencies do not infer any detailed knowledge requirement of either information science or management technology, nor need they. It was evident in the responses from both expert and educator panels that the depth of knowledge required for newly

registered nurse differs from that of the informatics nurse specialist who would be expected to have undertaken postgraduate studies in health or nursing informatics.

Only one competency (6.6) Recognise the need for using the available technology was rated higher by the newly registered panel than the educator panel. A new competency, (6.7) Discuss the ethical/legal implications of informatics in the health sector was identified by an educator in the responses to the first round in Phase Two. This competency was subsequently accepted as relevant by the educator panel. None of the responses received from the newly registered nurses considered this topic yet by entering data into a computer the nurse (as part of practice) is compiling or contributing to a form of record that has, like written documentation both legal and ethical legal implications.

6.9 COMPETENCIES THAT WERE EXPECTED BUT NOT IDENTIFIED.

While some competencies identified in international studies discussed in Chapter 2 would not be considered relevant to nursing in Australia and New Zealand it was anticipated that all nurses would have a sense of the importance of health protection. Study findings by Sinclair and Gardner (1999) and by M[C]Neil and Odom (2000) identify Irish and American nurse educators' expectations that students be educated about health and safety aspects of computer use. However there was no evidence in the findings of this study that any panellist identified these aspects as relevant.

154

6.10 REFLECTIONS ON THE METHOD

The application of a modified Delphi technique did enable the identification of several relevant competencies and the use of triangulation of panels of knowledgeable nurses served the dual purposes of establishing content validity of the questionnaire while allowing each panel's responses to be compared and contrasted.

It was important to the study that an educator panel and a newly registered nurse panel were used to identify relevant competencies. As Habermas (1990) theorises, knowledge is socially constructed and therefore it was possible that the two panels in Phase Two may not share the same view of which competencies were relevant.

The use of e-mail as a method of recruiting and communicating between the expert panel and the educator panel had the benefit of speedy response with most responses being returned within seven days. The posted communication took longer with the turn around period between postings and return to the researcher taking an average of two weeks.

The expert panel was heterogeneous in composition, in that while each panellist had experience of informatics; their experience was in different areas of nursing. The educator panel was necessarily homogeneous and the newly registered nurse panel were homogeneous only to the extent that they had recently begun the third year of registered nurse practice but they came from a variety of hospital based practice settings so they were at the stage in Benner's

(1984) developmental process where they were deemed to be able to reflect and identify their practice from their perspective. The composition of each panel was necessary so that a comparison of findings between panels could be inferred.

Participant withdrawal during a study is an identified threat to the validity of findings (Dempsey & Dempsey, 2000), something that is also recognised as a possible limitation in any Delphi study. Sumsion (cited in Sharkey and Sharples, 2001) has suggested that a 70% response rate is required to maintain rigour. Overall the experts' response rate was 71%, the newly registered nurses' was 75%, but the response rate of the educators was 50%. It is difficult to draw conclusions as to why participants withdrew from the study. Attempts to overcome panellist attrition were used. These took the form of reminders that responses were due and the use of prepaid return envelopes for posted responses.

Another factor that has to be accepted, is the impossibility of verifying that the participants were who they stated they were. This is not a problem limited to the Delphi technique; rather as Cormack (1996) suggests, it is embedded in any survey where participant credentials cannot be verified. However, nursing is not without its own language and informatics more so. None of the responses given by participants suggested they were other than genuine and knowledgeable about informatics.

The iterative process provided panellists with the opportunity to reflect on their responses and for some, to amend their responses to agree with the other panellists while others remained true to their first response. The Delphi technique also allowed the *Rules of Discourse* (Sumner, 2001) to be adhered to, by providing each participant with equal opportunity to contribute to the study. Iteration also allowed for elimination of doubt about the meaning of the competency statements thereby increasing the validity of the competencies. A further benefit of the iterative process is the serendipitous effect of providing information that may not have been known previously; an example of this being that while educators were aware of the meaning of the terms Graphic User Interface and Relational Database; the comments received with the responses to their first questionnaire showed that for many of the newly registered nurses, these were new terms.

A requirement of the Delphi technique is that it should not be researcher driven (Williams & Webb, 1994b). This provided an area of frustration for this researcher, as some of the competency statements generated by participants did not contribute to a well-constructed questionnaire. There was competency statements that were vague or wordy for example (3.11) *Question what is presented to gain knowledge of functionality and mastery requirements.* Following round one of Phase Two and at the request of a panellist the competency was reword *Critique the authority and validity of data.* There were other competencies that contained two statements; for

example, competency (2.3) Demonstrate the ability to use a word processor with speed and accuracy.

6.11 LIMITATIONS

The main limitation of this study was the lack of representation. New Zealand participants outnumbered the Australians. The expert panel had one Australian participant and none from New Zealand. This necessitated the inclusion of the American nurses who responded to the invitation posted on the listserver and is consequently worthy of comment. It is difficult to determine what influence, if any, the inclusion of American Nurses had on the outcome of the study. Given the globalisation of knowledge, particularly of ITCs, it may be that the views of Australasian nurses coincided with those of the American nurses. What is certain is that the nurse educators' and the newly registered nurses' panels were in agreement with the vast majority of the competencies identified by the experts.

Responses to list servers and journal advertisements were minimal. It is difficult to assess the number of nurses who could have been recruited. In hindsight, face to face contact with a possible sample may have encouraged more nurses to participate, however financial and time constraints prevented such an approach. The modest response to the invitation to participate may also be a reflection of the nursing culture. Nurses still tend to be self-effacing, and therefore may be less inclined to portray themselves as experts (Buresh & Gordon, 2000).

It is acknowledged that the educator panel demographic data was limited. While the country in which each panellist taught was determined, data related to age and teaching experience were not collected as it was considered by the researcher to be unrelated to the purpose of the study.

The findings of this study therefore cannot be generalised. The fact that the sample was purposely selected and modest number in each panel means that the sample cannot be considered as representative of the nursing body as a whole. Using a purposive sample of participants who could best answer the study questions was justified. These nurses though not numerous, were able to provide reasoned responses to the questionnaires. The findings of this study have identified that a list of proven competencies exist which are in the opinion of the study participants necessary to newly registered nurse practice.

6.12 STRENGTHS OF THE RESEARCH

The strength of this study lies in the fact that no recent study has surveyed newly registered nurses in either Australian or New Zealand about the informatics competencies they consider to be relevant to their practice needs and that knowledgeable individuals were used as study participants. The use of three panels of expert and knowledgeable nurses provided strength to the findings as the panellists had first hand knowledge of informatics in their respective areas of practice and although American Nurses contributed to the

first phase, it was the Australian and New Zealand educators and newly registered nurses who finally accepted or rejected the competencies.

While competencies for entry to registered nurse practice exist, they have not to date, included informatics competencies. The competencies identified in the findings of this study are therefore worthy of consideration for inclusion in the requirements for entry to practice of both the Australian and New Zealand registration bodies if such requirements are to properly address the needs of nurses working in an information dependent work milieu. Findings are also applicable to assessment of nurses returning to the workforce who may not have been previously exposed to computer use in nursing.

6.13 CONCLUSION

The study was based on the theoretical underpinnings based on the works of Benner (1984) and Habermas (1990). The identification of competencies through a process of group communication enabled each group to independently reach consensus on the relevancy or otherwise of each competency. Identification of the 33 competencies on which both the educator and newly registered nurse panels agree suggests there is a relationship between the informatics competencies contained in the undergraduate curriculum and the informatics requirements of the newly registered nurse.

The findings of this study indicate that the informatics competencies which were suggested as relevant to the undergraduate

curriculum by the experts and the educators panels encompass not only the informatics skills required by the newly registered nurse but also those which may be required later in their career for continued professional development. The newly registered nurse panel's responses were typically practice orientated, and since this was what was asked of them it is not surprising that most did not look at the competencies from the viewpoint of what they might need to further their academic development.

Based on the findings of this study, a valid and useable set of competencies has been identified that have proven relevance to the preparation of, and practice needs, of newly registered nurses. These competencies can also serve as baseline requirements of any nurse in clinical practice. Consequently the study findings have value not only to nurse educators in the tertiary education settings, but also to educators employed in the clinical care settings as a set of competencies that nurses will need to demonstrate if they are to nurse effectively.

6.14 RECOMMENDATIONS

Recommendation 1

To prepare a computer and information literate graduate, the undergraduate nursing curriculum should incorporate all the competencies identified as relevant by both the educator and newly registered nurse panels. These competencies while determined as relevant to Australian and New Zealand nurses have also been found

in previous studies carried out in Europe (Saranto & Leino Kilpi, 1998; Sinclair & Gardner, 1999) and in America (Staggers, Gassert & Skiba 1999: M^{C}Neil & Odom, 2000). Nurses often work in countries other than the one in which they received their undergraduate education, the inclusion of these competencies will therefore enable the newly registered nurse to be prepared for practice in countries other than Australian and New Zealand.

The undergraduate curriculum therefore should include the following; an understanding of how a computer works to the extent that the nurse can input, store and retrieve data in electronic or printed format; the use of commercially available software, which is appropriate to their clinical and ongoing learning needs; communication and information retrieval; the need to protect client data; utilise health monitoring systems and be aware of the implications of using information technology within the health care setting.

To enable dissemination of the study findings, a copy of this study will therefore be forwarded to each of the relevant nursing registration authorities, the study participants and offered for journal publication in an abridged format.

Recommendation 2

Students should be assessed at the start of their undergraduate curriculum. If found not to be computer literate the student should be offered self paced learning opportunity to obtain skills prior to their

participation in informatics classes. This recommendation is made because members of both the expert and educator panels identified a need to assess students' computer skills at the beginning of their undergraduate education as students' abilities and exposure to ICTs vary. These findings are similar to those of Gassert and McDowall (1995) and Pearson (1996). This suggests that there continues to be students who are not confident computer users and therefore may have difficulties keeping up with those students who have previous exposure to ICTs.

Recommendation 3

Nurses need to be aware that they need to protect their own health. The responses provided by each panel did not address health promotion issues connected to informatics, a subject that has been well publicised (Cornell University, 2003). It was expected that ergonomic design of workstations and legislation to protect the health of computer users would have been identified within desirable competencies. The fact that these topics were not addressed suggests that nurses need to be more aware of the importance of promoting good work habits.

Recommendation 4

Evidence based nursing requires information literacy (Bird & Roberts, 1998). Australian and New Zealand nursing registration authorities should acknowledge that information literacy (that also

demands computer literacy) is essential to the application of evidence based practice and should therefore be specifically included in the list of competencies required for entry to registered nurse practice and for ongoing practice.

Recommendation 5

It was noted by some of the members of the expert panel that not all undergraduate nurses were able to access informatics systems during clinical simulation or practicum, a view that was also expressed by Conrick and Foster (1995) and Carter and M^{C}Guinness (1997). Nursing is a practical profession therefore students should be exposed to "real life working environment" if they are to develop clinical competencies required of informatics. It is therefore recommended that nursing students be able to access and interact with hospital information systems.

Recommendation 6

The use of electronic networking was not accepted as a competency by the newly registered nurse panel. In an age when information gathering and sharing is important to personal and professional development (Lakeman, 1999), emphasis on the benefits of using this medium should be promoted.

Recommendation 7

Nurse educators should be cognisant that the undergraduate curriculum should reflect the realistic depth of knowledge required for newly registered nurses. Both expert and educator panellists identified that the newly registered nurse knowledge requirements differ from that of the informatics nurse specialist. In light of these opinions undergraduate nurses need to be aware of, but not necessarily possess detailed knowledge of information sciences and related technologies that are considered to belong to the realm of postgraduate studies.

Recommendation 8

Differences between the educator and newly registered nurse panels in the ratings of some competencies in *Competency Group 2 Commercially Available Software* suggests that further research is required to determine if expert clinicians, as defined by Benner (1984), require a different set of informatics competencies to those suggested as needed by the newly registered nurses.

Recommendation 9

Cheek and Dotskatsch (1998, p.243) identify that the nursing profession and students' educational needs are affected by the rapid change in ICTs employed in the care of clients. Nurse need to be proactive in the ways ICTs can promote clients well being. There is a need for ongoing research into the ways nurses utilise informatics.

6.15 CONCLUDING STATEMENT

The findings that both nurse educators and newly registered nurses panellists judged 33 informatics competencies to be relevant suggests that there is a relationship between what is taught in the undergraduate curriculum and the informatics related practice needs of newly registered nurses.

In addition to having relevance to the undergraduate curricula, the findings of this study will have significance for employers and nurse educators in the health care setting as they provide a benchmark against which to evaluate their clinical nursing staff's computer and information literacy. While ongoing professional development is offered to existing clinical staff, there is a trend for nurses to take breaks of varying length from their career as family commitments impinge on their lives. Some nurses returning to the work force may have little or no experience of informatics as they completed their pre-registration education with no exposure to informatics. The study findings now provide a list of informatics competencies based on research findings that can be used to assess the learning needs of clinical nurses when they return to the work force.

References

Aarts, J. (1994). Towards a founding principle of nursing informatics. In Paul Wainwright (Ed.). *Nursing Informatics.* Edinburgh: Churchill Livingstone.

American Nurses Association. (2001). *The scope of practice of nursing informatics and the standards of practice and professional performance for the informatics nurse specialist.* Washington. DC: American Nurses Publishing.

Arnold, J. M. (1998). Nursing informatics educational needs. *Computers in Nursing, 14*(6), 333 - 339.

Australian Nursing Council. (2002). *Code of ethics for nurses in Australia.* Retrieved on 24 August, 2003 from http://www.anci.org.au

Axford, R., & M^{C}Guinness, B. (1994). Nursing informatics core curriculum. *Informatics in health care – Australia, 3*(1) 5 - 10.

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

Barker, P. J. (1996). Questionnaire. In D. F. S. Cormack. *The research process in nursing.* (3rd ed.). Oxford: Blackwell Science Ltd.

Barribal, K. L. & White, A. (1999). Non-response in survey research: A methodological discussion and development of an explanatory model. *Journal of Advanced Nursing, 30*(3) 677 - 686.

Beanland, C., Schneider, Z., LoBiondo –Wood, G., & Haber, J. (1999). *Nursing Research: Methods, critical appraisal and utilisation.* Sydney: Mosby Publishers Australia Pty Ltd.

Beech, B. F. (1991). Changes: The Delphi technique adapted for classroom evaluation of clinical placements. *Nurse Education Today, 11,* 207 - 212.

Beech, R. (1999). Go the extra mile use the Delphi technique. *Journal of Nursing Administration, 7,* 281 - 288.

Bell, P., Daly, J. and Chang, E.M.L. (1997). A study in the educational and research priorities of registered nurses in rural Australia. *Journal of Advanced Nursing, 25,* 794 - 800.

Benner, P. (1984). *Novice to expert: Excellence and power in clinical nursing practice.* Menlo Park. Ca: Addison-Wesley.

Benner, P., & Wrubel, J. (1989). *The Primacy of caring: Stress and coping in health and illness.* Menlo Park. Ca: Addison-Wesley.

Bechtel, G.A., Davidhizar, R., & Bradshaw, M.J. (1999). Problem-based learning in a competency-based world. *Nurse Education Today, 19,* 182 - 187.

Bird D., & Roberts, P. (1998). The role of library and information services in the modular curriculum. *Nurse Education Today, 18*(7), 583 - 591.

Boxer, E., & Kluge, B. (2000). Essential skills for beginning registered nurses. *Nurse Education Today, 20,* 327 - 335.

Boyce, A. (1993). Nurses are contributing everywhere especially in information technology. *Nursing Informatics New Zealand Conference '93 The Challenge of Change.* Auckland: NINZ.

Bruce, C. S. (1995). Information literacy: A framework for higher education. *Australian Library Journal, 44*(3), 158-170.

Bryson, D. (1991). The computer-literate nurse. *Computers in Nursing, 9,* 100 - 107.

Canavan, K. (1996, November/December). New technologies propel nursing profession forward. *The American Nurse.* 1 - 2.

Carter, B. E., & M^{C}Guinness. B. (1997). Expanding nursing informatics knowledge through curriculum development: a collaborative faculty practice model. *Nursing Informatics.* Netherlands: U. Gerden et al. 431 - 436.

Carter, B. E., & Axford, R.L. (1993). Assessment of computer learning needs and priorities of registered nurses practising in hospital. *Computers in Nursing, 11*(3), 122 - 125.

Carty, B. & Rosenfeld, P. (1998). From computer technology to information technology: findings from a national study of nurse education. *Computers in Nursing, 16*(5), 259 - 265.

Cheek, J., & Doskatsch, I. (1998). Information literacy: a resource for nurses as lifelong learners. *Nurse Education Today, 18,* 243 - 250.

Cheek, J., Gibson, T., & Gilbertson, J. (1995). Competencies; really or merely useful? In G. Grey & R. Pratt. (Eds.). *Issues in Australian Nursing 4.* Melbourne: Churchill Livingstone.

Chu, S., & Thom, J. (1993). Nursing informatics towards the 21st century. Inaugural National Health Informatics Conference, Brisbane: HIC93.

Chye, E. (1996). *The virtual librarian: Making IT happen for nursing.* 4th National Health Informatics Conference (HIC '96) at the, Carlton Crest Hotel, Melbourne.

168

Clinton, M., & Scheiwe. D. Ed. (1995). *Management in the Australian Health Care Industry*. Pymple, Australia: Harper Educational.

Conrick, M. & Foster, J. (1995). *The Integration of Informatics into Undergraduate Curricula*. HIC'95 IT's time for healthcare. 3rd. National Health Informatics Conference, Australia.

Coles, C. (2002). Developing professional judgment. The Journal of Continuing Education in the Health Professions, 22, 3-10.

Cornell University (2003). *COErgo*. Retrieved on March 11 2003 from http://ergo.human.cornell.edu/

Cribb, C. (1998). *Information skills training for engineers*. Retrieved on August 24, 2002, from the World Wide Web: http://www.asee.org/conferences/search/00290.pdf

Crisp, J., Pelletier, D., Duffield, C., Adams, A. & Nagy, S. (1997. March/April). The Delphi method? *Nursing Research, 46*(2), 116 - 118.

Cormack, D.F.S. (Ed.). (1996). *The research process in nursing*. (3rded.). Oxford: Blackwell Science.

Crotty, M. (1993). The emerging role of the British nurse teacher in Project 2000 programmes: a Delphi study. *Journal of Advanced Nursing, 8*, 150 - 157.

D.f.E.E. (1998). *Initial teaching training national curriculum. Circular 4/98, Annex B*. London: Department of Education and Employment.

Dalkey, N. C., Rourke, D.L., Lewis, R., & Snyder, D. (1972). *Studies in the quality of life*. Lexington, Massachusetts: Lexington Books.

de Vaus, D. A. (1991). *Survey in social science*. Sydney: Allen & Unwin.

Dempsey, P.A. & Dempsey, A.D. (2000). *Using Nursing research: Process, critical evaluation and utilization*. (5th ed.). Philadelphia: Lippincott, Williams & Wilkins.

Dertouzos, M. (1997). *What will be: How the new world of information will change our lives*. San Francisco: Harper Collins.

Doordan, A. M. (1998). *Research survival guide*. Philadelphia: Lippincott-Raven.

Dreyfus, H. L. & Dreyfus, S.E. (1984). *Mind over machine. The power of human intuitive expertise in the era of the computer*. New York: Free Press.

Drucker, P. F. (1995). *Managing in a time of great change*. Oxford: Butterworth Heinemann.

Duffield, C. (1989). The Delphi technique. *The Australian Journal of Advanced Nursing, 6*(2), 41 - 45.

E. C. D. L. Foundation, (1997). *European Computer Driving License*. Retrieved May 17, 2000, from http://www.ecdl.com

Englebardt, S.P., & Nelson, R. (2002). *Health care informatics: an interdisciplinary approach*. St Louis: Mosby.

Everett, A. (December, 1993). Piercing the veil of the future: A review of the Delphi method of research. *Professional Nurse*, 181 - 184.

Flatley-Brennan, P. F. (2000). Nursing informatics: two fundamental developments. *Health Informatics Journal, 6*(3), 127 - 133.

Garland, K.J., Anderson, S.J. & Noyes, J.M. (July, 1998). The intranet as a learning tool. A preliminary study. *Information Research, 4*(1). Retrieved February 16, 2001, from http://www.shef.ac.uk/~is/publications/infres/papers51.html

Gassert, C. A., & M^{C}Dowall, D. (1995). Evaluating graduate and undergraduate nursing students' computer skills to determine the need to continue teaching computer literacy. *Medinfo, 8*, Part 2: 1370.

Gendron, D. (1994). The tapestry of care. *Advances in Nursing Sciences, 17*(1), 25-30.

Gonczi, A., Hager, P., & Oliver, L. (1990). *Establishing competency-based standards for the professions*. National Office of Oversees Skills Recognition. Research Paper No. 1. DEET. Canberra: Australian Government Publishing Service.

Goodman, C. M. (1987). The Delphi technique: A critique. *Journal of Advanced Nursing, 12*, 729 - 734.

Goosen, W. T. F. (1996). Nursing information management and processing a framework and definition for systems analysis, design and evaluation. *International Journal of Biomedical Computing, 40*, 187 - 195.

Goosen, W. T. F., Epping, P.J.M.M., & Dassen, T. (1997). Criteria for nursing information systems as a component of the electronic patient record: An international Delphi study. *Computers in Nursing, 15*(6), 307 - 315.

Graveley, E.A., Lust, B.L., & Fullerton, J.T. (1999). Undergraduate computer literacy, evaluation and intervention. *Computers in Nursing, 17*(4), 166-169.

170

Graves, J., Amos, L., Huether, S., Lange, L., & Thompson, C. (1995). Description of a graduate program in clinical nursing Informatics. *Computers in Nursing, 13*(2), 60 - 70.

Graves, J., & Corcoran, S. (1989). The study of nursing informatics. *Image: Journal of Nursing Scholarship, 21*(4), 277 - 231.

Green, B., Jenkins, D., Potter, N., & Davies, S. (2000). Information technology in nurse education: A multimedia approach to teaching biological sciences. *Health Informatics Journal, 6*, 86 - 90.

Grey, M. (1994). Data collection methods. In G. LoBiondo-Wood, & J. Haber, J. (Eds.). *Nursing research.* St. Louis: Mosby –Year Book.

Grobe, S.J. & Pluyter-Wenting, E.S.P. (Eds.) (1994). *Nursing Informatics: An International Overview for Nursing in a Technological Era.* Proceedings of the 5th International Conference on Nursing Use of Computers and Information Science. The Netherlands: Elsevier Science.

Habermas, J. (1971). *Knowledge and human interest.* Cambridge: Polity Press

Habermas, J. (1990) *Moral Consciousness and Communicative Action.* Cambridge: Polity.

Hager, P. (1993). Conceptions of competence. *Proceedings from the 49th Annual Meeting of the Philosophy of Education Society.* Retrieved April 26, 2001, from http://www.ed.uiuc.edu?EPS/PES-yearbook/93_docs/HAGER.htm

Hager, P., Gonczi, A., & Oliver, B. (1996). *Competency-based approaches to professional education.* Retrieved June 05, 2002, from http: www.eddep.wa/edu/cpr.Competency%20Framework.pdf

Hasman, A & Sosa, M. (1995). Education and training of Health Informatics in Europe. *Journal of Advanced Nursing*, 38(2), 127-135.

Hasson, F., Keeney, S., & M^CKenna, H. (2000). Research guidelines for the Delphi survey techniques. *Journal of Advanced Nursing, 32*(4), 1008 - 1015.

Health Professionals Competency Assurance Act 2003. NZ Government Print.

Hebert, M. (2000). A National Education Strategy To Develop Nursing Informatics Competencies. *Canadian Journal of Nursing Leadership, 13*(2), 11 - 14.

Hebda, T., Czar, P., & Mascara, C. (1997). *Handbook for Nurses and Health Care Professionals*. Menlo Park CA: Addison - Wesley.

Helmer, O.H. (1983). *Looking forward. A Guide to futures' research*. Beverly Hills. CA: Sage.

Henderson, R. D., & Deane, F.P. (1993). *Assessment of satisfaction with computer training in a health care setting*. The challenge of change. Nursing Informatics Conference 1993, Auckland, N.Z.: Nursing Informatics NZ INC.

Hicks, C. (1990). Research and Statistics: A practical introduction for nurses. New York: Prentice Hall.

Holloway, K. (March, 1999). Developing an evidence base for clinical skills teaching in an undergraduate program. *Nursing Praxis of New Zealand*.

Honey, M. (1991). *The challenge of teaching computer skills. An impetus for learning*. Auckland: Nursing Informatics New Zealand.

Holt, J., Barrett, C., Clark, D. & Monks, R. (2000). Network. The globalization of nursing knowledge. *Nurse Education Today, 20(6), 426 - 431*.

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

Hovenga, E. J. S., Murray, P., Huynh, M. & Goossen, W. (1996). *Recommendations for courses in health and medical informatics as part of nursing programs*. 6th International conference on health and medical informatics, Newcastle, Australia: International Medical Association, WGI.

International Medical Informatics Association, (1999) Minutes of the general assembly meeting 10 November. Washington DC.: Retrieved June 6, 2002, from http://www.infocom.cqu.edu.au/imia-ni/Nursing_Informatics_research/home.html

IMIA-NI (Nursing Informatics: Special Interest Group of International Medical Informatics Association) (1997/8). *Definition of nursing informatics*. General Assembly in Stockholm 1997, and amended for clarity at the General Assembly in Seoul, 1998. Retrieved July 27, 2000, from http://www.infocom.cqu.edu.au/imia-ni/gamins98.html

Jones, L. D. (1997). Building the information infrastructure required for managed care. *Image: Journal of Nursing Scholarship, 29*(4), 377 - 381.

i

172

Keene, N. (1993). The Northland model: Development of an integrated patient management system. *Nursing Informatics New Zealand Conference '93 The Challenge of Change.* Auckland: NINZ.

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

Lakeman, R. (1997). Using the Internet for data collection in nursing research. *Computers in Nursing, 15*(5), 269 - 275.

Lakeman, R. (2000). Charting the future today: Psychiatric and dental health nurses in cyberspace. *Australian and New Zealand Journal of Mental Health Nursing, 9,* 42 - 50.

Lakeman, R. M., & Murray, P. J. (2000). *The Internet and its impact on nursing: Research and reflection on the benefits and pitfalls of computer-mediated communication.* Nursing Informatics 2000. One step beyond: The evolution of technology and nursing. 7th International congress, Auckland, New Zealand: Adis International LTD.

Lang, T. (1998). *An overview of four futures methodologies.* Retrieved January 29, 1999, from http://www.soc.hamaii.edu/~future/j7/LANG.html.

Leasure, A. R., Davis, L., & Thievon, S. 1. (2000). Comparison of student outcomes and preferences in a traditional vs. World Wide Web-based baccalaureate nursing research course. *Journal of Nursing Education, 39*(4), 149 - 154.

Leeder, T. (1991). *Working paper two in nursing informatics'91.* Proceedings of the post conference in health care technology: Implications for change. Berlin: Springer.

Lewis, D., Watson, J., & Newfield, S. (1997). Implementing instructional technology: strategies for success. *Computers in Nursing, 15*(4), 189 - 190.

Lester, S. (1995, March). Beyond knowledge and competence towards a framework for professional education. *Capability, 1*(3), 44 - 52.

Linstone, H. A. & Turoff., M. (1975). *The Delphi method: Techniques and applications.* Reading. MA.: Addison-Wesley.

Lockyer, L., Patterson, J. & Harper, B. (1999). Measuring effectiveness of health education in a web-based learning environment: a preliminary report. *Higher Education Research and Development, 18*(2), 233 - 246.

Love, C. (1997). A Delphi study examining standards of patient handling. *Nursing Standard, 11*(45), 34 - 38.

Mallow, G., & Gilje. F. (1999). Technology-based nursing education: Overview and call for further dialogue. *Journal of Nursing Education, 38*(6), 248 - 251.

Marini S.D. (2000). Introduction of nursing informatics in the nursing baccalaureate program at the American University of Beirut. *Computers Informatics Nursing, 18*(5), 240 - 247.

Marriner-Tomey A, & Alligood. M. R. (1998). *Nursing theorists and their work.* St. Louis: Mosby Year Book.

Masys, D. R., Flatley-Brennan, P. Ozbolt, J.G. Corn, M. & Shortcliffe E.H. (2000). The 1999 ACMI Debate. Are medical informatics and nursing informatics distinct disciplines? *Journal of the Medical Informatics Association, 7,* 304 - 312.

M^CAllister, M. (1998). Competency standards: Clarifying the issues. *Contemporary Nurse, 7,* 131 - 137.

M^CCloskey, J. C. B., & Burr, G.M. (Eds.). (1992). *Nursing Interventions Classifications (NIC): Iowa Intervention project.* St. Louis, Mosby.

M^CKenna, H. P. (1994). The Delphi technique: A worthwhile research approach for nursing? *Journal of Advanced Nursing, 19,* 1221 - 1225.

M^CKenna, L. G. & Ribbons, R.M. (2000). *Integrating information and Health care technologies in undergraduate nursing programmes.* 7th International Congress Nursing Informatics, Auckland, N.Z.: One step beyond: The evolution of technology and nursing.

M^CNeil, B. J., & Odom, S.K. (2000). Nursing informatics education in the United States: Proposed undergraduate curricula. *Health Informatics Journal, 6*(1), 32 - 38.

Millay, E. S. V. (1988). *Collected sonnets.* New York: Harper & Row.

Mitroff, I. & Turoff. M. (1975), Chapter 1 Philosophical and methodological foundations of Delphi. Linstone, H. A., & Turoff, M. (Eds.). *The Delphi Method: Techniques and Applications.* Reading, MA: Addison Wesley Publishing Company.

Murray, P. J. (1997). E-discourse and continuing professional education: The fusion of nursing knowledge and informatics to close the theory - practice gap. *Nursing Informatics.* IOS Press.

Nilsson Karjerno, K.N., Nordstrom, G., Krusebrant, A., & Bjorvell, H. (1998). Perceptions of research utilisation comparisons between health care professionals, nursing students and a reference group of nurse clinicians. *Journal of Advanced Nursing, 31*(1), 99-109.

Noll, M. L., and Murphy, M.A. (1993). Integrating nursing informatics into a graduate research course. *Journal of Nurse Education, 32*(7): 332 - 334.

National Advisory Council for Informatics in Nursing Education and Practice. (December, 1997). A national informatics agenda for nursing education and practice. Report to the secretary of the Department of Health and Human Services. HRSA.

Nursing Council of New Zealand. (2002). *Competencies for entry to the register of comprehensive nurses*. Wellington: Nursing Council of New Zealand.

Nurses Board of Victoria. Retrieved November 1, 2002 from http://www.nbv.org.au

Nurses Organisation, N. Z. (1996). *Ethics in Research,* Author.

The National League for Nursing. (1997). *Nursing informatics competencies.* Peterson, H. & Gerdin-Jelger, U. New York: The National League for Nursing.

Oakley, P. & Graves, M, (1995, Feb). Restructuring: Decentralisation *Health Service Journal, 30,* 26-30.

Joint Commission on Accreditation of Health Care Organizations (1999). Comprehensive Accreditation Manual for Hospitals: The Official Handbook. Oak Park, I.L.: J.C.A.H.C.O.

Parry, D. (1999). *Finding medical information on the Internet: Who should do it and why should they know*. Dunedin, New Zealand: University of Otago.

Parry, D., Breton, A., Abernathy, D., Cockcroft, S., & Gillies, J. (1999). *Using the Internet to teach health informatics.* Dunedin: New Zealand, University of Otago.

Patton, M. Q. (1990). *Qualitative Evaluation and Research Methods.* Newbury Park, London, Sage Publications.

Pearce, R.K.S., & Trenerry, A. (2000). Developing a competency-based nursing programme. *Professional Nurse, 15*(5), 326 - 329.

Pearcey, P. A. (1995). Achieving research-based nursing practice. *Journal of Advanced Nursing, 22,* 33 - 39.

Pearson, J. R. (1996). *Computer use amongst first year student nurses enrolled in a nursing degree programme.* Conference'96 Informatics: Shaping the future. Wellington, New Zealand: Nursing Informatics New Zealand Inc.

Pelletier, D. (1995). Diploma-prepared nurses' use of the technological equipment in clinical practice. *Journal of Advanced Nursing, 21,* 6 - 14.

Pelletier, D., Nagy, S., Mitten-Lewis, S., Duffield, C., & Crisp, J. (1995). *Cardiac nurses, technology and computers in clinical practice-snapshot from a Delphi study.* It's time for healthcare The 4th Annual Health Informatics Conference, Adelaide, South Australia.

Piercey, C. (February, 1995). *A focus on learning: Assessing clinical competencies.* 4th Annual Teaching Learning Forum, Perth: Edith Cowan University.

Polit, D.F., Beck, C. .T., & Hungler, B.P. (2001). *Essentials of nursing research: Methods, appraisal and utilization.* (5th ed.). Philadelphia: Lippincott.

Powell, C. (2003). The Delphi technique: Myths and realities. *Journal of Advanced Nursing, 14*(4), 376 - 382.

Proctor, S., & Hunt, M. (1994). Using the Delphi survey technique to develop a professional definition of nursing for analysing nursing workload. *Journal of Advanced Nursing, 19,* 1003 - 1014.

Rasch, R. F. R., and Cogdill, K.W. (1999). Nurse practitioners' information needs and information seeking: Implications for practice and education. *Holistic Nursing Practice, 14*(4), 90 - 97.

Reed. J & Ground, I. (1997). *Philosophy for nursing.* London: Arnold.

Reid, N. G. (1988). The Delphi technique: Its contribution to the evaluation of professional practice. *Professional competence and quality assurance in the caring professions.* R. E. Ellis. (Ed.). New York: Chapman and Hall.

Report of the National Review of nurse education in the higher sector -1994 Report, T. R. *(1994). Nursing Education In Australian universities and beyond.* Canberra: AGPS.

Ribbons, R.M. (1998). The Internet: Practical applications in nurse education. *Nursing Education Today, 18*(5), 413 - 418.

Roberts, K., & Taylor, B. (1998). *Nursing research process: An Australian perspective.* Melbourne: Nelson I.T.P.

176

Ronald, J. A., & Skiba, D.J. (1987). *Guidelines for basic computer education in nursing.* New York: National League for Nursing.

Rosenfeld, P., Salazar-Riera, N., & Vieira, D. (2002). Piloting an information literacy programme for staff nurses: Lessons learned. CIN: *Computers, Informatics, Nursing, 20*(6), 236 - 241.

Rowe, K. (1996). *The information needs and information seeking behaviour of paediatric nurses at Christchurch Hospital.* Library studies. Unpublished thesis. Wellington, N.Z.: Victoria University of Wellington.

Russell, A., & Alpay, L. (2000). Practice nurses' training in information technology: Report on an empirical investigation. *Health Informatics Journal, 63,* 142 - 146.

Ryan, S. A., & Nagle, L. Ed. (1994). Nursing informatics: An unfolding of a new science. In *Nursing Informatics: An international overview of nursing in a technological era.* Amsterdam: Elsevier.

Salmon, M. E. (1999). Thoughts on nursing: Where has it been and where is it going? *Nursing and Health care perspectives, 20*(1), 20 - 25.

Sarantokos, S. (1998). *Social Research.* South Yarra, Melbourne: Macmillan Education Australia Pty Ltd.

Saranto, K. (1998). Outcomes of education information technology at nursing polytechnics. *Health Informatics Journal 4,* 84 - 91.

Saranto, K., & Leino-Kilpi, H. (1997). Computer literacy in nursing: Developing the information technology syllabus in nursing education. *Journal of Advanced Nursing, 25,* 377-385.

Saranto, K., Leino-Kilpi, H., and Isoaho, H. (1997). Learning environment in informatics technology. *Computers in Nursing, 15*(6), 324 - 332.

Saranto, K., & Tallberg, M. (1998). Nursing informatics in nursing education: A challenge to nurse teachers. *Nurse Education Today, 18,* 79-87.

Sermeus, W., & Alaerts, N. (1997). *Overview of nursing informatics education in Europe: Update 1997.* 2nd European Conference on Health Telematics Education 97. Lisbon, Portugal.

Sharkey, S., & Sharples, A. (2001). An approach to consensus building using the Delphi technique: Developing a learning resource in mental health. *Nurse Education Today, 21,* 398-408.

Sinclair, M., & Gardner, J. (1997). Nurse teachers' perceptions of information technology: a study of nurse teachers in Northern Ireland. *Journal of Advanced Nursing, 25,* 327 - 376.

Sinclair, M., & Gardner, J. (1999). Planning for information technology key skills in nursing education. *Journal of Advance Nursing, 30*(6), 1441 - 1450.

Skiba D.J., Ronald. J., & Simpson R. (1991) *Educating health care professionals in informatics: the scholars program.* Proceedings of the Fourth International Conference on Nursing Use of Computers and Information Science. Berlin: Springer-Verlag.

Skiba, D. J. (1997). Transforming nursing education to celebrate learning. *Nursing and health care perspectives, 18*(3), 127 - 128.

Smith, D., &. Norris, T. (1995). *Nursing and the Internet: A U.K. perspective.* 7th National Nurse Educators Conference, Alice Springs.

Sorrels-Jones, J., &. Weaver, D. (1999). Knowledge workers and knowledge -intense organisations, part 1. A promising framework for nursing and health care. *Journal of Nursing Administration, 29*(7/8), 12 - 18.

Spitzar, A. (1998). Moving into the information area: Does the current nursing paradigm still hold? *Journal of Advanced Nursing, 28*(4), 786 - 793.

Staggers, N., Gassert, C.A., & Curran, A. (2002), A Delphi study to determine informatics competencies for nurses at four levels of practice. *Nursing Research, 56*(6), 383 - 390.

Staggers, N. Gassert, C.A., & Skiba, D.J. (1999). Health professionals' views of informatics education. *Journal of American Medical Informatics Association, 7,* 550 - 558.

Storey, L. (1998). Functional analysis and occupational standards: Their role in curriculum development. *Nurse Education Today, 18,* 3 - 11.

Sumner, J. (2001). Caring in nursing: A different interpretation. *Journal of Advanced Nursing, 35*(6), 926 - 932.

Sutton, F. and Arbon, P. (1994). Australian Nursing - moving forward? Competencies and the nursing profession. *Nursing Education Today, 14,* 388 - 393.

Tietze, M. F. & Huber, J.T. (1995). Electronic information retrieval in nursing. *Nursing Management, 26*(7), 36 – 42.

Thede, L. Q. (1998, April 27). *Undergraduate informatics: What should it include?* From Fantasy to Reality. Orlando FL: Retrieved September 5, 1998, from http://www.nursingcenter.com/treasures/rutgers/the design form.html

Travis, L. Flatley-Brennan, P. (1998). Information science for the future: An innovative nursing informatics curriculum. *Journal of Nursing Education, 37*(4), 162 - 168.

Tschudin, V. (1992). *Ethics in Nursing.* Boston, Butterworth Heineman.

Turley, J.P. (1997). Nursing informatics '97: The impact of nursing knowledge and healthcare informatics. In U, Gerdin, P. Wainwright, M Tallberg (Eds.). Development of informatics as a discipline. Amsterdam: IOS Press.

Turley, J. P. (1998). Towards a model for nursing informatics. *Image: Journal of Nursing Scholarship, 28*(4), 309 - 313.

Turoff, M., & Hiltz, S. R. (N.D.). Computer based Delphi processes. Invited book chapter in Adler, M., & Ziglio, E. (Eds.) *Gazing into the oracle: The Delphi method and its application to social policy and public health.* London: Kingsley. Retrieved on January 19, 2001, from the World Wide Web: http://www.eies.njit.edu/~turoff/Papers/delphi3.html

United Kingdom Central Council for Nursing, Midwifery and Health Visiting. (2000). *Competencies for entry to the professional register.* London: UKCC.

Vanderbeek J., U. D., Jaworski R., Werner L., Hergert, D., Berry T. & Baas, L. (1994). Bringing Nursing informatics into the undergraduate classroom. *Computers in Nursing, 12*(5), 227 - 231.

Vanderbeek, J., & Beery, T.A. (1998). A blue print for an undergraduate health care informatics course. *Nurse Educator, 23*(1), 15 - 19.

Verhey, M. P. (September, 1999). Information literacy in an undergraduate nursing curriculum: Development, implementation, and evaluation. *Journal of Education in Nursing, 38*(6), 252 - 259.

Wallace, M. C., Shorten, A., Crookes, P.A., M^C.Gurk, C. & Brewer, C. (1999). Integrating information literacies into an undergraduate nursing programme. *Nurse Education Today, 19*, 136 - 141.

Wallace, M. C., Shorten, A., Crookes, P.A., M^C.Gurk, C. & Brewer, C. (1999). Integrating information literacies into an undergraduate nursing programme. *Nurse Education Today, 19,* 136 - 141.

Whiting, L.P. (1994). A Delphi study to determine defining characteristics of interdependence and dysfunctional independence as potential nursing diagnoses. *Issues in Mental Health Nursing (15),* 37 - 47.

Wicklein, R. C. (2000). Identifying critical issues and problems in technology education using a modified-Delphi technique. *Journal of Technology Education, 5* (1), 1045 - 1064.

Williams, P.L. & Webb, C. (1994a). The Delphi technique: an adaptive research tool. *British Journal of Occupational Therapy, 61*(40), 153 - 156.

Williams, P. L., & Webb, C. (1994b). The Delphi technique: A methodological discussion. *Journal of Advanced Nursing (19),* 180 - 186.

Wilson, J. (1996). *Lakes Area information systems pilot RNZ Plunket Society Inc: swapping paperwork for apples.* Nursing Informatics NZ Inc. Conference proceedings 1996 Informatics: Shaping the future. Wellington: NINZ.

Winskill, R. (2000, June). Is competency based training/education useful in for workplace training. *Contemporary Nurse, 9*(2), 115 - 119.

Wishart, J., & Ward, R. (2002). Individual differences in nurse and teacher training students' attitudes toward and use of information technology. *Nurse Education Today, 22*(3), 231 - 240.

Appendices

Appendix A Ethics Approval

VICTORIA UNIVERSITY OF TECHNOLOGY

MEMORANDUM

TO: Leonie Murphy
Nursing Department
Footscray Campus

FROM: Ms Zana Stefanovski
Acting Secretary, Human Research Ethics Committee

DATE: 16 April 1998

SUBJECT: **HRETH 13/98:**

*The Relationship Between Informatics in Undergraduate
Nursing Curricula and the Preparation of Nurses for Practice*

The Executive of the Human Research Ethics Committee have considered the above
application and granted provisional approval from 16 April 1998 to
30 September 1998.

The application will be submitted to the Committee for consideration for full approval
at its next scheduled meeting on 21 May 1998.

If you have any further queries, please do not hesitate to contact me on ext. 4710.

Zana Stefanovski

Ms Zana Stefanovski
Acting Secretary for HREC

VICTORIA
UNIVERSITY
OF TECHNOLOGY

MEMORANDUM
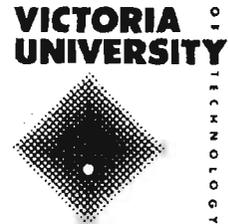
TO: Leonie Murphy
School of Nursing
St Albans Campus

Lesley Watson
390 Dee Street
Invercargill, New Zealand

FROM: Dr John Allen
Director, Office for Research

DATE: 18 November 1998

SUBJECT: **HRETH 13/98**

In response to your letter dated 13 November 1998 requesting an extension of approval for project:

HRETH 13/98:   *The Relationship Between Informatics in Undergraduate Nursing Curricula and the Preparation of Nurses for Practice (HREC 98/41; HREC 98/131)*

The Executive of the Human Research Ethics Committee, has extended the existing approval for the above application to 30 March 1999.

If you have any further queries please do not hesitate to contact me on ext. 4710.

Dr John Allen

Appendix B <u>Listserver Invitation to Expert Panel</u>

Body of message to Listservers Nrsing-L and Nurseres to recruit registered nurses experienced in the clinical use of informatics

From: Lesley Watson <watsonla@southnet.co.nz>

To: <u>NRSING-L@LIBRARY.UMMED.EDU</u> and

<u>Nurseres@LISTSERV.KENT.EDU</u>

Subject: Australian and New Zealand nursing informatics study

I am currently undertaking studies to gain a Master of Health Science through the Department of Nursing at Victoria University of Technology, Melbourne. I intend to survey Australian and New Zealand nurse educators and clinicians to establish the relevance of nursing informatics competencies addressed in undergraduate curriculum to the clinical practice of newly registered nurses. The Delphi technique, which involves study participants responding to a series of questionnaires, will be used. In order to establish a questionnaire that is free from my bias as a researcher and nurse educator, I am asking for volunteers who have knowledge of nursing informatics to form a group of experts to help identify the content of the first questionnaire. This part of my research is anticipated to be completed by 30th May 1998.

If you are able to help, please email me, Lesley Watson, at <u>watsonla@southnet.co.nz</u> by April 15th. 1998.

Appendix C <u>Information Sheet and Invitation to participate</u>

Similar wording was used for all three panels

Study Title: The Relationship Between Informatics in the Undergraduate Nursing Curricula and The Preparation of Nurses for Practice

---

Thank you for expressing interest in contributing to the study of nursing informatics competencies.

The intent of the study is to investigate whether competencies included in the nursing informatics content of the undergraduate nursing curriculum are the competencies required by newly registered nurses when in clinical practice. To do this, the study will require participation from a group of experienced registered nurse clinicians who are able to use e-mail to communicate with me, a group of nurse educators, and a final group of newly registered nurses. Only nurses from Australia or New Zealand will be participants in the educators or newly registered nurse groups.

A competency is defined as a state of having the knowledge, judgment, skills, energy, experience and motivation required to respond adequately to the demands of one's professional responsibilities (Tschudin, 1992, p.53). Nursing informatics is defined 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 health care (Graves & Corcoran 1989).

The study will apply the Delphi technique, aiming to identify group consensus about nurses' opinion of informatics competencies. This technique doesn't require that you meet other participants. However I will contact you by paper mail, e-mail or telephone.

As part of the experienced nurse group you will be asked to identify core nursing informatics competencies required of newly registered nurse in their clinical practice and the competencies you consider should be included in the undergraduate curriculum. This will be achieved through three rounds of questionnaires. When each questionnaire is completed it should be returned to me at <u>watsonla@southnet.co.nz</u>. Your responses will be

analysed along with those of other participants. The second and third questionnaires will be accompanied by a summary of comments from the previous questionnaire. This will give you some idea of how the other participants responded to the questionnaire and give you opportunity for further comment. It is expected that the study will take eight weeks to complete.

The core competencies identified by your group will be used as the basis of questionnaires that will be sent to two other groups involved in this study. These will be a group of nurse educators, and a group of newly registered nurse.

The Ethics Committee of Victoria University of Technology, Melbourne has given approval for the study. Any information given during the study will be treated in confidence and access restricted to the research supervisor Leonie Murphy and myself. To protect your anonymity your name or that of your institution will not be used in any publication related to this study.

You have the right to withdraw from the study at any time prior to its completion.

Please let me know, as soon as possible, if you are willing to be part of the study. Unfortunately I cannot accept e-mail letters of consent so I will have to send you a consent form by airmail which when signed should be returned to me either by fax or in the envelope provided.

Further questions you may have about this study can be addressed to myself, Lesley Watson at 390 Dee Street, Invercargill, New Zealand. Tel: +64-3-218-6462 or email at watsonla@southnet.co.nz or my research supervisor Leonie Murphy, Department of Nursing, Faculty of Human Development, Victoria University of Technology, Footscray Campus, Melbourne, Australia. (Tel: +61-3-9688-4661)

Thank you for your interest

Lesley Watson

Consent Form

[Originals were printed on VUT letterhead]

Study Title: The Relationship Between Informatics in the Undergraduate Nursing Curricula and The Preparation of Nurses for Practice

---

I, _____certify that

I am voluntarily giving my consent to participate in the study entitled:

"The relationship between informatics in undergraduate nursing curricula and the preparation of nurses for practice." being conducted through Victoria University of Technology by:

Lesley Watson as investigator

Leonie Murphy as supervisor

I certify that I have read the information sheet about this study and have had the opportunity to have any questions answered. I understand that I can withdraw from this study at any time and that this withdrawal will not jeopardise me in any way.

I have been informed that the information I provide will be kept confidential.

Name: _____

Postal Address:_____

Telephone No.:_____

Fax No.:_____

E-mail address:_____

Signed:_____Date_____

Witness:_____Date_____

Appendix D <u>Phase One First Questionnaire</u>

Study Title: The Relationship Between Informatics in the Undergraduate Nursing Curricula and The Preparation of Nurses for Practice

The purpose of this questionnaire is to gather the opinions of Experienced Nurses about the competencies required of a Nurse Clinician in applying Nursing Informatics to their practice.

Please provide the following information:

Name:

Contact Address:

Telephone number:

E-mail address:

Fax Number:

Do you have any nursing experience in either Australia or New Zealand? If so please provide an outline of that experience.

Question One

Please identify the age range to which you belong

22-30	31-40	41-50	51-60	61-65
☐	☐	☐	☐	☐

Question Two

Please identify the number of years of your experience in Nursing Informatics

1-2	3-4	5-6	7-8	9-10	11-15	16-20	21 or more
☐	☐	☐	☐	☐	☐	☐	☐

> Tschudin (1992,p.53) defines competency as " a state of having the knowledge, judgment, skills, energy, experience and motivation required to respond adequately to the demands of one's professional responsibilities".

Using this definition as a framework, please complete the following two questions

Question Three:

List the Nursing Informatics competencies that you consider necessary for a newly registered Nurse Clinician.

Question Four:

Which Nursing Informatics competencies should be taught in undergraduate nursing curriculum?

Appendix E Phase One Second Questionnaire

Study Title: The Relationship Between Informatics in the Undergraduate Nursing Curricula and The Preparation of Nurses for Practice

Dear

Following analysis of responses to question three in the initial questionnaire, nursing informatics competencies considered necessary for a newly registered nurse clinician can be placed into 5 categories:

1. Elementary understanding of computers

2. Information transmission and retrieval

3. Data protection

4. Knowledge of health care monitoring systems

5. Use of commercially available software

Competencies for each category are listed in the following pages. You are asked to indicate how necessary you believe each competency to be for inclusion in the undergraduate curriculum (under column heading UGC) and for newly registered nurses (under column heading NRN) using informatics in clinical practice.

Each competency should be given a rating using the following descriptors:

SA_____if you strongly agree

A_____if you agree

U_____if you are undecided

D_____you disagree

SD_____if you strongly disagree

Space is provided for you to add comments on the rating given to each competency.

**CATEGORY ONE: COMPETENCIES ASSOCIATED WITH AN
ELEMENTARY UNDERSTANDING OF COMPUTERS**

SA __ if you strongly agree	A ___ if you agree	U ___ if you are undecided
D ___ if you disagree	SD ___ if you strongly disagree	

UGC _____ Undergraduate curriculum   NRN _____ Newly Registered Nurse

Competency	UGC	NRN	Comments
Demonstrate knowledge of the keyboard layout			
Demonstrate knowledge of the GUI (Graphic User Interface)			
Demonstrate the ability to turn computer on/off			
Demonstrate the ability to format a floppy disk			
Recognise there are different types of operating systems			
State the difference between client/server and desktop stand alone programs			
Recall the meaning of computer terminology			
Be able to use various pointer devices - mouse, light pen, touch screen roller ball			
Recognise compatibility issues related to hardware and data			

Some responses mentioned basic computer skills, use or literacy, but did not expand on the concept of "basic". Could you please itemise what "basic computer skills" you believe should be included

_____
_____
_____

CATEGORY TWO: COMPETENCIES ASSOCIATED WITH THE USE OF COMMERCIALLY AVAILABLE SOFTWARE

SA __ if you strongly agree   A__ if you agree   U__ if you are undecided
D ___ if you disagree   SD_ if you strongly disagree
UGC _____ Undergraduate curriculum   NRN_____ Newly Registered Nurse

Competency	UGC	NRN	Comments
Recognise which word processing program they use most often			
Demonstrate the ability to use a word processor with accuracy and speed			
Demonstrate the ability to use spreadsheets			
Demonstrate the ability to use a relational database			
Demonstrate the ability to use a statistical program			
Demonstrate the ability to use graphics presentation programs			
Describe what scheduling packages are able to do			
Examine the real worth of the hardware or software			

CATEGORY THREE   COMPETENCIES ASSOCIATED WITH COMMUNICATION AND INFORMATION RETRIEVAL

SA __if you strongly agree A__if you agree U__if you are undecided	
D ___if you disagree SD_if you strongly disagree	
UGC _____Undergraduate curriculum	NRN_____Newly Registered Nurse

Competency	UGC	NRN	Comments
Describe the use of network login procedures			
Demonstrate the ability to communicate using email			
Demonstrate the ability to access information using internet			
Describe the use of local computer networks			
Apply search techniques to target a search, including Boolean operators i.e. and, or, not			
Knowing how to ask the right questions			

Additional comments/competencies

Appendix E

CATEGORY THREE   COMPETENCIES ASSOCIATED WITH COMMUNICATION AND INFORMATION RETRIEVAL (continued)

SA __if you strongly agree   A____if you agree   U__if you are undecided

D ___if you disagree   SD__if you strongly disagree

UGC _____Undergraduate curriculum   NRN_____Newly Registered Nurse

Competency	UGC	NRN	Comments
Distinguish the difference between data and information			
Use collegial networking			
Demonstrate the ability to complete a literature search using a data base (e.g. CINAHL or MEDLINE)			
Describe use of a hospital information system			
Demonstrate the ability to access a hospital information system			
Question what is presented to gain knowledge of functionality and mastery requirements			

Additional comments/competencies

Page 5

CATEGORY FOUR: **COMPETENCIES RELATED TO DATA PROTECTION**

SA ___ if you strongly agree **A**_____if you agree **U**____if you are undecided	
D ____ if you disagree **SD**____if you strongly disagree	
UGC _____Undergraduate curriculum	**NRN**_____Newly Registered Nurse

Competency	UGC	NRN	Comments
Appreciate opportunities and challenges that informatics brings to health care - security, privacy, confidentiality			
Basics of portable computing solutions			
Analyse issues of privacy and confidentiality of information			
Applicable standards affecting development of electronic patient records			
Appreciate language and need for consistency in nursing			
Ability to use electronic resources to locate current information on nursing problems			
Appreciate the changes occurring as a result of an increased use of informatics.			
Follow strategies designed to maintain patient confidentiality and data integrity			

CATEGORY FIVE: KNOWLEDGE OF HEALTH CARE
MONITORING SYSTEMS

SA __ if you strongly agree   A_____ if you agree   U_____ if you are undecided

D ___ if you disagree   SD_____ if you strongly disagree

UGC _____ Undergraduate curriculum   NRN_____ Newly Registered Nurse

Competency	UGC	NRN	Comments
Demonstrate general knowledge of the various career tracks taken by nursing informaticians and importance of these roles to the advancement of practice and development of clinical applications to support end users			
Demonstrate an appreciation of the integration of technology and the impact of reengineering and restructuring on roles in all aspects of wellness and disease state management			
Demonstrate a knowledge of telecommunications, artificial intelligence, robotics and system applications that can support clinical practice			
Know the use of clinical information systems – Patient record, care planning			
Recognise the need for utilising the available technology			
Demonstrate knowledge of types of information systems a nurse may encounter			
Demonstrate knowledge of basic processes involved in, for example, charting a medication in an automated system			

Additional comments/competencies

Question 4 of the first questionnaire asked which nursing informatics competencies should be taught in undergraduate nursing curriculum. The majority of the competencies were identified as necessary to both newly registered nurse practice and the curriculum.

Several participants made statements about informatics. For example, it was suggested that competencies related to newly registered nurse should be taught at different levels of depth.

I am asking you for feedback on each statement.

Statement One

"Many of the competencies could be integrated into assignments, communication methodologies and research initiatives. Many of the actual skills can be achieved by independent study labs as well as meeting with groups that can review and challenge assignments made on-line."

What are your thoughts about this statement? What, if any, are the additional competencies identified in this statement?

_____

_____

_____

_____

_____

Statement Two

"One of the most significant issues is awakening the interest of practitioners in learning that leveraging the technologies can enhance productivity, patient outcomes and day-to-day practice."

What are your thoughts about this statement? What, if any, are the additional competencies identified in this statement?

_____

_____

_____

_____

Statement Three

"Industrious and curious students can be encouraged to develop technologies for assignment completion as well as formalizing the questions to address research initiatives in nursing informatics."

What are your thoughts about this statement? What, if any, are the additional competencies identified in this statement?

_____

_____

_____

_____

_____

Statement Four

"All nursing students would work with nursing specific competencies (e.g. hospital information systems, computerised charting) unless they could demonstrate proficiency in the skills."

What are your thoughts about this statement? What, if any, are the additional competencies identified in this statement?

_____

_____

_____

_____

Statement Five

"I believe all topics are becoming more and more relevant to everyday nursing. If nursing does not take a lead in how informatics shapes what we do and vice versa...non-nurses will determine our profession's future. We currently have a tendency to over-simplify informatics concerns, expect more than the current systems can provide, yet can't communicate what it is that we do clearly enough for programmers to quantify nursing and lack of a universal language muddies the waters."

What are your thoughts about this statement? What, if any, are the additional competencies identified in this statement?

_____

Thanks for the time you have spent completing this questionnaire. Your answers

will be analysed along with the other experienced nurses taking part in the study. I

will contact you when analysis is completed and the third questionnaire is ready for

you to complete.

Lesley Watson

Appendix F Phase One Third Questionnaire

Study Title: The Relationship Between Informatics in the Undergraduate Nursing Curricula and The Preparation of Nurses for Practice

Dear (Panellist's name)

First of all, many thanks for your continued contribution to the study. Analysis of questionnaire responses has proved to be interesting and very challenging.

The second questionnaire was set in a way that would enable me to determine if there was a difference in response to undergraduate nursing competencies and those required by newly registered nurse. Analysis suggests there is little significant difference so I will not ask you to differentiate undergraduate from newly registered nurse in this questionnaire.

I have provided feed back for each competency. You may be asked to reconsider your response where lack of consensus is indicated.

Some of the existing competencies have been moved to the new category of IMPLICATIONS OF INFORMATION TECHNOLOGY TO THE NURSING PROFESSION. Response to the second questionnaire identified new competencies that have been added to the category of ELEMENTARY UNDERSTANDING OF COMPUTERS.

Each new competency should be given a rating using the following descriptors:

SA___if you strongly agree   **A**_____if you agree

U____if you are undecided   **D**__if you disagree

SD___if you strongly disagree

Space is provided for you to add comments on the rating given to each competency, category heading or content. I would be extremely grateful if you could complete this questionnaire as soon as you can, I seriously underestimated the time needed for data analysis, consequently I need to start the Australasian educators panel next week if at all possible.

CATEGORY ONE: **COMPETENCIES ASSOCIATED WITH AN ELEMENTARY UNDERSTANDING OF COMPUTERS**

SA___if you strongly agree **A**____if you agree **U**___if you are undecided	
D____if you disagree **SD**___if you strongly disagree	

Competency	Previous rating	New Rating	Comments
Demonstrate knowledge of the keyboard layout			
Demonstrate knowledge of the GUI (Graphic User Interface)			
Demonstrate the ability to turn computer on/off			
Demonstrate the ability to format a floppy disks			
Recognise there are different types of operating systems			
State the difference between client/server and desktop stand alone programs			
Recall the meaning of computer terminology			
Demonstrate the ability to use various pointing devices - mouse, light pen, touch screen roller ball			
Recognise compatibility issues related to hardware and data			

Additional comments/competencies

SA_____if you strongly agree	A_if_you agree	U_____if you are
undecided **D**____if you disagree	**SD**_____if you strongly disagree	

CATEGORY ONE: COMPETENCIES ASSOCIATED WITH AN ELEMENTARY UNDERSTANDING OF COMPUTERS

New competencies derived from responses to 2nd Questionnaire
Please provide your rating for each one

Competency	Rating	Comments
Demonstrate the ability to obtain a printout of a file		
Demonstrate the ability of how to clear printer paper jams		
Knowledge of how to change a printer toner or ink cartridge		
Demonstrate the ability of how to access files or folders on both hard and floppy disk drives		
Demonstrate the ability of how to create folders or directories		
Demonstrate the ability to save files on a disk drive		
Demonstrate the ability of what a spreadsheet does		
Demonstrate the ability of what a word processor does		
Describe the function of video/sound cards		

Additional comments/competencies

**CATEGORY TWO: COMPETENCIES ASSOCIATED WITH THE USE
OF COMMERCIALLY AVAILABLE SOFTWARE**

SA__if you strongly agree   A_____if you agree   U__if you are undecided
D__if you disagree   SD if you strongly disagree

Competency	Previous Rating	New Rating	Comments
Demonstrate the ability to install an "off the shelf program" onto a hard drive			
Recognise which word processing program they use most often			
Demonstrate the ability to use word processor with accuracy and speed			
Demonstrate the ability to use spreadsheets			
Demonstrate the ability to use a relational database			
Demonstrate the ability to use a statistical program			
Demonstrate the ability to use graphics presentation programs			
Describe what scheduling package			
Describe what scheduling packages are able to do			
Examine the real worth of the hardware or software			

| SA___if you strongly agree | A___if you agree | U___if you are undecided |
| D___if you disagree | SD___if you strongly disagree | |

Competency	Previous Rating	New Rating	Comments
Understand the use of network login procedures			
Ability to communicate using email			
Ability to access information using internet			
Use of local computer networks			
Application of search techniques to target a search, including Boolean operators i.e. and, or, not			
Knowing how to ask the right questions			

Additional comments/competencies

Appendix F

CATEGORY THREE (CONTINUED): COMPETENCIES ASSOCIATED WITH COMMUNICATION AND INFORMATION RETRIEVAL

SA__f you strongly agree   A___if you agree U____if you are undecided
D__if you disagree   SD____if you strongly disagree

Competency	Previous Rating	New Rating	Comments
Appreciation of the difference between data and information			
Collegial networking			
Able to complete a literature search using a data base (e.g. CINAHL or MEDLINE)			
Ability to use electronic resources to locate current information on nursing problems			
How to question what is presented to gain knowledge of functionality and mastery requirements			

Additional comments/competencies

CATEGORY FOUR: COMPETENCIES RELATED TO DATA
PROTECTION

SA___if you strongly agree   A____if you agree U____if you are undecided
D____if you disagree   SD____if you strongly disagree

Competency	Previous Rating	New Rating	Comments
Appreciate opportunities and challenges that informatics brings to health care - security, privacy, confidentiality			
Apply the basics of portable computing solutions			
Analyse issues of privacy and confidentiality of information			
Recognise the need for standards affecting development of electronic patient records			
Use strategies designed to maintain patient confidentiality and data integrity			

Additional comments/competencies

CATEGORY FIVE: **KNOWLEDGE**   **OF**   **HEALTH**   **CARE**
MONITORING SYSTEMS

SA___ if you strongly agree   A___ if you agree   U___ if you are undecided
D___ if you disagree   SD___ if you strongly disagree

Competency	Previous Rating	New Rating	Comments
Elementary knowledge of telemetry, telecommunications, and system applications that can support clinical practice			
Describe use of a hospital information system			
Ability to access a hospital information system			
Knowledge of health management information systems a nurse may encounter			
Knowledge of basic processes involved in, for example, charting a medication in an automated system			

Additional comments/competencies

Page 8

CATEGORY SIX   IMPLICATIONS OF INFORMATION
TECHNOLOGY USE AND THE NURSING PROFESSION.

Competency	Previous Rating	New Rating	Comments
General knowledge of the various career tracks taken by nursing informaticians and importance of these roles to the advancement of practice and development of clinical applications to support end users.			
Appreciate integration of technology and the impact of reengineering and restructuring on roles in all aspects of wellness and disease state management			
Possess an appreciation of what computers can & cannot do at the present and some feeling of potential changes likely to caused by computers			
Appreciate language and need for consistency in describing nursing actions			
Critically analyse the changes occurring as a result of an increased use of informatics.			
Appreciate the need for utilising the available technology			

Additional comments/competencies

(panellist's name, thanks for the time you have spent completing this questionnaire.

Your answers will be analysed along with the other experienced nurses taking part in the study. I will contact you when analysis is completed.

Appendix G Message used to recruit Newly Registered Nurse Group

Journal advertisement to be placed in the Australian Nurses Journal, Nursing Careers Allied Health and in Kai Tiaki: Nursing New Zealand

An invitation Newly Registered Nurses interested in Nursing Informatics

I'd like to invite you to participate in a research project I am undertaking as part of my Master of Health Science studies at Victoria University of Technology, Melbourne.

The research, which will use the Delphi technique, involves answering a series of three questionnaires about informatics competencies required by newly registered nurses in Australia and New Zealand. My aim is to find out which competencies need to be included in undergraduate nurse education.

The study will run from 30 May. to 30 September, 1998.

If you think you can help me by becoming a study participant; then I'd like to hear from you by 30 April, 1998 so I can send you more detailed information.

You can contact me, Lesley Watson at 390 Dee Street, Invercargill, New Zealand, Tel No. (+64) 03-2186462 or at watsonla@southnet.co.nz.

Body of message to Listservers nrsing L and nurseres to recruit Newly

Registered Nurse Group

From: Lesley Watson <watsonla@southnet.co.nz>

To: NRSING-L@LIBRARY.UMMED.EDU

To: NURSERES@LISTSERV.KENT.EDU

Subject: Newly Registered Nurses and Nursing Informatics competencies

I am currently undertaking studies to gain a Master of Health Science through the Department of Nursing at Victoria University of Technology, Melbourne. I would like to survey Australian and New Zealand Nurses to establish the relevance of nursing informatics competencies addressed in undergraduate curriculum to the clinical practice of newly registered nurses. The study, which is based on the Delphi technique, will use a series of questionnaires to establish the collective opinions of those taking part in the study. E-mail will be used for posting and the return of the completed questionnaires. The study will run from 30 May to 30 September, 1998. So, if you are newly registered, that is now in the second year of clinical practice and working in either Australia or New Zealand, then I'd really like to hear from you.

If you are interested in helping, please email me, Lesley Watson, at watsonla@southnet.co.nz by 30 April, 1998.

Appendix H <u>Letter of Invitation to Directors of Nursing</u>

390 Dee Street
Invercargill
New Zealand

September 29, 1998

Director of Nursing

Dear Director of Nursing

I am a nurse educator living in Invercargill, New Zealand, while studying as a distance student of the Department of Nursing, Victoria University of Technology, Melbourne. The reason for contacting you is to ask for your assistance in finding at least one member of your nursing staff who would be willing to participate in a study I am undertaking as a Master of Health Science (Nursing) student.

The study involves a group of Australian and New Zealand nurses with a minimum of two and no more than four years post registration clinical experience. The aim of the study is to identify nursing informatics competencies that are needed by newly registered nurses when applying informatics to their clinical practice. The Delphi technique will be used, this involves each study participant completing three successive questionnaires and being given feedback on how the other participants in the group have responded. In doing this, it is anticipated that I will be able to identify the opinion of the group as a whole. Study participants would be expected to complete the questionnaire outside their work time.

Approval to carry out this study has been granted by the University's Ethics Committee; are there any local requirements that must be met?

If you are willing to help me, I would appreciate you giving the enclosed information sheet; consent form and return addressed envelope to whoever agrees to participate.

Thank you in anticipation

Appendix I Phase Two First Questionnaire

The relationship between informatics in undergraduate nursing curricula and the preparation of nurses for practice

You are asked to complete this questionnaire by providing ratings for the competencies listed on the following pages. You are invited to identify additional informatics competencies you consider necessary for beginning registered nurse and inclusion in the undergraduate curriculum.

A panel of nursing informatics experts has identified the list of competencies. It is not an exhaustive list; rather it is meant as a starting point for further development.

Each competency should be given a rating using the following descriptors:

SA_____if you strongly agree

A_____if you agree

U_____if you are undecided

D_____you disagree

SD_____if you strongly disagree

Space is provided for you to add comments on the rating given to each competency, category heading or wording.

CATEGORY ONE: COMPETENCIES ASSOCIATED WITH AN ELEMENTARY UNDERSTANDING OF COMPUTERS

Competency	Rating	Comments
Demonstrate knowledge of the keyboard layout		
Demonstrate knowledge of the GUI (Graphic User Interface)		
Demonstrate ability to turn a computer on/off		
Demonstrate ability to format a floppy disk		
Recognise there are different types of operating systems		
State the difference between client/server and desktop stand alone programs		
Recall the meaning of terminology associated with elementary computer use		
Demonstrate ability to use various pointing devices – mouse, light pen, touch screen roller ball		
Recognise compatibility issues related to hardware and data		
Demonstrate ability to obtain a printout of a file		

CATEGORY ONE COMPETENCIES ASSOCIATED WITH AN
ELEMENTARY UNDERSTANDING OF COMPUTERS (continued):

Competency	Rating	Comments
Demonstrate ability to clear printer paper jam		
Demonstrate how to change a printer toner or ink cartridge		
Demonstrate ability to create folders or directories		
Demonstrate ability to save files on a disk drive		
Describe the use of spreadsheet software		
Describe the use of word processor software		
Describe the function of video/sound cards		

Additional comments/competencies

CATEGORY TWO: COMPETENCIES ASSOCIATED WITH THE USE OF COMMERCIALLY AVAILABLE SOFTWARE

Competency	Rating	Comments
Demonstrate ability to install an "off the shelf program" onto a hard drive		
Recognise which word processing program they use most often		
Demonstrate ability to use word processor software with accuracy and speed		
Demonstrate ability to use spreadsheets		
Demonstrate ability to use a relational database		
Demonstrate ability to use a statistical program		
Demonstrate ability to use graphics presentation programs		
Describe what scheduling packages are able to do		
Examine the worth of the hardware or software		

Additional comments/competencies

CATEGORY THREE: COMPETENCIES ASSOCIATED WITH COMMUNICATION AND INFORMATION RETRIEVAL

Competency	Rating	Comments
Describe the use of network login procedures		
Describe the use of local computer networks		
Demonstrate ability to communicate using email		
Use collegial networking		
Distinguish the difference between data and information		
Demonstrate ability to complete a literature search using a data base (e.g. CINAHL or MEDLINE)		
Apply search techniques to target a search, including Boolean operators i.e. and, or, not		
Use the Internet to access information		
Demonstrate ability to use electronic resources to locate current information on nursing problems		
Demonstrate knowledge of how to ask the right questions		
Question what is presented to gain knowledge of functionality and mastery requirements		

Additional comments/competencies

CATEGORY FOUR: COMPETENCIES RELATED TO DATA PROTECTION

Competency	Rating	Comments
Assess opportunities and challenges that informatics brings to health care - security, privacy, confidentiality		
Analyse issues of privacy and confidentiality of information		
Use strategies designed to maintain patient confidentiality and data integrity		
Analyse the need for standards affecting development of electronic patient records		

Additional comments/competencies

CATEGORY FIVE: KNOWLEDGE OF HEALTH CARE MONITORING SYSTEMS

Competency	Rating	Comments
Demonstrate elementary knowledge of telemetry, telecommunications, and system applications that can support clinical practice		
Describe use of a hospital information system		
Ability to access a hospital information system		
Discuss health management information systems a nurse may encounter		
Describe basic processes involved in, for example, charting a medication in an automated system		

Additional comments/competencies

CATEGORY SIX   IMPLICATIONS OF INFORMATION
TECHNOLOGY USE AND THE NURSING PROFESSION.

Competency	Rating	Comments
Identify the various career tracks taken by nursing informaticians and importance of these roles to the advancement of practice and development of clinical applications to support end users		
Critique the integration of technology and the impact of reengineering and restructuring on roles in all aspects of wellness and disease state management		
Describe what computers can and cannot do at the present and the potential changes likely to caused by computer use		
Recognise language and need for consistency in describing nursing actions		
Critically analyse the changes occurring as a result of an increased use of informatics		
Recognise the need for utilising available technology		

Additional comments/competencies

Appendix J Phase One Round One Summary Of Content Analysis

Statements from first questionnaire returns from Expert Panel	keyword or phrase	Interpretation
Question One List the Nursing Informatics competencies that you consider necessary for a Newly Registered Nurse Clinician.		

Expert 1

Ability to access data from "in systems" and internet sources.	Ability to access data from "in systems" and internet sources. Ability to access data from internet sources.	refers to an intranet or local area networks.
Ability to input data to various systems using word processing skills	word processing	

Expert 2

Basic Computer skills. Such as a Level 100-200 Computer Course.	basic computer skills	Very broad needs clarification by panel
Comfort with e-mail, word, messaging systems	e-mail	
	word	Word processing software
	messaging systems	paging systems
Use of the Internet would be helpful.	Internet	

Content Analysis (Continued)

Statements from first questionnaire returns from Expert Panel	keyword or phrase	Interpretation
Expert 3		
1 - Computer literacy: (a) basic software skills of word processing, spreadsheet, relational database, statistical program and graphics presentation programs,	basic software skills of word processing	
	spreadsheet	
	relational database	
	statistical program	
	graphics presentation programs	
Expert 3		
(b) demonstrate understanding of an OS and the difference between client/server and desktop stand alone programs and	(b) demonstrate understanding of an OS	OS = Operating System
	difference between client/server and desktop stand alone programs	
c) utilisation of a scheduling package of software.	scheduling software	
2 - Skill in e-mail, WWW and intranet utilisation	2 - Skill in e-mail	
	2 - Skill in WWW utilization	
	2 - Skill in intranet utilisation	
Especially Boolean searching Logic	Boolean Logic	Applied to literature searching techniques
4 - General knowledge of information systems that support clinical, administrative, education and research initiatives in practice	knowledge of information systems that support clinical, administrative, education and research initiatives in practice	

Content Analysis (Continued)

Statements from first questionnaire returns from Expert Panel	keyword or phrase	Interpretation
Expert 3 (continued)		
5 - Difference between data and information	difference between data information	
6 - General knowledge of the various career tracks taken by nursing informaticians and importance of these roles to the advancement of practice and development of clinical applications to support end users.	knowledge of the various career tracks taken by nursing informaticians and importance of these roles to the advancement of practice and development of clinical applications to support end users.	
7 - Integration of technology and the impact of reengineering and restructure on roles in all aspects of wellness and disease state management	Integration of technology and the impact of reengineering and restructure on roles in all aspects of wellness and disease state management	
8 - Knowledge of telecommunications, artificial intelligence, robotics and system applications that can support clinical practice.	Knowledge of telecommunications, artificial intelligence, robotics and system applications that can support clinical practice.	
9- Knowing how to ask the right questions.	Knowing how to ask the right questions.	Applied to computer use and information finding
Expert 4		
Ability to use electronic resources to locate current information on nursing problems	use electronic resources to locate current information on nursing problems	
Appreciate the changes occurring as a result of an increased use of informatics.	Appreciate the changes occurring as a result of an increased use of informatics.	
Follow strategies designed to maintain patient confidentiality and data integrity.	Follow strategies designed to maintain patient confidentiality and data integrity.	
Use of electronic communication (E-Mail)	E-Mail	

Content Analysis (Continued)

Statements from first questionnaire returns from Expert Panel	keyword or phrase	Interpretation
Expert 5		
Basic keyboard skills	keyboard skills	
Knowledge of the GUI	GUI	Graphic user interface
Ability to use business type software, word processor, spreadsheet.	software word processor	
	software spreadsheet.	
Understanding of the use of network login	network log in	
Expert 6		
Basic computer use (formatting disks, turning computer on/off, meaning of computer terminology	Basic computer use	
	formatting disks	
	turning computer on/off meaning of computer terminology	
Able to word process with reasonable accuracy and speed	word process speed accuracy	
Able to identify what word processing program they use most often	name the word processing software	
Able to complete a literature search using a data base (e.g. CINAHL or MEDLINE)	literature search	
Able to send and receive e-mail	e-mail	
Describe use of a hospital information system	use of hospital information system	
Able to access a hospital information system	access a hospital information system	

Content Analysis (Continued)

Statements from first questionnaire returns from Expert Panel	keyword or phrase	Interpretation
Expert 7		
Computer function knowledge base; how they work; various types	Computer function knowledge base; how they work; various types	
Definitions of terms-especially audit, hardware types, processors, servers	Definitions	
Mobility with various pointer devices - mouse, light pen, touch screen, roller ball	various hardware devices - mouse, light pen, touch screen, roller ball	
Graphic user interfaces the pretty face on the nuts and bolts of the system assessing glitzy versus functional	Graphic user interface	
	assessing functional versus glitzy	assessing merits of hardware or software
Opportunities and challenges that informatics brings to health care - security, privacy, confidentiality. Basics on portable computing solutions	Opportunities and challenges that informatics brings to health care	
	security	data security
	privacy confidentiality	data security
	Basics on portable computing solutions	basic knowlegde to overcome basic computer problems
Internet, e-mail, research on the net, focusing a search	e-mail	
	research on the net	
	focusing a search	literature search
Applicable standards affecting development of electronic patient records	electronic records	
International compatibility concerns with hardware and data.	hardware	
	data	consistency in language use
Language and need for consistency in nursing		

Content Analysis (Continued)

Question 4 Which Nursing Informatics competencies should be taught in undergraduate nursing curriculum?

Statements from first questionnaire returns from Expert Panel	keyword or phrase	Interpretation
Expert 1		
Word processing	Word processing	
Spreadsheet analysis	Spreadsheet analysis	
Data access- in database management, from library resources, from Internet and online resources	Data access- in database management	
	Data access from library resources	
	Data access from internet	
	Data access online resources	
Expert 2		
Basic Computer Literacy courses	Basic Computer Literacy courses	Requires more input from experts
Expert 3		
1 - Computer literacy: (a) basic software skills of word processing, spreadsheet, relational database, statistical program and graphics presentation programs,	Computer literacy	
	basic software skills of word processing basic software skills spreadsheet, basic software skills relational database basic software skills statistical program basic software skills graphics presentation programs,	
(b) demonstrated understanding of an OS and the difference between client/server and desktop stand alone programs	(b) demonstrated understanding of an OS	
	the difference between client/server and desktop stand alone programs	

Content Analysis (Continued)

Statements from first questionnaire returns from Expert Panel	key word or phrase	Interpretation
c) utilisation of a scheduling package of software	scheduling software	
2 - Skill in e-mail, WWW and Intranet utilisation	skill in e-mail	
	WWW	
	Intranet utilisation	
especially Boolean searching Logic	Boolean searching	Literature search
4 - General knowledge of information systems that support clinical, administrative, education and research initiatives in practice	General knowledge of information systems that support clinical, administrative, education and research initiatives in practice	
5 - Difference between data and information	Difference between data and information	
6 - General knowledge of the various career tracks taken by nursing informaticians and importance of these roles to the advancement of practice and development of clinical applications to support end users.	General knowledge of the various career tracks taken by nursing informaticians and importance of these roles to the advancement of practice and development of clinical applications to support end users.	

Content Analysis (Continued)

Statements from first questionnaire returns from Expert Panel	key word or phrase	Interpretation
7 – Integration of technology and the impact of reengineering and restructure on roles in all aspects of wellness and disease state management	Integration of technology and the impact of reengineering and restructure on roles in all aspects of wellness and disease state management	
8 - Knowledge of telecommunications, artificial intelligence, robotics and system applications that can support clinical practice.	Knowledge of telecommunications, artificial intelligence, robotics and system applications that can support clinical practice.	
9- Knowing how to ask the right questions. All of the above at different levels of depth, many of which can be integrated into assignments, communication methodologies and research initiatives. Many of the actual skills can be achieved by independent study labs as well as meeting with groups that can review and challenge assignments made on-line.	how to ask the right questions.	
	general comment	

Content Analysis (Continued)

Statements from first questionnaire returns from Expert Panel	key word or phrase	Interpretation
One of the most significant issues is awakening the interest of practitioners in learning that leveraging the technologies can enhance productivity, patient outcomes and day-to-day practice.	general comment	
Industrious and curious students can be encouraged to develop technologies for assignment completion as well as formalising the questions to address research initiatives in nursing informatics.	general comment	

Expert 4

1) Searching electronic databases (like CINAHL) and the Internet.	Searching electronic data bases CINAHL internet.	
2) Electronic communication (E-Mail)	(E-Mail)	
3) Basic computer concepts like keyboarding, saving data, data security.	Basic computer concepts	
	key boarding	using a keyboard
	saving data	
	data security.	
4) Basic word processing	Basic word processing	

Content Analysis (Continued)

Statements from first questionnaire returns from Expert Panel	key word or phrase	Interpretation
Expert 5		
Basic keyboard skills	keyboard	
Knowledge of the GUI	GUI	Graphic user interface
Ability to use business type software, word processor, spreadsheet.	Ability to use business type software	
	Ability to use word processor	
	Ability to use spreadsheet.	
Understanding of the use of network login	network login	
The need for utilising the available technology.	need to use available technology	
Privacy and confidentiality of information.	Privacy and confidentiality of information.	
Use of clinical information systems – Patient record, care planning.	clinical information systems	
Use of clinically oriented software applications e.g. ECG monitoring	software for clinical use.	
Use of the Internet for:	Internet	
Email	Email	
Literature searching	Literature searching	
Information searching	Information searching	
Collegiate[Collegial] networking.	Collegial networking.	

Content Analysis (Continued)

Statements from first questionnaire returns from Expert Panel	key word or phrase	Interpretation
Expert 6		
Basic computer use (formatting disks, turning computer on/off, meaning of computer terminology	Basic computer use	
	☐formatting disks	
	turning computer on/off,	
	meaning of computer terminology	
Able to word process with reasonable accuracy and speed	word processing speed and accuracy	
Able to identify what word processing program they use most often	name word processing software used	
Able to complete a literature search using a data base (e.g. CINAHL or MEDLINE)	literature search	
Able to send and receive e-mail	e-mail	
Describe use of a hospital information system	use of a hospital information system	
Able to access a hospital information system	access a hospital information system	

Question Four:

All of those listed above that the student does not possess upon entering the curriculum.
For example, many younger students have good basic word processing, e-mail and Internet skills, these students would not be required to take that portion. However, those students not meeting basic competencies in "non-nursing computer skills" would have to do remedial work.
Nursing specific competencies (e.g. hospital information systems, computerised charting)

Expert 7

1.Basic equipment knowledge	Basic knowledge equipment	
2.Basic internet activities-search and validate info found	Internet search and validate info found	info = information

Content Analysis (Continued)

Statements from first questionnaire returns from Expert Panel	key word or phrase	Interpretation
3.Types of information systems a nurse may encounter	type information systems	
4.Basic processes involved in for example, charting a medication in an automated system	automated system	
5.How to question what is presented to gain knowledge of functionality and mastery requirements	how to question what is presented to gain knowledge of functionality and mastery requirements	
6.General computer terms	General computer terms	
7.Standards to be met	Standards to be met	
8.Clinical hands on practice	Comment	

Appendix K Experts Phase One, Round 2
Undergraduate -V- Newly Registered
Competencies

Summary of Mann-Whitney U Values and Significances

	Competency	U	Significance
1.1	Knowledge of the keyboard layout	19.5	p > 5%
1.2	Knowledge of the GUI (Graphic User Interface)	23	p > 5%
1.3/1.4	Ability to format disks, turning computer on/off	23.5	p > 5%
1.5	Appreciation of different types of operating systems	24	p > 5%
1.6	Understand the difference between client/server and desk top stand alone programmes	22	p > 5%
1.7	Knowledge of the meaning of computer terminology	17.5	p > 5%
1.8	Be able to use various pointer devices – mouse, light pen, touch screen roller ball	24	p > 5%
1.9	Have knowledge of compatibility issues related to hardware and data	18.5	p > 5%
2.1	Ability to identify what word processing program they use most often	21.5	p > 5%
2.3	Ability to use word processor with accuracy and speed	21.5	p > 5%
2.4	Ability to use spreadsheets	20.5	p > 5%
2.5	Ability to use a relational database	18	p > 5%
2.6	Ability to use a statistical program	18.5	p > 5%
2.7	Ability to use graphics presentation programs	16	p > 5%
2.8	Utilisation of a scheduling package	20.5	p > 5%
2.9	Ability to determine the real worth of the hardware or software	23.5	p > 5%
3.1	Understand the use of network login procedures	18	p > 5%
3.2	Ability to communicate using email	17.5	p > 5%
3.3	Ability to access information using internet	17.5	p > 5%
3.4	Use of local computer networks	17.5	p > 5%
3.5	Application of search techniques to target a search, including Boolean operators i.e. and, or, not	16.5	p > 5%
3.6	Knowing how to ask the right questions	15.5	p > 5%
3.7	Appreciation of the difference between data and information	24.5	p > 5%
3.8	Collegiate networking	24.5	p > 5%
3.9	Able to complete a literature search using a data base (e.g. CINHAL or MEDLINE)	16.5	p > 5%
3.10	Ability to use electronic resources to locate current information on nursing problems	16.5	p > 5%
3.11	How to question what is presented to gain knowledge of functionality and mastery requirements	22	p > 5%
3.12	Describe use of a hospital information system	22	p > 5%
3.13	Able to access a hospital information system	22	p > 5%
4.1	Appreciate opportunities and challenges that informatics brings to health care – security, privacy, confidentiality	24.5	p > 5%
4.2	Privacy and confidentiality of information	17.5	p > 5%
4.3	Applicable standards affecting development of electronic patient records	23	p > 5%
4.4	Follow strategies designed to maintain patient confidentiality and data integrity	24.5	p > 5%

Summary of Mann-Whitney U Values and Significances (Continued)

	Competency	U	Significance
4.5	Appreciate language and need for consistency in nursing	22.5	p > 5%
4.6	Apply the basics of portable computing solutions	23	p > 5%
4.7	Appreciate the changes occurring as a result of an increased use of informatics	17.5	p > 5%
5.1	Knowledge of telecommunications, artificial intelligence, robotics and system applications that can support clinical practice	21	p > 5%
5.4	Knowledge of types of information systems a nurse may encounter	19.5	p > 5%
5.5	Knowledge of basic processes involved in, for example, charting a medication in an automated system	24.5	p > 5%
5.6	Use of clinical information systems - Patient record, care planning	24.5	p > 5%
6.1	General knowledge of the various career tracks taken by nursing informaticians and importance of these roles to the advancement of practice and development of clinical applications to support end users	20.5	p > 5%
6.2	Appreciate integration of technology and the impact of reengineering and restructuring on roles in all aspects of wellness and disease state management	22	p > 5%
6.6	Appreciate the need for utilising the available technology	24.5	p > 5%