STUDENT NURSES' CONCEPTIONS OF COMPUTERS IN HOSPITALS

By

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Date October 4, 1988
The trend toward increased computerization in Canadian hospitals has profound implications for hospital employed nurses, the majority of whom are educated in community college nursing programs. Educators, in response to this trend, must be attentive to the quality of student learning when planning for computer content in nursing curricula. The purpose of this phenomenological study was to identify how student nurses, enrolled in a community college nursing program, conceptualize the impact of computer use on hospital employed nurses. Students' conceptions were analyzed in relation to their: (a) attitude toward computers, and (b) length of clinical experience.

Thirty-five (11 first-year, 11 second-year and 13 third-year) students enrolled in the nursing program at Cariboo College in Kamloops, British Columbia, were interviewed. Three broad, and ten forced-response, questions generated both qualitative and quantitative data, which were reported as primary and secondary findings.

Data analysis, through use of the constant comparative method, was carried out on a formative and summative basis. Findings indicated that subjects had little awareness of computer use by nurses today. Their knowledge of how computers may be used by nurses in the future was also limited, and appeared to center around three broad areas:
nursing, communication, and administration.

Subjects' conceptions of the impact of computer use on hospital employed nurses fell into four categories: (a) nursing image, (b) professionalism, (c) patient care, and (d) workload. Their comments on these four categories were further classified into three sub-categories, indicating whether they felt that the increased use of computers would: (a) enhance, (b) detract from, or (c) both enhance and detract from, each category. It was found that subjects' conceptions differed in complexity in direct proportion to the year in which they were enrolled in the program and also the length of their clinical experience. The majority of subjects had positive attitudes toward computer use. In addition, it was found that there was a significant relationship between complexity of conception and attitude.

Students enter nursing programs with established conceptions and attitudes. The goal in planning computer programs must be to sequence computer content through the use of a taxonomy of learning outcomes, so that quality of learning is a priority, and positive attitudes are fostered.
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CHAPTER 1
Introduction

There is little doubt that we are living in an increasingly technological society, where information is being generated at a previously unheard of rate. This trend has profound implications for society, as attempts are made to adapt to these forced changes.

The health care system is moving toward increased use of computer technology as a means of processing large volumes of information. Movement in this direction poses many questions and concerns, not only for health care practitioners themselves, but for the institutions where these practitioners are educated and the practice settings where they are employed.

In British Columbia computers and computer applications of technology have been quietly creeping into health care settings at a steady rate over the last decade. Nurses are the largest single group of health professionals employed in health care settings in this province. The Registered Nurses Association Of British Columbia (R.N.A.B.C.) reports that there were 24,128 practising members in May, 1988. Because of their numbers, nurses will have a tremendous influence on the adoption of the increased use of computers in practice settings. Individual acceptance is critical to the success or failure of any innovation such as use of computers (Hall &
Some literature suggests that nurses are willing and ready to begin the educational process of learning the technical skills required for satisfactory utilization of computers (Krampf & Robinson, 1984). While acquisition of technical skills is very important, institutions must become concerned with how they can provide a comfortable feeling of acceptance for these innovations (Krampf & Robinson, 1984). There is little information in the literature about development of the affective domain of users. Gaps exist concerning nurses' attitudes toward the use of computers and how the use of computers will affect their role. Most surveys on acceptability have been conducted after computer systems have been implemented (Whitehouse, Preston, Tobin, Miller, & Bailey, 1975). If nurses are to be proactive, rather than reactive to change, more education is needed to help nurses make wise choices about these innovations which may in turn, have impact upon their practice.

The increasing use of computers in health care has profound implications for nursing education (Ronald, 1983). There is growing evidence of a surge of interest by schools of nursing in computer technology. This interest presumably, is due in part to the increased use of computers in nursing administration and practice (Parks, Damrosch, Heller, & Romano, 1986). However, very few authors address the educational needs related to the use of computers by health
care professionals, in either their initial educational programs, or through continuing education activities (Hannah, 1983).

There is a dearth of information on what nurses and nursing students currently know and desire to know about computers (Parks et al, 1986). It appears that only four major American studies identifying the learning needs of nurses have been reported in the literature in the last decade (Walker, 1981; Ronald, 1983; Heller, Romano, Damrosch, & Parks 1985; & Parks et al. 1986). Ronald (1983) focused her attention on the learning needs of nurse educators, while Walker (1981), Heller et al. (1985) and Parks et al. (1986), studied the learning needs of student nurses enrolled in baccalaureate or masters programs.

As a direct result of attempts to identify nurses' learning needs in relation to computers, a number of prescriptive articles and texts have been written (Edmunds, 1982; Skiba, 1983; Ronald, 1983; Hannah, 1983; & Ronald & Skiba, 1987). These authors present step by step "how to" approaches for curriculum planning and for content development. Their writing appears to be focused on the quantity or amount of content to be included when developing computer awareness courses, rather than on assessment of the quality of learning.

The absence of reported studies is evidence of a void of information available on students enrolled in community
college nursing programs in Canada in terms of their attitude toward, knowledge of, and learning needs, in regard to computers in nursing. One must be cognizant of the fact that graduates of these programs primarily work in hospitals. In addition, information concerning nursing students’ conceptions about the role of computers in hospital nursing and the quality of their conceptions appears to be non-existent in the literature.

Background

A National Study

In March 1987, The National Federation Of Nurses’ Unions released the results of its thirteen month national study. This three part study, entitled Infostat, prepared by principal investigator Kay Desborough, studied registered nurses currently using computers in Canadian health care agencies. The purpose was to document the effects and implications of patient management systems on nurses and nursing care, and to provide nursing leaders with qualitative and quantitative information to direct and support decision making for current use and future development of these systems.

Study 1 was a qualitative research study involving taped interviews with 45 registered nurses from nine health care
agencies in Eastern, Central and Western Canada. Through the use of the constant comparative analysis technique, four conceptual categories emerged from the data. These categories were: (a) the context (a set of interrelated computer education, organizational, computer system, and personal factors) in which the computer system is used; (b) the effects on the nurse; (c) the effects on the delivery of nursing care; and (d) the effects on the patient. Study 1 generated the hypothesis that the context in which nurses use computerized patient information management systems determines the effects on nurses, the delivery of nursing care, and on patients.

Study 2 set out to quantify the factors identified by subjects in Study 1 and to determine the relationship between context and the effects of computers on nurses, the delivery of nursing care, and patients. A 50 question survey tool, compiled using the factors identified in Study 1, was completed by 393 registered nurses in fourteen health care agencies in Canada.

It was found that the context in which the computer system is used by nurses determines the effects on nurses, the delivery of nursing care, and patients. Of particular relevance in shaping the focus of this study were correlational findings indicating: (a) a positive relationship between computer education factors and the nurses' perceptions of the effects of using computers on
nurses, (b) a negative relationship between computer system factors and the nurses' perceptions of the effects of using computers on nurses, (c) a positive relationship between the use of clinical applications and the nurses' perceptions of the effects of using computers on the delivery of nursing care and on patients, and (d) a significant relationship between the age of the nurse and the nurses' perceptions of the adequacy of computer training.

In addition, comments from the nurses indicated a number of findings which were also relevant in shaping this study. Relevant findings were: (a) few nurses have a broad knowledge about computers, (b) many nurses have problems with entering data from a keyboard, (c) nurses feel uneasy about computer security, (d) some nurses were negative about computer system factors, especially in terms of slow response time, downtime, and the structure and usefulness of computer applications, (e) more older than younger nurses, reported that the training to use the computer had been inadequate, (f) many nurses reported stress, frustration and discomfort associated with using computers, (g) nurses expressed concerns about the legal and ethical implications associated with using computers, (h) most nurses were told that computer systems were expected to increase efficiency and effectiveness, but instead they have added to workload, and (i) nurses complained that computer systems that were supposed to save time, are inordinately time-consuming.
Part 3 involved the dissemination of the findings from this study to Canadian nurses. Overall findings of the study indicate that despite a large number of negative comments about the use of computers by nurses, 65.5% of those sampled would recommend the use of computers for managing patient information. Implications and recommendations from the study were identified for the Nurses Unions, Nursing Education, Nursing Practice, Nursing Administration, and Nursing Research. The recommendation that those involved in educating professional nurses collaborate to develop guidelines for training nurses to use computers for managing patient information was a factor in shaping this study.

A Provincial Project

In March 1987, the Ministry of Advanced Education and Job Training in British Columbia provided funding support to the British Columbia Institute of Technology to develop course materials for nurses and nursing students, in response to the perceived need for nurses to learn about computers. The project, entitled, *Computers In Nursing Project*, began in June, 1987. Data was collected from four sources at the outset of the project: (a) review of existing materials, (b) formal and informal interviews with nurse educators at selected nursing programs, (c) informal interviews with nursing co-ordinators of hospital computer systems in various
Vancouver hospitals, and (d) random sampling of the general nursing populace.

Input from these sources was used to develop a curriculum. The curriculum included three modules: (a) basic computer literacy, (b) an overview of computer applications in health care, and (c) legal, ethical and professional issues. The three modules were distributed to all nursing programs in British Columbia in May and June of 1988, with the expectation that they would be tailored to meet the needs of individual programs, and incorporated into nursing curricula in September, 1988.

Local Factors

Cariboo College currently offers a Registered Nurse (R.N.) diploma program in nursing. Its faculty, supported by college administration, is lobbying for degree granting status in response to the Canadian Nurses Association position (adopted in 1982) that the baccalaurate degree should be the only entry level to professional nursing practice in Canada by the year 2000. Additionally, the College administration is committed to implementing computer technology and is encouraging all its faculty and staff to become computer literate, by offering tax benefits to those who purchase computers, and by making courses available free of charge. The Cariboo College nursing department is
represented by a faculty member on the Computers In Nursing Project. This indicates the department's commitment to advancing computer use amongst its student body.

Royal Inland Hospital, the only acute care facility in Kamloops, is presently in the beginning stages of implementing a hospital patient management system (HPMS) supplied by Travenol Healthcare Information Services, Canada. The projected plan is for nurses to be using computers on the nursing units within five years. This facility provides clinical placements for Cariboo College nursing students, as well as providing employment for the majority of its nursing graduates.

Purpose

Developments concerning computer technology on the Canadian nursing scene nationally, provincially and locally, coupled with identified gaps in the literature, especially evidenced by the lack of research involving student nurses enrolled in community college nursing programs, serve as indicators of the need for further study. It would appear that the situation regarding the implementation of computers and computer technology in nursing education in British Columbia, at the present time, is solely in the hands of politicians, administrators, and faculty, who all claim to have the interests of the student and quality education at
heart. Unfortunately, this does not allow for input from nursing students, who will be directly affected by changes due to the increased use of computers in both the educational and the practice settings.

The primary purpose of this study is to identify how nursing students, in a community college nursing program, conceptualize the role of computers in hospital nursing. It is the researcher's belief that in order to successfully implement computer content into nursing curricula in this province and indeed nationally, an attempt must first be made to understand the perspective of the students for whom the content is intended.

By identifying how students conceptualize the role of computers in hospital nursing and by analyzing their complexity in relation to the nurse's: (a) length of clinical exposure, and (b) attitude toward computers, it is anticipated that decisions about when, and where to incorporate computer content into the curricula of community college schools of nursing may be facilitated. The researcher's ultimate goal is to promote positive acceptance toward computer use in hospital nursing and to increase the quality of student learning about computers in nursing by responding to a knowledge of the student's perspective. Although it is recognized that both the quantity and quality of learning are equally important, the main issue in this thesis is quality of learning.
In order to more effectively identify initial questions, pose hypotheses, and interpret results, a model for research in nursing informatics will be used as a framework to guide this study. Nursing informatics (NI) is the use of information technologies by nurses in relation to the care of patients, or the educational preparation of individuals to practice the discipline (Hannah, 1985). The NI Pyramid (see Figure 1) is one model for research in nursing informatics which provides a four-dimensional structure, in which to devise and locate meaningful NI research (Schwirian, 1986).

Three elements of the model, information, technology, and users, are arranged to form the triangular base of the pyramid, depicting the fact that they interact to form NI activity. The apex of the pyramid is the goal or the objective toward which all the other elements are directed. The interactivity of all the elements is bidirectional, in nature allowing an investigator to enter the model at any point in terms of posing research questions or developing hypotheses, while at the same time, allowing the researcher to see where a particular study fits into the larger scheme of knowledge related to NI (Schwirian, 1986).
For the purposes of this study, USERS are first, second, and third year nursing students enrolled in a community college nursing program which is preparing them for employment in hospitals. INFORMATION is the computer awareness content and skills that student nurses, enrolled in community college nursing programs, need to work comfortably and effectively with computers in hospitals. TECHNOLOGY is the accessibility and availability of computer hardware and software to facilitate both (a) acquisition of computer skills, and (b) use in the job setting. GOALS are two-fold: (a) the primary goal is to determine how student nurses conceptualize the role and function of computers as they effect nurses in hospitals, and (b) the secondary goal is to identify how the findings may be incorporated into planning.
for implementing computer content in community college nursing curricula.

Research Questions

One broad and three specific questions guided this study:

1. How do nursing students in a community college nursing program conceptualize the role of computers in hospital nursing?

(a) Is there a difference in complexity among first, second, and third-year nursing students' conceptions of the role of computers in hospital nursing?

(b) What is the relationship between nursing students' conceptions of the role of computers in hospital nursing, and length of clinical experience?

(c) What is the relationship between nursing students' conceptions of the role of computers in hospital nursing, and their attitude toward computers in hospital nursing?
Definition Of Terms

The terms relevant to this study are listed and defined below.

Community College Nursing Program: Nursing in Canada is taught in three settings: hospital, community college, and university. This study focuses on nursing programs based in the community college setting. More specifically, this study focuses on one college program: the Cariboo College Nursing Program, in Kamloops, British Columbia, Canada.

Cariboo College Nursing Program: The nursing program at Cariboo College is a twenty-four month program spread over three academic years. It's mandate is two-fold: (a) to prepare students to successfully complete the national registration exams to enter the nursing profession, and (b) to prepare students to meet minimal standards of nursing practice, as specified by the Registered Nurses Association of British Columbia, so that they may be employed in acute and long term care facilities upon graduation from the program.
Cariboo College Nursing Program Structure: The twenty-four month Cariboo College nursing program is divided into three academic years and six semesters. Each semester is further divided into clinical rotations as indicated in Table 1.

<table>
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<th>YEAR</th>
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Hospital Nursing: Nurses practise nursing in a variety of hospital settings. Some hospitals serve clients in a specific age group, such as geriatric or pediatric hospitals. Others serve the needs of acute or long term care clients, and some are even specialized in terms of disease process, such as rehabilitation and burn hospitals. The hospital setting referred to in this study is the general acute care hospital. In 1985, the majority of nurses practising in British Columbia worked in hospitals
(76.5%) and primarily in acute care facilities (R.N.A.B.C. News, 1986, p. 16).

Attitudes Toward Computers: Attitudes are learned predispositions which influence how one responds, either favourably or unfavourably. Attitudes toward computers may be observed in the behaviour of an individual such as his/her willingness or resistance to use a computer. In this study, student attitude was determined to be positive, neutral, or negative by assessing students' ratings on a five point Likert-type attitude scale and by noting positive and/or negative comments directed toward computers during the interviews.

Conceptions Of The Role Of Computers In Hospital Nursing: Conceptions express abstractions formed by generalizations from particulars (Kerlinger 1986). Concepts are formed by our past experiences and influence our perception. People learn to conceptualize their own reality as they grow up (Marton, 1981). Students' conceptions or abstractions of the role of computers in hospital nursing are therefore formed by generalizations based on their: (a) awareness of computer use in hospital nursing today, and (b) knowledge of how computers may be used by nurses in the future. In this study, conceptions were analyzed to form categories of conception. In addition, the quality of students'
conceptions were assigned a rating of high or low complexity based on specific characteristics.

Length Of Clinical Experience: Length of clinical experience was measured in hours. It varied for first, second, and third year Cariboo College nursing students as outlined in Table 2.

Table 2.
Number Of Clinical Hours In Each Semester And Year Of The Cariboo College Nursing Program

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Because the number of hours of clinical experience increases significantly each year, relationships between subjects will be discussed in terms of years in the program throughout the study. The exception will be when reporting and discussing the answer to research question number two.
CHAPTER 2

Review Of Literature

Review of the literature will be organized into three main subsections to allow for organization of materials into a logical pattern. The first subsection "Computers In Hospitals," is aimed at providing a context for the study. It begins by tracing the general evolution of computers within hospitals, and more specifically, within hospitals in British Columbia and the rest of Canada. This is followed by an overview of how computers are currently being used in hospitals by nurses, and then by a brief introduction to issues raised by nurses concerning computer use.

The second subsection "Attitude Toward Computer Use," is aimed at presenting an overview of one of the variables in the study. The discussion of attitude begins by looking at what is meant by attitude, and is followed by an historical review of studies on nurses' attitudes toward computer use. Then the focus shifts to the identification of factors affecting computer usage.

The third subsection "Learning," is aimed at presenting learning as a change in conception, thereby bringing the other main variable of the study into focus. The discussion of learning begins with an attempt to define learning need, and then turns to focus on studies which identify the learning needs of nurses with regard to computers. Finally,
the notion of computer literacy for nurses is discussed, and a taxonomy for evaluating quality of learning is briefly described.

Computers In Hospitals

The purpose of this subsection is fivefold, designed to: (a) trace the general historical evolution of computer technology in hospitals, (b) put this evolution into a Canadian context, (c) identify the current situation in hospitals in British Columbia, (d) present a short overview of the ways in which computers are being used in hospitals to support nursing practice, and (e) highlight issues concerning computer use by nurses working in hospitals.

Evolution Of Computers In Hospitals

Ball and Hannah (1984) note that computers entered hospitals in the 1950's, and at that time were used only for administrative tasks such as calculating payroll, inventory control, tabulating patient charges and generating and analyzing medical statistics. They point out that during the 1960's, three factors shaped developments toward increased computerization: (a) hospital administrators were exposed to the possibility of automating health care activities, (b) equipment became more refined and sophisticated, and
(c) manufacturers recognized the potential for sales in the health care market.

The 1970's saw the development and installation of hospital information systems, with special-service computer functions, developed for specific hospital departments such as: pharmacy, dietary, radiology, laboratory and electrocardiology. The focus of development then became one of finding a way for these isolated special-service functions to communicate with each other.

The 1980's has brought the refinement of hospital information systems and a better understanding of information needs of nurses, the development of computerized patient care planning, and the increased use of information data bases and expert systems. Many authors, including O'Brien (1984), note that computerization has not advanced in health care as quickly as once predicted, mainly due to: (a) the high cost of computer hardware, (b) health professionals lack of knowledge, (c) a shortage of processing experts, and until recently (d) unsophisticated technology.

Developments In Canada

Efforts are underway by a variety of people to determine the status of computing efforts in hospitals in Canada. An article published in the The Canadian Nurse in June, 1988 reported the results of a survey done by Karen Webber of
Halifax in March, 1987. She contacted 85 hospitals and chronic care agencies in all the Canadian provinces and territories where computer terminals were in place on nursing units. She found that a computer system was first used on a nursing unit in 1977. By March, 1987, thirty sites used computers for the management of patient information. The thirty agencies, the provinces where they are found, as well as the hardware, and software being used by each, were compiled and published in chart form in the article. A modified version of this chart (see Appendix A) presents a sense of the diversity of systems being implemented across the country and raises the question of how nurses will cope with this diversity as they move from one employment situation to another.

In 1987, The Canadian National Health Care Computer Survey was conducted by The Kennedy Group, an independent health-care information systems consulting firm based in San Francisco. This survey was the first major attempt to collect information on all Canadian hospitals with more than 150 acute care beds. Findings have recently been reported for 337 institutions. One finding is of particular interest to this study. It was found that the status of automation in nine patient care areas, (with the exception of admissions\ discharge\ transfer, central patient index, medical records, and pharmacy) in the majority of institutions surveyed was limited.
The Kennedy Group predicted that automation in major patient care areas was anticipated to be the most significant growth in the future. They pointed out that all nine major areas, which impact on the delivery of patient care in hospitals across the country, are actively planning for and selecting automated systems. Nursing, as one of these patient care areas, is poised to initiate the use of such technology, which may well in turn, change the face of the profession.

**Developments In British Columbia**

The introduction of computers into hospitals in British Columbia appears to have lagged behind the rest of Canada and it appears to have been influenced dramatically by politics and power struggles (O'Brien, 1984). To illustrate this struggle, a brief description follows.

In the 1960's and early 1970's the first hospital computerization occurred in British Columbia, a happening which was consistent with the rest of the country. At that time, Vancouver General Hospital (V.G.H.) and the British Columbia Health Association (B.C.H.A.) acquired main frame computers to run financial and payroll systems. As well, by the early seventies, V.G.H. installed computers in its laboratory and radiology departments. By the mid-seventies, four other hospitals in the province had installed different...
laboratory systems (Royal Inland Hospital in Kamloops included). Unfortunately, there was a blossoming of a wide range of minicomputers in British Columbia hospitals, without any joint planning or consideration of future needs.

In 1975, the provincial government appointed a consulting firm, Systemhouse, to advise it on hospital-based computer planning. This resulted in a committee, comprised of directors of finance from ten hospitals in the province, being formed to find a common approach to hospital computer systems using Interdata computers. By 1980 it was clear that the Interdata system had failed, due to out-of-date hardware, laboratory systems, and inappropriate software.

At this point, O'Brien (1984) points out that lack of funding was a major problem, even though agencies were willing to co-operate in a common approach. Consequently, different approaches continued to be taken by institutions. The Ministry of Health, in 1980, formed a hospital Computer Advisory Committee and a consultant was hired to develop a computer plan for four different groups of hospitals: (a) hospitals with Interdata systems, (b) large non-teaching hospitals (Royal Inland Hospital in Kamloops included), (c) very small hospitals, and (d) large teaching hospitals.

Two Vancouver hospitals, Lion's Gate and The University Of British Columbia (U.B.C.), embarked on a very different course toward computerization about this time. Lion's Gate Hospital was part of a pilot project, whose objective was to
implement a hospital-wide (IBM) patient care system, the focus of which was on patient care, particularly in nursing areas. However, just before the terminals were to be installed, the pilot project was aborted.

Meanwhile, the new Ministry of Health formed the British Columbia Hospitals Shared Systems Society, to fund and develop shared hospital computer systems. This system, a decentralized one, which opposed the central system concept, was designed to achieve cost control in hospitals by sharing systems. This new system, according to the Ministry's plan, was to be implemented first in departments which lend themselves to computerization, such as laboratory, pharmacy, admitting and discharge, and financial services. "Shared Systems" also planned to implement nursing applications but, to date, this has not materialized. Hospitals who agreed to abide by the "Shared Systems" approach, would receive funding for all the necessary hardware.

Lion's Gate Hospital, faced with this situation, decided to go ahead with their plans for installing a complete patient care system. Their decision was based on several facts: (a) their existing financial system hardware and software needed replacing, (b) they were happy with the well proven IBM system used by at least ten hospitals in Canada, and (c) they had a high level of commitment from staff. In May, 1983, an IBM mainframe was installed.
The British Columbia Health Association (B.C.H.A.), representing the provinces' hospitals, had also chosen, at about the same time, to use IBM computers and have since converted payroll support for its members onto an IBM mainframe. B.C.H.A. offers access and computer support for members choosing to use the IBM patient care system, similar to the one at Lion's Gate. They envisioned offering their computer services to hospitals throughout the province and to date several members are using their services.

Meanwhile, computerization had been phased into the U.B.C. Health Sciences Center Hospital since its opening in 1980. It was, at that time, the most computerized hospital in Canada, due to ready availability of funds when it was built. Computerization there had its beginnings with a laboratory system, followed by admitting, pharmacy, health records, radiology, nursing station communication, and financial systems. The system links the hospital together through 160 terminals and allows each nursing station to communicate with 15 departments, other nursing stations, and the nursing office. Data General minicomputers which use Meditech software, are used.

As this discussion illustrates, by using several hospitals as examples, nurses working in large or small hospitals in British Columbia find themselves caught in the middle of three vastly different approaches to hospital information systems: (a) centralized, (b) decentralized, and
(c) individual department systems (Mikuleky and Ledford, 1987). To date, nurses in many hospitals in British Columbia and across this country have not had a lot of input into choice of systems that will benefit nursing. Currently, both hospital administrations, and all hospital departments, including nursing, are being faced with making tough decisions as to which approach to take, and are weighing the pros and cons of each, based on financial constraints within their respective institutions.

**Computer Support For Nursing Practice**

Computer support for nursing practice is in its infancy in Canada, as identified in the findings of The Kennedy Group (1988). Although much has been written in nursing literature, the intent of the following discussion is merely to present an overview of how computers can be used by nurses to support their practice, and not to discuss any one application in detail.

Ball and Hannah (1984) discuss direct computer support for nursing practice under the following headings: patient monitoring, documentation, patient care planning, special-service computer functions, and hospital information management systems. The use of the computer for administrative tasks such as quality assurance, patient classification systems for nursing workload determination and
unit staffing, and reporting, all affect the nurse in an indirect way.

Mikulekly and Ledford (1987) noted nursing applications for computers. They found that nurses use computers for a variety of functions, which they categorize under the general areas: (a) patient classification and staffing requirements, (b) administration, (for such things as personnel records, quality assurance studies, and budgeting, and word processing for such things as updating policies and procedures), (c) nursing practice (in both the central nursing station, and at the bedside, for order entry, results reporting, monitoring patient's physiological functions, generating nursing care plans, and maintaining clinical records), and (d) nursing education and research.

Although the majority of nurses working in medium and small acute care hospitals in Canada are not presently using many of these applications, all are using patient monitoring, and a number are using at least one or more other applications. The future promises to inundate the nurse with more computer applications, as all hospitals strive for efficient information management, and quality patient care.
Issues Concerning Computer Use

With the present trend of society, transforming from an industrial to an information society, many issues are being raised by nurses about how this change will impact their practice of nursing. Ball and Hannah (1984) identify eight broad sources of resistance to computers in health care, which can also be viewed as issues in nursing informatics: (a) oversell by the vendor, (b) users' unrealistic expectations, (c) change in the traditional procedures and practice, (d) insufficient involvement of nurses, (e) improving "old systems" versus shifting to new paradigms, (f) fear of leaving the "Gutenberg Culture," or printed word, (g) curriculum changes, and (h) fear of the unknown. While each of these eight broad issues deserves specific attention only two issues will be outlined briefly in this study: (a) job expectations, and (b) technology and touch.

Many nurses are raising the issue that they are expected to do everything they did thirty years ago, plus a great deal more (Hope, 1984). Romano (1985) states that nurses must let go of certain areas while taking on new ones. She feels we are no longer in an industrial society with a factory mentality, but rather, we are in a knowledge intensive era and must practise accordingly. It seems that even if nurses experience a shift in their own mentalities, to reflect the trends of society, they are often locked into employment
situations where the factory mentality prevails. Stress and burnout are often the result of such situations.

The profession of nursing is both an art and a science, with these two components forming its cornerstones. With the advent of computer technology into hospitals, many nurses have voiced concerns about the danger of the patient becoming dehumanized. John Naisbitt (1982) suggests that institutions such as hospitals should consider "human ballast," or a high touch component, when they introduce a new technology. He feels that the more technology around people, the more people need the human touch.

Issues relating to the increased use of technology by society in general, and by nurses in particular, will not go away by pretending they do not exist. These issues must be discussed, debated, and confronted by nurses who wish to break down existing barriers of resistance toward computer technology.

Attitudes Toward Computer Use

The threefold purpose of this subsection is to: (a) discuss what is meant by attitude, (b) present an historical review of reported studies on nurses' attitudes toward computers, and (c) identify factors affecting computer usage.
Definition Of Attitude

A universally accepted definition of attitude does not appear in the literature and, consequently, there are a wide variety of professional uses and definitions of the term. For the purposes of this study, the definition posed by Fishbein and Ajzen (1975), describing attitude as "a learned predisposition to respond in a consistently favourable or unfavourable manner with respect to a given object" (p. 6) will be adopted.

The literature, as reviewed by Stronge and Brodt (1985), indicates certain generally accepted characteristics of attitudes: (a) attitudes are learned, (b) once social attitudes are established, they are considered to be relatively stable and enduring, and (c) attitudes are an antecedent of behaviour. In considering these characteristics of attitude, it became clear that persons' attitudes toward computers are learned and influence their willingness or resistance to use computers.

Historical Review Of Studies On Nurses' Attitudes Toward Computers

A review of the literature on nurses' attitudes toward computers indicates a shift in attitude. Nurses in the 1960's and 1970's were very negative, while nurses in the
1980's are becoming increasingly more positive.

Reznikoff, Holland, and Strobel (1967) surveyed all full-time hospital employees at the Institute of Living (psychiatric hospital) in Hartford, Connecticut, to determine their existing attitudes toward computers. They used a modified version of a questionnaire developed by Kobler, at the University of Washington, which consisted of 35 items, each rated on a six-point scale, ranging from "strongly agree" to "strongly disagree." They reported that of all the employees, student nurses were consistently more negative than the other occupational groups.

Because of the findings of Reznikoff et al. (1967), a separate study of the attitudes of student nurses toward computers was undertaken. Rosenberg, Reznikoff, Stroebel, and Ericson (1967) administered a questionnaire to 54 junior and senior nursing students from five diploma programs, at the beginning and the end of their 3-month psychiatric rotation, at the Institute of Living in Hartford, Connecticut. The students were expected to use automated nursing notes during their rotation at that institution. The questionnaire used was developed by Kobler, and modified by Reznikoff et al. (1967). A test-retest comparison of computer and non-computer groups was made. Although there was no significant difference in attitudes between the two groups at the outset, findings after three months indicated that exposure of nursing students to automated nursing notes
during their psychiatric affiliation led to a favourable change in their attitude toward the use of computers in patient care.

Chang (1984) pointed out that in the 1970’s, only a few nurses were involved in computer applications in nursing. Startsman and Robinson (1972) developed and administered a short attitude scale and an open-ended questionnaire to 338 physicians, paramedical staff, and students at a university medical centre. Of this sample, 69 were student nurses and 39 were staff nurses (approximately 1/3 of the sample). Results indicated that nurses had a relatively negative attitude when compared to the other groups. The reliability of the attitude scale used was .87, using a split-half correlation method.

Because of the increased trend toward automation in the health care industry, seven years later, Melhorn, Legler and Clark (1979) used a modified version of the Startsman and Robinson questionnaire. They surveyed a sample of 180, thirty of whom were staff nurses and six of whom were student nurses (approximately 1/6 of the sample). They did not report the reliability coefficient of this modified tool. Findings indicate that the respondents displayed a positive overall attitude toward computers, as indicated by a willingness and even a desire to learn more about them in their daily work. The respondents who used the computer more extensively, and on a daily basis, were more positive.
Ronald (1983) studied the learning needs and attitudes of 159 nursing faculty members with a masters degree or above, and who taught in schools of nursing within the continental United States. She used Startsman and Robinson’s attitude scale for the attitude component of this study. The reliability of the scale on the study sample was .63, using coefficient alpha. Findings of the study indicate that nursing educators had positive attitudes toward computers. Their attitudes were more positive with respect to the computer's efficiency and importance to society, and less positive in relation to their willingness to use and accept the use of computers.

Chang (1984) surveyed 156 volunteer participants, assigned using Houle’s (1980) adoption to change typology, into two groups: (a) the pace setters, and (b) the middle majority. All subjects had attended workshops conducted by Chang. This study looked at the difference between: (a) pace-setters and the middle-majority in their expectations of computer use with respect to their personal lives, relationships with clients, relationship to the profession, and view of the health care system and health care costs, and (b) the two groups in their willingness to interact with the computer to accomplish specific nursing activities.

The Computer Use Expectations Scale (CUES) was used for data collection in the study. It was divided into the
following two sections: (a) Section 1 was related to willingness to interact with computers. Nine items had an internal consistency using Cronbach's alpha of .77, while six items examined separately had a reliability of .78, and three had a reliability of .83, and (b) Section 2 of this tool was related to the influence of computers.

Chang found that the group responding with a greater percentage of favourable responses in relation to computer use (pacesetters) were also significantly more willing to interact with computers. She suggests that the education of nurses should include increased experience with computer use and information management in the future.

Merrow (1985) completed a descriptive study in order to facilitate planning future education in the area of computer-based nursing practice. She assessed nurse educators' and nursing service personnel's knowledge of, and attitudes toward, computer applicability to nursing practice. A stratified random sample of twelve hospitals and NLN-accredited baccalaureate schools of nursing in New England was selected, from which three institutions were chosen. Thirty-six subjects were interviewed, using an interview schedule which consisted of both direct and open ended questions, aimed at collecting data in three areas: (a) attitude, (b) knowledge, and (c) demographic and employment variables. All of the subjects were registered nurses, the majority of whom were female (97.2%) and held
masters degrees. At the conclusion of the interview, the researcher subjectively assigned each subject an attitude rating.

Findings suggest that although there were differences in the types of statements made by various groups (nursing service personnel and nurse educators, people with experience using a computer in nursing practice, and those without, and people from varying educational programs), the majority of nurses interviewed (22) were considered to be positive, and eight were neutral, in their attitudes toward computer use in nursing practice. Six of the respondents were considered to have a negative attitude toward computer use in nursing practice, with the majority being nursing service personnel.

The availability of a reliable, valid tool designed specifically to measure nurses' attitudes toward computers was nonexistent for years, and researchers found themselves either: (a) using tools designed for a large variety of audiences, (b) designing their own tools, or (c) subjectively assigning subjects an attitude rating based on the data generated in their studies. The need was apparent for a tool designed for nurses, and in 1985, Stronge and Brodt focused their attention on developing such a tool to measure nurses' attitudes toward computers.

They developed a Likert-type scale to measure nurses' attitudes toward computerization. Sixty-six statements were originally included in the questionnaire. After obtaining
index of discrimination scores for all items, those above .50 were included in the final version of the tool. The questionnaire was piloted by 60 people, made up of junior and senior nursing students as well as faculty at Marycrest College in Davenport, Iowa. The final twenty item questionnaire is believed to be valid and reliable, with \( r = .90 \) split-half reliability coefficient, using the Spearman-Brown prophecy formula.

In summary, then, it appears that the attitudes of nurses towards computers have become progressively more positive over the years. Recently, a specific tool has been deemed valid and reliable as a means of collecting quantitative attitudinal data (Stronge & Brodt, 1985). Its use by researchers in various parts of the world should allow for the collection of comparable quantitative data, which will provide a more general sense of nurses' attitudes towards computers. Although a review of the nursing literature, which was thought to reflect the major issues concerning the use of computers by nurses, was the means used to generate statements for inclusion in the tool, it is possible that there were other issues important to nurses which were not reported in the literature, and consequently were excluded. Even though a tool has been developed which measures quantitative data, there still appears to be a dearth of qualitative data on nurses' and student nurses' attitudes, thus leaving a sense of not truly knowing the
perspective of the individual nurse or student nurse. Accordingly, in order to truly present an accurate picture of the attitudes of nurses toward computer use, there appears to be a need to mesh the two research paradigms.

Factors Affecting Usage

Attitude measurement is an integral part of gaining an understanding of an individual's behaviour, in view of the fact that attitude has a significant influence on an individual's response. Stronge and Brodt (1985) indicated that if an individual's attitude to a given object (such as a computer) is known, it can be used in conjunction with other variables to predict and explain reactions of the individual to that object.

Demographic variables, such as age, have been commonly thought to influence the rate of adoption of innovations such as use of computers (Chang, 1984). Experts have found that individuals in their mid-thirties and younger tend to adapt quickly to the computer, while those over fifty are more likely to be intimidated (Inman, 1983).

In a survey of 237 full-time professional nurses in a metropolitan hospital in northeastern Ohio, the findings of Krampf and Robinson (1984) were in contradiction to the findings of most researchers. The age ranges and frequencies of the respondents in their study were: 20-29 years
(n = 95), 30-39 years (n = 71), 40-49 years (n = 41), and 50+ (n = 30). With the use of a two-part written questionnaire, they found that most older adults did not appear to be threatened by the computer. They also found that the older the adult, the higher the level of education, and the more extensive the exposure to the computer, the more likely a computer problem would challenge, rather than frustrate, the respondents.

Although the literature revealed that initial computer resistance is frequently associated with an individual’s perceptions that (a) a good mathematics background is a prerequisite for computer use, and (b) computers tend to make numerous errors, Krampf and Robinsons’ (1984) results were disproving. Sixty-six percent of the respondents in their survey felt that a mathematics background was not necessary for computer competency, while eighty-seven percent indicated that they believed computers to be relatively error free.

Houle (1980) noted that the rate of adoption of the use of computers, as with any other innovation, is positively correlated with favourable previous experience and, from this, Chang (1984) deduced that previous use of computers, whatever the setting, may influence nurses’ expectations.

The literature indicated a lag between computer potential and current level of usage of computers in nursing. Parks, et al. (1986) noted that factors evident in the literature which might explain this phenomenon are shortage
of nursing faculty with computer expertise, reluctance of faculty to learn computer skills and to modify the curriculum to include them, limited choice of computer software and textbooks, and lack of consensus concerning what should be included in a computer education for nurses.

Although some attention has been placed on attitude and other factors which may affect computer usage such as: age, level of education, and exposure to a computer, the findings are often contradictory. As more demand is being placed on individuals, including nurses, to use computers in their work, it is clear that much work remains to be done.

Learning To Use Computers

As pointed out thus far, whether nurses are ready or not, computer use in nursing is becoming a reality. Therefore, the onus will be on nursing education programs to provide computer content in their curricula, and also on nurses to learn how to use this new technology. Pivotal to the development of programs, is the identification of nurses' computer learning needs, and a means of determining whether these needs have been met. The purpose of this subsection is fourfold, designed to: (a) discuss what is meant by learning need, (b) highlight studies about the learning needs of nurses with regard to computers, (c) discuss computer literacy for nurses, and (d) discuss evaluation of learning,
and the notion of a taxonomy to determine quality of learning.

Learning Need

Houle (1972) defined "need" as a condition or situation in which something necessary or desirable is required or wanted. He noted that it is often used to express the deficiencies of an individual or some category of people, either generally, or in some set of circumstances. He indicated that a need may be perceived by the person or persons possessing it (felt need), or by some observer (ascribed need).

Knowles (1980) noted that an educational need is something people ought to learn for their own good, for the good of the organization, or for the good of society. He saw an educational need as the discrepancy between what individuals, or organizations, want to be and what they are; or, in other words, the distance between an aspiration and a reality.

Boone (1985) defined "need" as a deficiency, imbalance, lack of adjustment, or gap, between the present situation and a set of societal norms believed to be more desirable. He implied a gap between what is and what ought to be. Beatty (1981) referred to the same phenomenon as a measurable discrepancy existing between a present state of affairs and a
desired state of affairs as asserted either by an 'owner' of need, or by an 'authority' of need.

It should be obvious that not all needs of adults are educational, and that therefore, education cannot meet all needs. Need is a vague term, perceived to be dealing with something essential, rather than a whim. Adult educators would agree that need provides a deep motivating drive for learning, even though there is no universal agreement as to its definition.

Because the definition of need is vague, so also is the definition of the process of needs assessment. Monette (1977) stated that generally, needs assessment is concerned with learning needs. It appears to be a systematic method for identifying and responding to various possible requirements for educational action.

Scriven (1978) stated that needs assessment is a determination of the difference between what is and what ought to be, or between the actual and the ideal, or between the goal state and the present state. Needs assessment is believed, by many, to be the first step in program planning, and therefore it is the essence of adult education. Griffith (1978) feels that even though ideally, needs assessment should be the first step in programming, in practise that is not often the case. Many other factors affect programming, including political power structures within institutions, the programmers' own bias, attempts to profitably utilize unused
space, and attempts to increase revenues.

Although opinions differ as to the definition of need and needs assessment, the determination of need through the use of a needs assessment is believed by many to be an important step in program planning, and as such, must be considered in planning computer awareness and literacy programs for nurses.

Learning Needs Of Nurses Regarding Computers

Anderson, Gremy and Pages (1974) appear to have done the beginning work in the area of education of health personnel in medical informatics, identifying the necessity for more and better education of both practitioners and students in the health care disciplines about medical informatics. They proposed three levels of preparation: (a) The first would be a general level of computer education, designed to provide a general knowledge of computers and data processing, for all health service users; (b) the second would be designed for those who would keep their main orientation as members of a particular health care discipline, but who would be involved in working with experts in data processing, on projects involving both the design and implementation of systems; and (c) the third would involve extensive training for those considered to be experts in both their particular health care disciplines and computer science, and who would spend the
major part of their time involved in the development and initiation of new computer systems. Hannah (1983) pointed out that the only flaw in the research of Anderson et al. (1974) is that their model suggests detailed objectives only in the cognitive domain (Bloom et al. 1956), and completely overlooks the affective domain (Krathwohl, Bloom & Masia, 1964).

Several major studies have been done in the last decade which identify computer learning needs for nurses. Walker (1981) surveyed 193 registered nurses from 29 states in the United States, who were recognized as experts in nursing computerization, and asked them to rank eleven categories of computer learning needs. She found that the areas in which the desired knowledge was highest were those directly associated with the nurses' current or anticipated roles in nursing. From this she recognized the need for developing educational objectives for nursing computer education.

Ronald (1983) surveyed a national sample of 159 nursing educators on their current and desired level of knowledge in sixteen computer areas. She noted that the highest percentage of respondents (50.9%) taught in baccalaureate programs, and the lowest percentage (8.2%) taught in diploma programs. Both scales used to measure nursing educators' current knowledge and desired knowledge about computers had reliability coefficients of .93, using coefficient alpha.

She found that the nursing educators who participated in
the study had an identified need to learn about computers. The subjects perceived themselves as having a low level of knowledge about computers, and wished to have a high level. Ronald reported that there was a significant difference in the subjects' current knowledge and learning needs based on the type of program in which they taught. She found that educators teaching in graduate programs had the highest level of current knowledge and the lowest learning need with respect to computers. As in Walker's study (1981), Ronald found that the areas in which the desired knowledge was highest, was in areas directly associated with the nurses' current or anticipated roles. Ronald concluded that a needs assessment of each group of learners should be done, so that programs could be developed to provide learners with opportunities to identify and meet their own individual learning needs. This is consistent with the beliefs of adult education.

Heller et al. (1985) described the approach of a task force established at the University of Maryland in October, 1983, which studied the curriculum implications of computer applications in nursing. The task force was made up of representatives of faculty and students, and completed its work in April, 1984. Data was collected from the literature, through networking and site visits, as well as a survey of baccalaureate nursing students (n = 56), masters nursing students (n = 51), and faculty members (n = 74).
The questionnaire used for the survey was a modified version of Ronald's (1983) instrument, with some items from Walker's (1981) tool. In the tool, as adapted by the authors, the reliability (coefficient alpha) of the revised questionnaire was .96 for baccalaureate students' desired knowledge, .95 for masters students' desired knowledge, .91 for faculties' assessment of desired knowledge for baccalaureate students, and .91 for faculties' assessment of desired knowledge for masters students.

This survey was the first to measure what students wanted to know, and what faculty thought students needed to know. Results of the survey revealed that students desired a high level of knowledge. However, a discrepancy was evident with faculty expectations. In some areas, faculty thought that baccalaureate students needed to know less than students wanted to know. In most areas faculty thought masters students needed to know more than they desired to know. The findings in this study were consistent with Ronald's (1983) and Walker's (1981) studies, in that the areas in which the desired knowledge was highest, were those that were most directly associated with the nurses' current or anticipated nursing roles. Heller et al. (1985) conclude their study by advocating the need to include content about computer capabilities and applications in nursing in the curriculum, and suggest several approaches to this end. They see faculty development as the cornerstone to successful curriculum
Merrow (1985), in her study of nursing educators' and nursing service personnel's knowledge of and attitudes toward computer use in nursing practice, found that knowledge of computer use in nursing practice was related to current computer use in nursing practice. Individuals in her study who were rated as minimally knowledgeable about computer use in nursing practice, never use a computer.

A more recent study was conducted by Parks et al. (1986) at a large American urban university school of nursing. Data was collected as part of the work of a Task Force appointed by the Dean of the School of Nursing, to determine what knowledge, related to computer applications in nursing, should be included in the curriculum. The purpose of the study was two fold: (a) to describe faculty (n = 71), baccalaureate students' (n = 124), and masters students' (n = 105) perceptions of their level of current knowledge and the desired level of knowledge about aspects of computer applications in nursing, and (b) to describe faculty perceptions of the level of knowledge about computer application in nursing of baccalaureate and masters students.

Parks et al. (1986) used two versions (one for faculty and one for students) of an amalgam of Ronald's (1983) tool and Walker's (1981) scale. Eight major components of the questionnaire provided evidence of high internal consistency ranging from .91-.95, using coefficient alpha. Correlations
between reported amounts of computer instruction and perceived current knowledge, using Pearson's correlation coefficient, were .53 for baccalaureate students, .45 for masters students, and .50 for faculty. Data was collected on faculties' computer usage, for seven activities (e.g., statistics, test scoring) through use of a 0-4 scale. The coefficient alpha reliability for the possible range of scores, on the the seven items was .74. Response rate for students was 95-100%, but faculty had only 49%.

The findings indicate that students and faculty had low levels of knowledge about computer applications, and desired high levels. This is consistent with the finding of Ronald (1983), and Heller et al. (1985). Faculty usage was shown to be positively associated with current knowledge.

The authors claim this research to be the first reported data on students' computer learning needs, from both faculty and student perspectives. However, Heller et al. (1985) appear to have been the first to report such findings. They are not referenced by Parks et al. (1986). It appears, from the literature reviewed, that nurses are making an attempt to understand the computer learning needs of various groups within the profession.
Although attempts are being made to determine the learning needs of students, practising nurses, and nurse educators, interestingly enough, there appears to be no clear consensus on required competencies in computer knowledge or usage. To compound matters, there appears to be no definition of the term "computer literacy", which has gained widespread acceptance. It seems that the term was first coined in the 1960's, and since then, numerous authors have defined it in a multitude of ways and references to it are abundant in nursing literature.

Skiba (1983) defined computer literacy as "an understanding of: computer capabilities (how the computer works); computer applications (how computers can be used and their relative advantages\disadvantages); and the knowledge of algorithm design (an introduction to the notion of algorithms and their representation in flowcharts)" (p. 8). A more concise definition is one coined by Marvin and Winther (1983): "computer literacy is a shifting set of skills, socially defined, in response to changing circumstances" (p. 97). This definition appears to be congruent with the intuitive feelings of most educators. Practitioners and educators alike disagree as to the extent of literacy necessary for different levels of students and practising nurses.
While there is disagreement over the level of literacy needed, most educators would agree with Hardin and Skiba's (1982) finding, in their comparative analysis of computer literacy education for nurses, that no single educational strategy is likely to be effective in achieving computer literacy for all nurses. These authors provided a conceptual framework for examining computer literacy components, and long and short range goals for educating nursing personnel.

Many authors addressed the necessity to examine the nature of learners enrolled in nursing programs when designing programs, planning curricula, and developing content for computer courses. Krampf and Robinson (1984) stated that educational programs for nurses must incorporate learning activities which are consistent with the characteristics of adult learners. Tarnow (1979) described some of these characteristics, which must be considered when working with adult learners. They included the:

(a) learners' readiness and capabilities, (b) relevance of the material to be learned, (c) satisfaction derived from the learning, (d) effectiveness of immediacy of application and tangible rewards, and (e) opportunity to make mistakes and to take risks.

Krampf and Robinson (1984) felt that a slow-paced, flexible, fail-proof, human interaction with the computer itself is the first step in the educational process for adult learners. They felt that this "hands-on" instruction should
progress from simple to complex. They also felt that a knowledgeable resource person should be available for troubleshooting, as it would seem that, depending on the instructors' approach, the adult learners' initial experience leads to either a positive or negative attitude, which tends to persist.

Ronald (1979) documented in the literature the first attempts to incorporate medical informatics in the nursing curriculum. Since then a number of prescriptive articles and texts have been written which present "how to" approaches to curriculum planning and content development (Edmunds, 1982; Skiba, 1983; Ronald, 1983; Hannah, 1983; & Ronald & Skiba, 1987).

Attention has been given by several authors to what should be included in specific levels of nursing education to allow nurses to achieve computer literacy. Hannah (1983), for instance, focused her discussion on the place of medical informatics in a baccalaureate nursing curriculum. Parks et al. (1986) identified the following specific knowledge related to computer applications in nursing, which should be included in two levels of nursing programs. At the baccalaureate level they would include: (a) using computers to help nurses care for patients, (b) the computers' effects on quality of health care, and (c) "hands-on" experience; at the masters level, content related to administration, education and research applications.
All of the literature reviewed to date is American in origin, with the exception of Hannah (1983) at the University of Calgary, Alberta, Canada. She reported the commitment of the nursing faculty at that university with regard to the development and implementation of medical informatics, using a threefold approach, which included community service, research and teaching.

It appears that some attention has been given to attempting to understand what computer literacy is and how it relates to nurses, so that programs can be designed to address their computer learning needs. In doing so, it appears that some attention has also been given to the learner, the learning context and managing the learning experience. Topics addressed include: characteristics of the adult learner, teaching methods, techniques and devices, levelling of content for specific groups of nurses, sequencing of content and strategies for implementation of computer content into nursing curricula. However, little or no attention has been given to assessment or evaluation of either the quantity or quality of the learning which results from these efforts.
Dahlgren (1978) describes learning as a change in conception. He feels there is a qualitative shift from one conception to another when learning has occurred. Evaluation of learning or change in conception involves both quantitative (how much) and qualitative (how well) aspects (Marton & Saljo, 1976). This research study is focused primarily on: (a) identifying the conceptions of students enrolled in a community college nursing program on the role of computers in hospital nursing, (b) arranging their conceptions into units or categories, and (c) evaluating the complexity or quality of these conceptions. Therefore, this discussion will focus primarily on the qualitative aspects of the evaluation of learning, even though it is recognized that both the quantitative and qualitative dimensions are equally important.

There are few instruments for measuring the quality of learning. Four evaluation devices will be detailed briefly. The most widely known is Bloom's Taxonomy (Bloom, Englehart, Furst, Hill, & Krathwohl, 1956). According to Biggs and Collis (1982), this taxonomy was designed to provide teachers with a means of ordering items in a hierarchial level of quality for testing purposes. The hierarchy subscribed to by Bloom et al. consisted of six levels: knowledge, comprehension, application, analysis,
synthesis, and evaluation. Most educators are familiar with this taxonomy, and even though it has definite merits, most will readily admit its shortcomings as being: (a) its intended use to guide the selection of items for constructing tests, rather than as a means of evaluating the quality of a student's response to a particular item, and (b) the difficulty of devising items to assess beyond the comprehension level of the taxonomy.

Schroder, Driver and Streufert (1967) developed an evaluation device to assess the quality of written essays in terms of four levels of conceptual structure. Through the course of their research, they found that low levels of structural complexity in students' responses were not incompatible with "good" marks, in the terms of recall of factual detail.

Marton and Saljo (1975) report the findings of a research study they did with students at the University of Gothenburg. Two groups of twenty first-year students were asked to read three sections of a textbook. The students in each group were given two different types of questions after they had read the first two sections. While one group received questions requiring detailed factual answers, the other group received questions which demanded a thorough meaning of the passage. A common set of both types of questions was given after the final section had been read. They found evidence to suggest that students adapt their way
of learning according to their conceptions of what was required of them and their individual conceptions of learning.

Much of the work on the evaluation of quality of learning, like the study just cited, has been done in Sweden at the University of Guthenberg, using a phenomenological approach to study student learning. Marton and his colleagues are working within a qualitative approach to learning, which assumes that most human learning depends on meaning and is directed toward it, and that what a student learns can only be gauged from the student's own perspective. They are interested in "what," rather than "how much," is learned.

The general research approach used by these researchers has been to use semi-structured tape recorded interviews, which are transcribed, to provide the data to be analyzed. The aim of analysis, in this type of research, is to yield descriptive categories of the qualitative variation found in the empirical data. These descriptive categories form what they call the outcome space, which is a kind of an analytical map of variation in what has been learned from a given learning task.

Further research by Marton and Saljo (1976) reported that student responses to a learning episode could be classified into four levels, showing increasing grasp of the complexities of the material that was taught.
The levels are ordered in terms of characteristics that include progression from concrete to abstract, an increasing number of organizing dimensions, increased consistency, and use of organizing or relating principles and hypothetical principles used at the most complex end (Biggs and Collis, 1982, p 14).

In looking at the work of Bloom (1956), Schroder et al. (1967), and Marton and Saljo (1976), it appears that there is agreement among the three that qualitative evaluation could proceed in a hierarchy of levels, in increasing structural quality. Attention will now be directed to the work of Biggs and Collis (1982), which is similar to that of Marton and Saljo, (1976).

Biggs and Collis (1982) began their work with the assumption that the quality of learning depends on factors both extrinsic and intrinsic to the learner. An example of an extrinsic factor is quality of instruction. Intrinsic factors include motivation, developmental stage, and prior knowledge. After extensive analysis, they refuted developmental stage as a frame of reference, and rather, subscribed to learning quality, as a point of departure for their work. They developed a taxonomy of learning outcomes, called the Structure of Observed Learning Outcomes (SOLO). Their SOLO Taxonomy is ordered in terms of five levels of learning outcome: (a) prestructural, (b) unistructural, (c) multistructural, (d) relational, and (e) extended abstract. Biggs and Collis (1982) emphatically point out that although they believe there are natural stages in the
growth of learning any complex material or skill, their levels are similar to, but logically distinct from, the developmental stages subscribed to by Piaget (1950) and others.

Those espousing the benefits of the SOLO Taxonomy herald it as a useful tool to help educators make judgements about the quality of learning that takes place in the courses they teach within their classrooms. It is an attempt at empirical classification of levels of learning outcome, in a form which has widespread applicability.

It appears that the work of evaluating the quality of learning is on the increase, especially in Sweden and Australia, and that educational researchers are striving to provide educators in general with an understanding of the concept of quality of learning and a means of assessing that quality. There appears to be little, if anything, reported in nursing literature to this end.

Summary

Nurses working in Canadian hospitals are already or are rapidly becoming affected by increased computerization, as noted in the findings of The Kennedy Group Survey (1988). A review of literature reveals a dearth of reported Canadian studies, and only a small number of American studies, dealing with nurses': (a) attitudes toward computer use,
(b) knowledge about computers, and (c) factors affecting computer usage. The studies reviewed focus on nurses in practice, nursing educators and baccalaureate and masters level nursing students, with the obvious absence of any recent literature on college prepared nursing students, the majority of which are employed in Canadian hospitals.

The literature does, however, point to the need for computer education for all nurses, with much emphasis being placed on this happening within nursing education settings. While several "how to" articles and texts have been published to aid content development and implementation of computer courses into curricula of nursing schools, there appears to have been little thought given to assessing the quality of learning that takes place there. The indication, then, for this Canadian study of the conceptions of nursing students in a community College based program, is clear.
The methodology used in this study is based on the qualitative research tradition called phenomenology, and is aimed at the generation of theory. Phenomenology derives from a philosophical orientation toward human experience as the experience exists in the consciousness of the individual. It considers subjective reality as the essence of human experience. Phenomenology guides the generation and interpretation of data to describe phenomena from the point of view of the individual who knows the problem intimately (Thorne, 1988). It is substance-oriented, and aimed at description, analysis, and understanding of experiences (Marton, 1981).

This study was designed to seek an empathetic understanding of students' conceptions of the role of computers in hospital nursing from students' descriptions of what it means to them. Student conceptions served as the object of analysis in this research.

Audio-taped interviews, using a semi-structured interview, schedule were conducted. Transcripts generated from those interviews were analyzed to yield descriptive categories of the qualitative variations found in the subjects' statements.

In summary, then, the methodology used in the study was
phenomenology, and the perspective was that of the student. The components of the method will be described in greater detail in the sections which follow.

Description Of Subjects

Sample Selection

The target population for this research was all nursing students enrolled in community college nursing programs in British Columbia. Even though it was recognized that these community college nursing programs vary in length, they all have the same mandate to prepare nurses as beginning practitioners and their programs are all organized in a similar fashion in terms of semesters. The identified accessible population was all first, second, and third year nursing students enrolled in Cariboo College’s diploma nursing program in the winter semester (January-April) of 1988. The numbers of students in each year were: 57 in first-year, 47 in second-year, and 67 in third-year, giving a total accessible population of 171 students.

It is important to note that the third-year class, consisted of two very distinct groups. The first group was composed of 51 so called "regular" students, for which the diploma nursing program was designed. The second group was composed of 16 registered psychiatric nurses (R.P.N.’s), who
were enrolled in an R.P.N. Access Program. These students were taking a modified diploma nursing program to supplement their psychiatric education and to enable them to become registered nurses. This R.P.N. group joined the "regular" students in September, 1987, at the beginning of the third year of the program (semester 5), and graduated in March 1988, approximately one month before the "regular" students. They were not included in the third-year population, as they were uncharacteristic of that group in terms of educational experience, program length and curriculum content modification.

The "regular" diploma nursing student population, from which the sample was drawn, numbered 155 students. Written permission, allowing the researcher to invite selected nursing students to participate in the study, was sought (see Appendix B) and obtained (see Appendix C) in January, 1988, from the Vice-President of Cariboo College.

Because the accessible population was predominantly female, (149 females and 6 males), it was initially decided to sample only that group. A table of random numbers was used to identify a sample of thirty female students, ten from each year of the program. These randomly selected female students were approached to participate in the study by means of a letter of introduction, which outlined the purpose of the research, procedures to be carried out, and it assured them of complete anonymity and confidentiality.
(see Appendix D). They were requested to indicate their willingness to participate in the study by returning a signed consent form (see Appendix E) to the researcher's mailbox at Cariboo College.

Telephone contact was then made with each subject who had returned the signed consent, to schedule a mutually convenient time to conduct the interview. All second and third-year female subjects who were randomly selected were willing to participate. One female first-year subject refused to participate because she lived out of town and was unable to schedule the interview for a mutually convenient time. She made it very clear that she was interested in the research and volunteered names of classmates who might be interested in taking her place. However, these names were not used but, rather, the random numbers table was once again used to select this tenth female subject from first-year.

Flexibility and adaptability of selection and sampling decisions, as well as their integration throughout the research process, are hallmarks of qualitative research (Goetz & LaCompte, 1984). As the study unfolded, through the joint processes of data collection, coding, and analysis of data, conceptions based on the female subjects' perspective became very apparent. Thus, it was decided to also seek out conceptions based on the male students' perspective. The small numbers of male students enrolled in the Cariboo College nursing program reflect trends for males employed in

Five of the six male students enrolled in the program, (one in each of first and second-year and three in third-year), were approached by letter to participate in the study. One male third-year student was not approached, because he was doing a clinical perceptorship in an outlying hospital, geographically removed from Kamloops. This geographic distance made it too difficult to schedule a mutually convenient interview time. Upon receiving the signed consent forms, the male subjects were also approached by telephone to schedule an appointment time to be interviewed. At that point, they were informed that they had not been randomly selected because of their small numbers, but that they were intentionally being invited to participate. All five readily chose to do so, even given those circumstances.

In summary, the total accessible population of "regular" diploma nursing students yielded the study sample breakdown in terms of year and sex depicted in Table 3 on the following page.
Table 3.

Frequency Of Male And Female Students In The Accessible Population Of Cariboo College Nursing Students From Which A Sample Was Drawn

<table>
<thead>
<tr>
<th>YEAR</th>
<th>CLASS</th>
<th>FEMALE</th>
<th>MALE</th>
<th>TOTAL</th>
<th>FEMALE</th>
<th>MALE</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1990</td>
<td>56</td>
<td>1</td>
<td>57</td>
<td>10</td>
<td>1</td>
<td>11</td>
</tr>
<tr>
<td>2</td>
<td>1989</td>
<td>46</td>
<td>1</td>
<td>47</td>
<td>10</td>
<td>1</td>
<td>11</td>
</tr>
<tr>
<td>3</td>
<td>1988</td>
<td>47</td>
<td>4</td>
<td>51</td>
<td>10</td>
<td>3</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>TOTAL</td>
<td>149</td>
<td>6</td>
<td>155</td>
<td>30</td>
<td>5</td>
<td>35</td>
</tr>
</tbody>
</table>

Subjects' Exposure To Computer Content

In response to the perceived increased use of computer technology in nursing, a conscious effort has been made over the last four years to incorporate computer awareness content into the nursing curriculum at Cariboo College. This content was placed in the Nursing Perspectives Course, which is taught in each year of the program. The brief content outline which follows indicates what was covered in each of the three years.

The first-year subjects (class of 1990), had a two hour seminar scheduled in semester 1, in which they were
introduced to the computer system at Cariboo College, and given the opportunity for a hands on experience. This seminar was led by a person employed in computer services and was held in a computer lab. Subjects were encouraged to send mail messages to a nursing instructor, to enable them to have some practical use of the computer. A handout was given to each subject with information on how to access the Cariboo college system.

In addition, this group also had a two hour seminar led by a member of the first-year nursing faculty, in which they discussed: (a) their experiences with computers, (b) the history of computers in health care, (c) the advantages and disadvantages of computers, and (d) the issues concerning nurses with increasing computerization in health care.

The second-year subjects (class of 1989), had similar four hour computer awareness seminars (as outlined above) scheduled for them while they were enrolled in semester one of first year. In semester 4 of second year, these subjects were required to read current library readings on computers in nursing as part of their Nursing Perspectives course. The majority of subjects integrated information from these articles into a compulsory assignment about Nursing In The Future. Even though computer awareness content was not taught specifically in this course, it came up in class discussion on several occasions.

Third-year subjects (class of 1988), were also all
scheduled, in semester 1 of first year, to attend a two hour computer awareness course on "Computers in Nursing," followed by a two hour hands-on practical session on accessing and using Cariboo College's computer system. As with the second-year subjects, these subjects received no structured hands-on computer experience while enrolled in the second year of the program, however, discussion on the effects of computer technology on nursing practice was integrated into the Nursing Perspectives course. In semester 5 of third year, several subjects did research papers on technology in nursing as a required assignment in the Nursing Perspectives course. In addition, semester 6 subjects were introduced to a computer assisted instruction (C.A.I.) program entitled Nurse Star, which is a computerized exam test bank. The intent in introducing students to this program was to promote its use in preparing for their registration exams. At the time of the study, this was the only nursing related C.A.I. program owned by the nursing department at Cariboo College.

In summary, a limited amount of content in computer awareness was made available to all subjects enrolled in the nursing program at Cariboo College. This content was incorporated into the Nursing Perspectives Course, with the exception of third-year. In third-year, subjects were also offered one instructional session with a C.A.I. test bank package. This package was designed to give students practice in answering multiple choice questions as preparation for
writing the national registration examinations. Table 4 depicts how the computer awareness content is dispersed throughout the program.

Table 4.
Scheduled Hours Of Computer Awareness Content In Each Semester Of The Cariboo College Nursing Program

<table>
<thead>
<tr>
<th>SEMESTER</th>
<th>FIRST YEAR</th>
<th>SECOND YEAR</th>
<th>THIRD YEAR</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>-</td>
<td>-</td>
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<tr>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>4</td>
<td>-</td>
<td>Perspectives</td>
<td>Perspectives</td>
</tr>
<tr>
<td>5</td>
<td>-</td>
<td>-</td>
<td>Perspectives</td>
</tr>
<tr>
<td>6</td>
<td>-</td>
<td>-</td>
<td>Nurse Star</td>
</tr>
</tbody>
</table>

Instrumentation

An interview schedule (see Appendix F) was developed by the researcher in which three semi-structured questions formed the framework for collecting qualitative data to answer the broad and specific research questions. The three interview questions were aimed at: (a) gathering descriptive data from which categories of student conceptions of the role
of computers in hospital nursing could be generated, and (b) determining each student's attitude toward the role of computers in hospital nursing. In addition, in order to obtain quantitative demographic data and data on computer usage, a respondent profile sheet, consisting of ten forced-response and open-ended questions, was developed and included at the end of each interview schedule.

The interview schedule was first piloted in January 1988, with two second-year nursing students, and resulted in further focused questions. It also provided an opportunity to critique the researcher's interviewing skills. Necessary revisions to the tool and interviewing style were addressed. The revised interview schedule was again piloted in February 1988, with two different second-year students. Minor revisions were made and it was felt at that time that it was ready for use. Second-year students were chosen for the pilots, because the researcher had easier access to that group of students on a regular basis, and second year was between the other two years.

The interview schedule and accompanying respondent profile were screened by the University of British Columbia Behavioral Sciences Screening Committee For Research and Other Studies Involving Human Subjects. Approval on ethical grounds for this research study (#B88-058) involving human subjects was obtained on March 10, 1988 (see Appendix G).
Data Collection

Thirty-five audiotaped interviews, ranging in length from 30-45 minutes, were conducted in March and April, 1988. These took place at mutually convenient scheduled times within the privacy of the researcher's office. Interview times were staggered with only one or two interviews scheduled per day, on alternate days, so as not to jeopardize the quality of the interviews with interviewer fatigue. On one occasion, three interviews were held on one day because of the lack of availability of the subjects due to final examination schedules at the end of the semester. At the outset of each interview, subjects were asked if they agreed to the interview being tape recorded, and all subjects readily agreed.

A semi-structured interview schedule (see Appendix F) was used, which enabled the researcher to gather comparable data between subjects within the same and different years of the nursing program (Bogdan & Biklen 1982). All questions were asked in the order outlined in the schedule and with only minor rewordings of the questions to make them consistent with the interviewer's and subjects' style. Questions were reworded when it was necessary to clarify their meaning to subjects. Probing for additional information and clarification of answers took place in each
If a subject addressed a question before it was asked, the question was still asked in sequence but the interviewer acknowledged that the question had been addressed. This communicated to the subject that the interviewer had been listening but in addition, provided the subject with the opportunity to expand on what had been said previously, and also precluded omission or cursory investigation of a question by the interviewer (Knafl, Pettengill, Bevis, & Kirchhoff, 1988). The researcher was cognizant of "putting words in the subject's mouth," and consciously attempted to avoid this, as it was observed to be a weakness in the first two of the four pilot interviews. During data collection, attempts were made to elicit and maintain the uniqueness of each subject's interpretation of his or her experience (Munhall, 1982).

At the conclusion of each interview, subjects were thanked for their participation, and asked if they would like to receive a copy of their transcript. Only one subject, a first year student who had considerable experience with computers, indicated she would like a copy. The reaction of the other subjects was one of, "I know what I've said, so it is not necessary to have a copy."

Tapes were identified with a number indicating the: (a) year of the program in which the student was enrolled, and (b) subject within each year. Numbers from 1-10 were
used to identify female subjects and 11-13 to identify male subjects.

Immediately after each interview, the researcher wrote a short summary of thoughts, feelings and reactions to the interview. These initial thoughts enabled the researcher to begin the process of analysis simultaneously with the data collection phase of the research. In this study, theory was generated by the joint operations of data collection, coding, and analysis of data. Glaser and Strauss (1967) point out that the generation of theory, coupled with the notion of theory as process, requires that all operations be done together as much as possible and intertwined continually from the beginning of the study to the end.

A dictaphone was used to transcribe the audio tapes verbatim into a computer in order to generate transcripts of the interviews. Originals of the transcripts were stored in a safe place for further reference later as the study unfolded. Photocopies of the originals were taken and were used as working documents from which the analysis was generated. These transcriptions, together with the written reactions to the interviews, provided 455 pages of data.

During the two month period of time when student interviews, transcription of tapes, coding and beginning analysis was occurring, informal discussions were also held with: (a) members of the Computers In Nursing Interest Group of the R.N.A.B.C., (b) the steering committee members for the
Computers In Nursing Project, and (c) colleagues at Cariboo College Nursing faculty. The intent of these discussions was to determine the climate and present state of the art of computers in both hospital and educational settings within British Columbia. In addition, a scheduled information gathering interview was held with the Director of Patient Care Services at Royal Inland Hospital in Kamloops to determine: (a) the status of computer implementation at the local hospital, (b) the degree of nursing input into system selection, and (c) plans for educating nurses to use it.

These informal discussions provided the researcher with a sense of the present state of the art of computer use by nurses in hospitals in Kamloops and the rest of British Columbia, and also a sense of how nurses and student nurses are being educated to use these computers. The information gleaned from these discussions, as well as from the review of the literature, provided a context for interpretation and discussion of the findings from this study.

Researcher’s Role

Because the nature of this study was both inductive, and generative, designed to discover analytic constructs or categories, it was expected that the subjectivity of the researcher would influence the analysis (Goetz & LeCompte 1984). Bogdan and Biklen (1982) point out that the
researcher is the key in qualitative research. At the time of the study, the researcher was a member of the nursing faculty at Cariboo College and as such, was keenly aware of variables impinging on this study from that unique perspective. It was anticipated that data analysis would be improved by the researcher's insight, from her experience as a practising nurse, a second-year nursing theory and clinical instructor, and a graduate student in adult education at the University of British Columbia.

It could be argued that the dual role of instructor\researcher put the researcher in a position which could be perceived by the subjects to be incongruent and possibly uncomfortable. A rapport had been established between the instructor\researcher and the present second-year class. These students had all been taught by the instructor\researcher, who was carrying a full teaching load in nursing theory throughout the year. As well, sixteen of the second-year students were taught clinically in the fall semester, (September-December, 1987) by the instructor\researcher, prior to her clinical release during the winter semester (January-April, 1988).

Because of staffing changes in the nursing department at Cariboo College, students enrolled in the third-year class were all taught nursing theory by the instructor\researcher in both their first and second years of the program. Additionally, over half the third-year class had been taught
by the instructor\researcher in the clinical area over the past two years. Several students had also had the instructor\researcher as a clinical instructor, both in first and second year.

It was felt that the familiarity and rapport that existed between the instructor\researcher and both second and third-year students, compensated for any role incongruency subjects might have felt and that instead of being a deterrent, it enhanced data collection, because the comfort levels of subjects and cooperation were increased. One third-year subject had received a probationary clinical evaluation from the researcher in a second year clinical rotation. At the time she was very angry, but at the beginning of her third year she came back and thanked the researcher for helping her to correct her weaknesses. This subject was not replaced by another for two reasons: (a) It was felt that the issue had happened long enough prior to the study and had been dealt with sufficiently so that it did not interfere with the subject’s ability to participate, and (b) the timing of the interview was close to the end of the semester, and many of the other third-year students had finished their practicum and were not available.

Throughout the interviewing phase of the study, the instructor\researcher was cognizant of her own biases regarding previous knowledge of subjects’ performance in the nursing program and accordingly, tried to consciously check
against this. For example, one third-year subject, whom the researcher knew previously as quite negative, came across in the interview as being very positive towards computers.

The first-year subjects who had not had any contact with the researcher, had a different relationship. These subjects were not familiar with the researcher as an instructor, and it was felt that perceived incongruency of role would therefore be reduced or non-existent. This posed a very different consideration for the researcher. Accordingly, she worked especially hard at increasing the comfort level of these subjects, so that they felt relaxed enough to reveal complete data in the interviews. Time was spent getting acquainted and in rapport building with each first-year subject prior to the commencement of each interview.

The researcher was also cognizant of her own positive attitude toward computer use in hospitals, and consciously tried not to reveal that positive bias to the subjects. Several subjects asked the researcher to reveal how she felt about computer use by nurses, after their interview had terminated. The fact that they posed that question, at that point in their interaction, served as an indication that subjects were unable to detect or respond to researcher bias during the actual audio-taped interview.
Analysis Of Interviews

Two strategies were employed in analyzing data generated from the interviews. Although the process of analysis of data was ongoing or formative throughout the study, the more formal or summative analysis was done after all of the data was collected and all the interviews were transcribed (Bogdan & Biklen, 1982). For the sake of clarity of discussion, formative and summative analysis will be discussed separately.

Formative Analysis

Formative analysis included what Glaser and Strauss (1967) describe as the constant comparative method of analysis. This is a process whereby comparisons of data are made between and among subjects from each year sampled. Interviews were scheduled to ensure that data from first, second, and third-year students was collected concurrently, so that differences in conceptions (if any) between, and among the years could be tested.

Immediately after each interview, and prior to transcribing the audio tapes, the researcher wrote a short summary of thoughts, feelings, and reactions to the interview, as well as any unusual circumstances which could influence the quality of the subject’s responses. During an
interview, one first-year female subject, revealed that she was not thinking straight because she had just found out that her Dad had cancer. A second-year subject, even though she had just found out she was pregnant, did not appear to let this news affect her responses. A circumstance with a different emotional component occurred in an interview with a third-year female subject. She had just come from a job interview where she had successfully obtained her first job as a nurse. She was very noticeably excited at the outset of the interview, and gave very short, to-the-point answers until she settled down about five minutes into the interview, and then offered more detailed responses.

During the transcription process, which involved listening to the tapes and typing the dialogue directly into the computer, thoughts and associations between transcript data and insights which came to the researcher were also recorded as observer comments. Both the initial observer comments, and those made during the transcription process, were recorded under the broad headings of: (a) conceptions, and (b) attitude. This served to focus the analysis around the areas of interest identified by the research questions guiding the study.

As the concurrent process of data collection and ongoing analysis proceeded, it became necessary to stop periodically and reflect on what appeared to be emerging from the data. Data generated from six subjects (two from each year)
consisting of the transcripts and all observer comments were read once again and a memo or summary was written of what appeared to be emerging. The technique of constant comparison between, and among years was used in writing these memos. This process of memo writing was carried out after each group of six interviews.

Transcripts appeared well used as the research unfolded and each one had ideas jotted in margins, important sections underlined, and key words and phrases used by subjects circled. All data, including transcripts, observer comments, and memos generated when comparing each group of six interviews, were identified by number and filed systematically in order to facilitate retrieval for use later in the process of analysis.

Ideas were tested with subjects, in each year, who were known by faculty to be perceptive and articulate. This helped to advance the formal analysis of the study (Bogdan & Biklen, 1982). Although the questions on the interview schedule continued to be asked as originally outlined, more focused probing was used to test out hunches. Review of the literature continued for the purpose of enhancing the analysis and the generation of theory.
Summative Analysis

Following the concentrated formative process of data collection and analysis, a short break was taken from the study to allow for reflection and synthesis of information prior to the commencement of summative analysis. The overwhelming volume of transcripts, notes, and memos indicated the need to organize the data into a more manageable form, so that relationships could be examined more readily.

Initially, the transcript of one subject at a time was examined to capture the full range and diversity of the data generated by that subject. Then, attention was focused on identifying data from that individual's transcript, under the two main broad headings of the study, conceptions and attitude. After attitudinal and conceptional data were identified from each of the thirty-five transcripts, attention was then directed toward identifying relationships: (a) between the two broad headings, and (b) within and between subjects enrolled in each year of the program.

Manipulation of data was facilitated by use of a computer. A separate computer file was made for each subject, under each of the two broad headings (conceptions and attitude). Data supporting each broad heading was pulled from the subject's transcript and typed into the file. A conscious attempt was made to preserve the subjects'
perspective by using his/her exact words. As these files were developed, it became clear that data supporting each heading further separated itself into sub-headings. Hard copies of the attitude and conception files for each subject were printed and became working documents for further analysis. For clarity of presentation, the process of data reduction and analysis of data pertaining to each of the two broad headings, as well as the respondent profiles, are discussed separately.

Analysis Of Conceptual Data

Because this phenomenologic research is of the second order perspective, aimed at description, analysis, and understanding of subjects' views on computers in hospitals, their views were considered as categories of description (Marton 1981). Several steps were involved in generating categories which were grounded in the data. The first step involved the gathering of data from each subject's transcript that pertained to his/her view or conception of the role of computers in hospital nursing. This data was typed into a computer file entitled "conceptions," and the data was clearly identified by using the same number as the subject's transcript.

The second step, aimed at the generation of categories of conception, was the organization of the conceptual data
under the following five sub-headings, which emerged from earlier analysis: (a) awareness of computer use in hospital nursing today, (b) knowledge of how computers will be used by nurses working in hospitals in the future, (c) views on how computers may affect the job/role of the nurse working in a hospital, (d) views on how computers may benefit nurses working in hospitals, and (e) views on how computers may limit nurses working in hospitals. On further examination of all the data on conceptions, from each subject, it became evident that this breakdown, although useful for starting to determine categories of conception, alternately resulted in fragmenting the data.

To reduce this fragmentation of data, which could lead to inaccurate analysis and interpretation of findings, a more global approach to the analysis of the data on conceptions was subsequently taken. It was decided to separate the data on subjects': (a) awareness of computer use in hospitals today, and (b) knowledge of how computers may be used by hospital employed nurses in the future, from the conception's file. As it was felt that these findings would provide the backbone or context for subjects' other conceptions concerning computers in hospital nursing, these data were analyzed, and reported separately. The resulting categories of description of subject's conceptions of the role of computers in hospital nursing, thus emerged from the remaining data in the conception file.
Once again, the transcripts, observer comments, and memos were reviewed, along with the revised conceptions file, and topics and thoughts which had been introduced by the subjects were identified. Extensive lists were made of words, phrases, and sentences from the thirty-five interviews which seemed to describe the subjects' way of thinking. These lists were then reduced to 43 themes (see Appendix H).

These 43 themes were re-examined and related themes were grouped, resulting in the emergence of four categories. The categories were named to reflect the overall nature of the themes they represented (see Appendix I).

At this point, it became apparent that subject responses stemmed from conceptions of how computers impact hospital employed nurses, rather than conceptions of the role of computers in hospital nursing. The broad research question posed at the outset of the study was revised to read: How do nursing students in a community college nursing program conceptualize the impact of computers on hospital employed nurses? The word processing function of the computer facilitated organization of data under each of the four final categories of conceptions. Subsequent review of the data determined the properties or attributes characteristic of each category, and these were grounded in the data through the use of direct examples taken from the transcripts. This will be discussed in some detail in Chapter 4.

Through the process of constant comparison it became
obvious that some subjects focused their attention on only two categories of conceptions, while others readily discussed three or four. It also became evident that some subjects chose to discuss either all positive or negative characteristics of the categories chosen, while others presented both. Comments from each subject's transcript were then organized according to sub-categories indicating whether the subject saw the use of computers by hospital employed nurses as (a) enhancing, (b) detracting from, or (c) both enhancing and detracting from that category.

Intuitively, the researcher could ascertain a difference in the quality of individual subjects' conceptions and sought a means of measuring this. Quantitative measures could be determined for: (a) the number of categories of conceptions discussed by each subject, and (b) whether they saw each category enhancing or detracting from the role of hospital employed nurses. It became apparent that these quantitative measures might serve as one means of determining the complexity or quality of the subjects' conceptions, and of drawing comparisons between subjects enrolled in each year of the program.

The first specific research question posed at the outset of the study was subsequently revised to read: Is there a difference in complexity between first, second, and third-year nursing students' conceptions of the impact of computers on hospital employed nurses?
In an attempt to answer this revised first specific research question, once again the transcripts were revisited, but this time, the researcher searched each transcript for complexity of conceptions, or a qualitative measure, to determine how the categories and their properties were linked. Determination of quality of conceptions was made firstly by reading all the conceptual data from each subject and intuitively arranging them in three piles: high, medium, and low levels of conception. Secondly, the researcher determined commonalities within each group of transcripts which prompted the researcher to rate them in a certain way. It was decided that there was often a fine line between the middle rating, and that of either high or low. Therefore, it was decided to use just the two opposite ratings of high, and low levels of complexity of conceptions, in order that clear distinctions might be found between subjects in each year.

A number of characteristics were used to rate subjects as having either high or low levels of conception. Subjects with low level conceptions discussed the categories and whether they felt they would be enhanced or detracted from, but did so in short, "to-the-point" answers, with little attempt to qualify their statements. They talked about computers in simplistic, magical terms, often portraying the feeling of disbelief. Little or no attempts were made to draw relationships between their experiences in the clinical setting, or to refer to happenings in other fields. They
often spoke as if they were removed from the situation, and seemed reluctant to voice opinions or suggestions.

Subjects who were rated as having high levels of conception appeared much more realistic in their opinions, and went beyond just talking about the category to offer suggestions and voice personal views on it. They tended to discuss trends in nursing, and society in general, as well as to relate the discussion to their own clinical experiences. Table 5 shows, diagramatically, what characteristics were included in each level of quality of conception.

Table 5.
Characteristics Of Quality Of Conception

<table>
<thead>
<tr>
<th>LOW</th>
<th>HIGH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Categories And Sub-Categories</td>
<td>Hypothesized About Categories</td>
</tr>
<tr>
<td>Magical, Simplistic Quality</td>
<td>Realistic Detailed Quality</td>
</tr>
<tr>
<td>Few Relationships</td>
<td>Related To Clinical And Other</td>
</tr>
<tr>
<td>Few Opinions</td>
<td>Opinions And Suggestions</td>
</tr>
<tr>
<td>Distanced From Situation</td>
<td>Personalized Situation</td>
</tr>
</tbody>
</table>

The subjects in each year, who fell in the middle were either moved to higher, or lower, levels of conception by reviewing their transcripts considering the following: (a) the number of categories discussed, (b) discussion of
whether each category was enhanced or detracted from, (c) the number of characteristics (high or low) of quality of conception, and (d) comparing the quality of their conceptions with those of other subjects in the high and low groups. Two first-year subjects, who fell in the middle, will serve as examples of this process.

The decision to move one of these first-year subjects to the high level of conception was based on the following: (a) three categories discussed; (b) both enhancement and detractions of two categories, and only enhancement of the third were discussed; (c) made one reference to an incident experienced in the hospital, and this incident was discussed in relation to how it would be affected by computer use; (d) gave one opinion and suggestion for what might be done; (e) personalized the discussion on one occasion; and (f) the quality of conception was more congruent with those of subjects placed in the high level.

The decision to move the other first-year subject who fell in the middle to the low level of conception was based on the following: (a) three categories were discussed; (b) both enhancement and detractions of two categories, and only the detractions of the third were discussed; (c) one reference only to her clinical experience; (d) one opinion in relation to employment in a global sense; (e) distant from the situation; and (f) the quality of conceptions was more congruent with those of subjects placed in the low level.
Frequency counts and chi-square distributions were used to determine the relationship between high and low level of conceptions and subjects': (a) year in the program, and (b) length of clinical experience. These findings will be presented in Chapter 4.

Analysis Of Attitudinal Data

The first step of analysis of subjects' attitude toward the role of computers in hospital nursing, was identification of data in the transcripts which indicated attitude. Firstly, a computer file named "attitude" was created, and secondly, sub-files, clearly identified by number, were made for each subject. At the beginning stage of analysis, attitudinal data was taken verbatim from each transcript and typed into each subject's sub file under the following four areas: (a) initial experience, (b) subsequent experience, (c) barriers to use, and (d) general attitudinal comments. Organization of the attitudinal data in this manner, at the outset, facilitated the process of data reduction under headings which were more relevant to this study.

On further examination of the data, it became clear that the first three areas, although helpful in terms of organizing the volume of data collected, and in presenting a clear picture of the subject's experience with computers, could not be used in assessing subject's attitude toward the
role of computers in hospital nursing. Although it was interesting to know if a subject's initial and subsequent experiences with a computer were positive or negative, and to know the circumstances surrounding the development of these attitudes, these personal experiences were all unrelated to hospital nursing. The literature points to a correlation between a subject's initial and subsequent computer experience and his/her attitude toward a computer, but this study did not set out to test such correlations.

Subjects indicated a number of local barriers to use of the Cariboo College VAX computer system. On reflection, these were felt to be misplaced under the heading, "Analysis Of Attitudinal Data". Data supporting barriers to computer usage was subsequently analyzed with other computer usage data in the respondent profile analysis section.

All the data identified under the two areas: initial experience, and subsequent experience with a computer, were not felt to be directly related to this study. However, they provided the researcher with an indication of where each of the subjects were in terms of their own personal comfort level and growth of attitude toward computer use in general. This data was felt to influence the study indirectly, so it was analyzed using frequency counts, and used to provide background information about the subjects enrolled in each year of the program. The findings are reported in Chapter 4 under the heading "Secondary Findings," and are also
discussed in Chapter 5 in terms of making local recommendations as an outcome of this study.

Three main sub-headings were considered in determining each subject's attitude toward the role of computers in hospital nursing. Firstly, all subjects rated themselves on a five point Likert-type attitude scale, for which a rating of "1" was considered to be negative, "2" moderately negative, "3" neutral, "4" moderately positive, and "5" positive. If students gave a range of scores, or rated themselves between the whole numbers on the scale, the lower number was consistently taken as the rating.

Secondly, it was noted whether subjects indicated a desire to purchase a home computer, or take a computer course. A positive response to either of these questions might indicate a positive attitude toward computers, as it indicated the subject's desire to commit time and money toward learning to use a computer. This study did not set out to determine if subjects' attitudes toward computers in general were consistent with their attitude toward computer use in hospital nursing. However, it was intuitively felt that if a subject had a positive attitude toward computers in general, he/she might also have a positive attitude toward computer use in hospital nursing.

Thirdly, both the transcripts and hard copies of each subject's attitude file made at the outset of the analysis were revisited. All comments indicating the subject's
attitude toward the role of computers in hospital nursing were examined, and examples of comments were cited from the transcripts to ground the researcher's subjective rating of the subject's attitude in the data. The outcome of this process was to rate each subject as being either positive, neutral, or negative about computer use in hospital nursing.

Once an attitude rating was determined for each subject, attention was turned to answering the third research question. Like the others, this one was also revised to read: What is the relationship between nursing students' conceptions of the impact of computers on hospital employed nurses, and students' attitudes toward computers? Frequency counts, and percentages that had been determined earlier in the study, were used as measures of high or low levels of conception and positive or negative attitude. The statistical significance of relationships was tested between the two variables by using the chi-square distribution. These findings are presented in Chapter 4.

Analysis of Respondent Profiles

Frequency counts, means, and percentages were used to analyze the data generated from the respondent profiles. Demographic data was analyzed, including: (a) age, (b) educational experience prior to entering the Cariboo College nursing program, (c) education specific to computing
(excluding experience in the Cariboo College nursing program), and (d) access to a computer at home. Computer usage data was analyzed including: (a) use at home, (b) use at Cariboo College, (c) barriers to use, and (d) family use (other than video games). Findings from this data provided the researcher with a clearer picture of the backgrounds of Cariboo College subjects in terms of their computer knowledge and use. Findings from the respondent profiles are reported in Chapter 4. under the heading "Secondary Findings."

Establishing Validity And Reliability

A number of strategies were employed to enhance validity and reliability through each step of this study. Reliability is concerned with the replicability of research findings, and validity is concerned with the accuracy of those findings. Reliability and validity will be discussed in terms of establishing both external and internal controls for each.

A number of controls were employed to enhance external reliability, or the extent to which independent researchers working in the same or similar context would obtain consistent results. At the outset, care was taken to describe the structure of the nursing program in the community college where the study took place, and to identify its structure in terms of length, and the number of clinical hours in each year. The process of the selection of subjects
included such details as how they were contacted, and the role of the researcher in relation to them. The setting and conditions under which the interviews took place, the interview tool, and details of how the interviews were conducted were also described in detail. In addition, an outline of the computer content in each semester of the nursing program was included. Analysis of interviews, in terms of both formative and summative analysis, and a detailed description of how categories of description were arrived at, was given considerable attention.

Internal reliability, or the question of whether, within a single study, multiple observers would agree (LeCompte & Goetz, 1982) was dealt with in a number of ways. Interviews were tape recorded to preserve all data and the interviews were subsequently transcribed verbatim. To determine inter-rater reliability, clean copies of the same four interview transcripts, and copies of the drafts generated during each step of the data reduction process were given to both thesis advisors. Each advisor was asked to read the data and to independently assess the researcher’s analysis of it, with the result that each advisor concurred with the researcher’s assessment. In addition, the researcher used verbatim comments from subject’s transcripts to support findings.

Validity is believed to be a strength of this type of research (LeCompte & Goetz, 1982). To enhance internal validity in terms of history and maturation, all interviews
were conducted in a two month period (March and April, 1988). Observer effects were controlled in the following ways: (a) subjects were informed that their status as students at Cariboo College would in no way be affected by their participation or non-participation in the study; (b) observer comments, which included observations of subject’s behavior during the interview were written after each interview, and these observations were noted where it was felt to have affected the findings; and (c) subjects were offered copies of their transcripts.

Selection and sampling followed rigorous identification of subgroups within the total student population, and then decisions were made to include an equal number of first, second, and third-year female subjects, because the majority of students in each class was female, and the class sizes were relatively equal. As each class had male students, it was then decided to include them to enhance the validity of the findings. The registered psychiatric nurse (R.P.N.) group was excluded, because that group would not be included in populations of nursing students in other programs. Mortality was not a problem in this study.

Threats to external validity are those effects that obstruct or reduce a study’s comparability and generalizability. The researcher identified the audience to which these results might be generalized early in the research as being community college nursing programs, and
acknowledged the fact that even though these programs differ in terms of length and required number of clinical hours, they share a common mandate. Care was taken to use common nursing terminology to define categories which would have meaning in any nursing educational setting. Subjects were all asked the same questions, in the order listed in the interview schedule, to allow for comparisons to be drawn across and between years.

Summary

In summary, data analysis for this study was carried out both on a formative and a summative basis. A combination of strategies for analysis was employed when analyzing interview transcripts. These strategies included: (a) analytic induction, (b) constant comparison, (c) typological analysis, and (d) enumeration (Goetz & LeCompte, 1984). Analytic induction was used initially to scan the data for coding categories and for relationships among categories. Constant comparison across categories was used throughout, and typological analysis was used to analyze conceptual data in order to place it in a taxonomy. In addition, enumeration, or the use of frequency counts, was employed to add a quantitative dimension to the data, so that comparisons between subjects in each year could be made.
As the research unfolded, it became evident that the findings divided naturally into two distinct groups: (a) primary findings, or those findings related to the research questions posed at the outset, and (b) secondary findings, or those related to the subjects' individual computer use and computer experiences while enrolled as students in the Cariboo College diploma nursing program.

Primary findings will be presented by using the research questions as a guide. For clarity of presentation, findings in relation to conceptions will be discussed first, because relationships are drawn later between conceptions and other variables. Findings under the heading "Conceptual Findings" will be organized under five sub-headings: (a) awareness of computer use by hospital employed nurses today, (b) conceptions of how computers will be used by hospital employed nurses in the future, (c) categories of conceptions of how computers impact hospital employed nurses, (d) complexity of conceptions, and (e) relationship of conception to clinical experience.

Findings under the heading "Attitudinal Findings" will be addressed under three sub-headings: (a) desire to purchase a computer or to take a course, (b) rating on an attitudinal scale, and (c) relationship between conception
and attitude.

Secondary findings will be presented under two subheadings: (a) demographics, and (b) computer access and usage. The chapter concludes with a summary of both the primary and secondary findings.

Primary Findings

Conceptual Findings

The broad research question was revised as the study unfolded, to read: How do nursing students in a community college nursing program conceptualize the impact of computers on hospital employed nurses? Conceptions, or thoughts, are formed by both our knowledge of present happenings and our expectations of future events. Therefore, as a point of departure in addressing this question, descriptive data and frequency counts of subjects' responses will be reported to illustrate their:
(a) awareness of computer use in hospital nursing today, and
(b) knowledge of how computers will be used by hospital employed nurses in the future.
Awareness Of Computer Use By Hospital Employed Nurses Today

Computer terminals were not available on nursing units at Royal Inland Hospital at the time of the study (March and April, 1988). Therefore, subjects did not see nurses using computer terminals as they carried out their jobs\roles. Eight first-year, nine second-year, and five third-year subjects commented on this fact. One first-year subject stated: "I can’t even picture in my mind where the computers would be set-up...how they would have it." Six first-year, six second-year, and seven third-year subjects indicated awareness that computers were being used in the lab at the local hospital. Several subjects discussed the fact that computerized lab results affected the nurse indirectly. It provided him\her with legible results that were available quickly. Norms printed on the reports aided the nurse in doing patient assessments. Three third-year subjects cited computers which are connected directly to the lab, to facilitate speed in reporting results to such critical care areas as, the intensive care unit (I.C.U.) and intensive care nursery (I.C.N.) unit, at Royal Inland Hospital. It is important to note that subjects in all three years of the program had lab tours scheduled as part of their clinical experience when they were enrolled in semester 2 of the program.

Subjects mentioned several other areas in the local
hospital where they thought computers were being used. Two first-year, and four third-year subjects noted that computers were being used in the Admitting Department. One first-year and one second-year subject thought they were being used in the records department, while one second-year student noted their use in X-ray. One first, one second, and three third-year subjects noted their use in the Pharmacy Department. The hospital's administrative functions were felt by one first-year and five second-year subjects to be computerized. Third-year subjects did not mention the hospital's administrative functions, although they are presently computerized. Specific examples of administrative uses noted by subjects included: operating room (OR) scheduling, payroll, stock taking, data storage of records, and bed availability. One first, one second, and no third-year subjects identified monitors, computerized (IVAC) thermometers, and computerized intravenous (IMED) controllers as ways computers were being used at the hospital.

Subjects varied in their awareness that the local hospital was in the beginning process of implementing a total hospital computer system. One first-year subject noted that she was not really too sure of what was happening with computers right now in the hospital, while another felt, "they are coming." One second-year subject mentioned that she had heard that, "they are coming and I feel that from the way people are talking, computers are moving into the system
fast." A second-year subject, who had worked in the Medical Records Department of the hospital, knew that the hospital was changing over to a computer system.

Third-year subjects seemed more informed, but gave a variety of responses, in terms of the time frame for implementation. One third-year subject noted, "They'll be online at the end of the summer or something...I think that is the plan." Another stated, "I think that hopefully they will be getting them in the new wing, which is scheduled to open in the summer." Two subjects noted that it looked like we were five years away from getting them on the floors. Others were less specific as indicated by the following comments: (a) "It is going to come into our hospital", (b) "quite a ways in the future," and (c) "the plan is definitely in the future for R.I.H. to become computerized."

First, second, and third-year subjects were not very aware of what was happening in hospitals outside of Kamloops, as indicated by these ten examples of their comments:

1. I’m not aware of them being used in other centers.
2. I’m not aware of a lot that is happening in nursing with computers today.
3. I’m not aware of them being used by nurses.
4. I’m not really aware of what’s happening or what’s being done with computers in nursing elsewhere.
5. I don’t know how comprehensive other hospitals are.
6. I’m not aware of what is going on. I don’t really know that much about it.
7. I’m not aware of anything happening in the province.
8. I haven’t really thought about it or discussed it with anybody.
9. I don’t know enough about the field.
10. I don’t know what is going on anywhere else.
Several subjects made reference to happenings within British Columbia, but their awareness of provincial happenings was minimal. A first-year subject noted that her husband had undergone heart surgery at St. Paul's Hospital in Vancouver, and speculated that computers were involved in his care, even though she indicated that neither she nor her husband was aware that "the hospital was invaded by computers." A second-year subject stated, "I imagine they are being used in places like Children's but, I'm taking big guesses here." Another second-year subject noted that her mother worked as a nurse in Victoria and used computers, but that she had never discussed it with her. One third-year subject noted that the Pharmacy in Salmon Arm Hospital where she did her preceptorship had a computer, while another thought they would not have computers in smaller hospitals. Another third-year subject noted that the hospitals in Nanaimo and all the doctor's offices were being connected to a central computer, while another thought that they were being used in hospitals "back east in Toronto."

Subjects' awareness of computer use by nurses in other provinces of Canada was also minimal. One second-year subject stated that she had heard awhile ago that the hospitals in Newfoundland were being linked by computer to try it out, and she speculated that this would spread right across the country. Subjects' seemed slightly more aware of happenings in the United States. A first-year subject
vaguely recalled that one of the teachers had spoken to them in class about computers in a hospital in California. Two second-year subjects referred to the video about a total hospital system that they had seen while in the first year of the nursing program. It showed a patient admitted to a hospital in California, and how computers had influenced his care. Third-year subjects made the following comments:

1. I know that there are hospitals in the States that are almost entirely run by computers.
2. I've heard that some hospitals in the States have computers and they use them at the bedside also.
3. They are in the nursing stations. I know that's happening now, somewhere in the States.
4. I believe that computers are used by nurses in the States.
5. They are used a lot more in the States and that they will eventually be coming up to Canada.

Evidence suggested that a small number of subjects had read articles pertaining to computers in nursing. During the course of the interviews, three first-year subjects made reference to things they had read. One second-year subject commented, "I've done the readings that were pertinent to the papers we handed in in the Perspectives Course on nursing in the future, but that was all. I didn't get into any extras." That same subject made the comment, "my background is lacking, but I am a student." Two third-year subjects revealed that they had read a number of articles and subsequently written papers on Computers In Nursing. Both brought their papers to the interview and one subject read from his paper to illustrate a point being made in the interview. Two other third-year subjects made reference to
articles they had read.

Only two subjects had actually seen a computer used by nurses or had used one personally in a hospital setting. A first-year subject had worked as a candystriper in a hospital in Victoria, and she had seen computers that were being piloted in a nursing station to keep track of patient's room assignments. A second-year subject had received a week's training, and she had direct work experience with the original computers in the medical records department at Royal Inland Hospital. Her comment was, "I'm only just aware of what I've worked with in medical records."

At this point in time, subjects did not seem to personalize the use of computers in the hospital setting, as evidenced by these two comments from first-year subjects: "It is not really impacting me right now," and "I'm not really aware of any big impact on me as a nurse." One second-year subject commented, "I don't feel like I have much to do with them. I don't think it pertains to me at all."

Others noted:

1. I think they are good for lab results but they don't directly relate to me at all at this point. My work ...what I'm doing in the hospital is not being helped by computers, I don't think. You see very little of it in nursing.
2. I'm not really aware of how they are impacting me indirectly.
3. Applying them to my job is hard for me to say because I'm not really working with them per se. Computers have not impacted me as far as a practical fashion in the clinical setting.
4. I haven't had enough exposure to know much more.
5. I've never really seen the application.
In summary, subjects' awareness of computer use in hospitals today appeared to center mainly around their local experiences. Direct hands-on experience by subjects to computers in the hospital setting was non-existent. Although several subjects noted articles they had read and a video they had been shown in first year nursing, the majority of subjects were unaware of happenings on both the provincial and national scene. A small number of subjects were vaguely aware that hospitals in the United States were more advanced in terms of technology. Subjects' awareness did not appear to increase dramatically as they progressed in the program, although third year subjects provided more detailed descriptions of their conceptions. It appears then that all thirty-five subjects have next to no awareness of computer use in hospitals locally, provincially, or nationally.

Knowledge Of How Computers May Be Used By Hospital Employed Nurses In The Future

Subjects' knowledge of how computers may be used by hospital employed nurses in the future, centered around three broad areas: (a) nursing, (b) administration, and (c) communication. Two of these areas involve direct computer use by nurses, while the other involves indirect use. Appendix J details the items cited by subjects in their interviews, under each of these three broad areas. In
addition, several subjects reported their thoughts of where, and when computers might be physically placed on the nursing units. Firstly, findings of subjects' views of how computers may be used by hospital employed nurses in the future will be reported, followed, secondly, by findings related to subjects' thoughts of where, and when this might occur.

The first broad area "nursing," included direct computer use by the nurse: (a) as a teaching tool, (b) for physiological monitoring, (c) for documentation, (d) for planning nursing care, and (e) as a reference source. Computer use by nurses for documentation purposes was the one area that the majority of subjects noted (91% first-year, 91% second-year, and 69% third-year). One third-year subject however, stated that she did not think we'd see a whole lot of the narrative and flow charting done on computers for some time, and her rationale was that the system presently used is "good and fast". Others however, thought that "all documentation and a lot of the clerical stuff could be on computers."

All eleven first-year (100%), ten third-year (77%), but only four second-year (36%) subjects noted the use of computers as reference tools. The one area that the majority of these subjects mentioned was as a source for drug information and compatibilities.

Computer use for physiological monitoring of patients was noted by a very small number of subjects in each year:
first-year (n = 3), second-year (n = 5), and third-year (n = 3). One second-year subject, even though she thought they would be used more for patient monitoring functions, stated: "I don't trust them, so I would still be checking the thing every ten minutes." Another noted that as technology moves into the hospital, patient monitoring will not only be evident in the critical care areas, but will become more routine on the regular floors.

Four first-year, five third-year, and no second-year subjects noted the use of computers as a teaching tool. A first-year subject stated that there isn't much teaching being done right now by nurses, because of the time factor. She thought that more might be done if computers are used because: "computers have all day if you want to spend with it...it doesn't rush things along." One-third year subject stated that the computer would have to be reasonably friendly, and that he could not see the computer teaching the patient to give his/her own insulin. He felt that it could not do the actual injection, which is the "scariest part." He thought that the computer could provide the information, but that the human contact still had to be there.

The final area under nursing uses identified by subjects was use of the computer to generate nursing care plans, and this was noted by only a small number of first-year (n = 3), second-year (n = 2), and third-year (n = 2), subjects. One second-year subject said, "computers might be used to
generate nursing care plans in some experimental hospitals."
A third-year subject said, "you could use the computer to
draw up a better care plan, by individualizing a standard
care plan."

The second broad area "communication," included direct
computer use by the nurse for communication with: (a) other
nurses, (b) doctors, (3) patients, (4) hospital departments,
and (5) other hospitals. Use of the computer to facilitate
communication between nurses received minimal attention by
subjects in all three years. One first-year subject said
that when she shows up for work in the future, she will have
a number, and when she enters that into the computer, she
will receive a whole print-out of not only who she is to care
for, but also, the patients listed in order of priority of
care. The print-out would also indicate notes on the
patient's condition, and what is expected as far as patient
care for that shift. Most of the subjects who discussed
communication between nurses focused their discussion around
communication at the change of shift and with updating the
nursing Kardex.

Use of computers to facilitate communication with
doctors also received minimal attention, and the subjects who
mentioned it focused on doctors using it to communicate
legible doctors' orders. Only one first-year subject noted
the use of computers by patients to facilitate communication
with the nurse. She illustrated her point with an example of
an aphasic patient. While only a very small number of first
(n = 1) and second (n=3), year subjects mentioned
communication between hospital departments, the majority of
third (n = 9) year subjects chose to discuss this area of
usage. Communication between hospitals was not mentioned by
any first-year, and only a minimal number of second and
third-year, subjects. One third-year subject stated that she
felt peoples' medical histories were going to be carried
around on little cards, and nurses would be able to access
them and update the information wherever the patient goes
across the country.

The third broad area "administration," included indirect
use by the nurse for: (a) scheduling, (b) finance, and (c)
statistics. Less than 25% of subjects in each year noted
these administrative uses. One second-year subject noted,
"I'm sure they will be used more on the administrative side
and eventually trickle down into the wards, but I can't see
that for a long time." A third-year subject said, "computers
would help with billing patients, if we ever get down to
charging for every tongue depressor being used, as they do in
the United States." Table 6 presents a summary of the three
areas discussed by subjects indicating their knowledge of how
computers may be used in hospital nursing in the future.
Table 6.
Frequency Of Response Indicating Students' Knowledge Of How Computers May Be Used In Hospital Nursing In The Future

<table>
<thead>
<tr>
<th>YEAR</th>
<th>FIRST</th>
<th>SECOND</th>
<th>THIRD</th>
</tr>
</thead>
<tbody>
<tr>
<td>COMPUTER USE</td>
<td>(n = 11)</td>
<td>(n = 11)</td>
<td>(n = 13)</td>
</tr>
<tr>
<td>IN THE FUTURE</td>
<td>f (%)</td>
<td>f (%)</td>
<td>f (%)</td>
</tr>
</tbody>
</table>

NURSING
- documentation: 10 (91) 10 (91) 9 (69)
- reference source: 11 (100) 4 (36) 10 (77)
- physiological monitoring: 3 (27) 5 (45) 3 (23)
- teaching tool: 4 (36) 0 (0) 5 (38)
- nursing care plans: 3 (27) 2 (18) 2 (15)

COMMUNICATION
- hospital departments: 1 (9) 3 (27) 9 (69)
- nurses: 4 (36) 3 (27) 1 (8)
- doctors: 2 (18) 5 (45) 5 (38)
- other hospitals: 0 (0) 1 (9) 1 (8)
- patients: 1 (9) 0 (0) 0 (0)

ADMINISTRATIVE
- finance: 2 (18) 2 (18) 3 (23)
- statistics: 1 (9) 1 (9) 3 (23)
- scheduling: 1 (9) 1 (9) 2 (15)
Several subjects, in all years, speculated as to when they thought computers would be physically placed in hospitals for use by nurses. Two first-year subjects made the following global statements: (a) "In five years, they will be everywhere," and (b) "I think there will be a lot of them." Two second-year subjects were more skeptical with their observations: (a) "I don’t think they are going to move as fast as I have been reading about. They will be in a lot of hospitals but I don’t think they’re going to be in every hospital. People get too excited too soon," and (b) "I can’t really see a great deal more computers coming in for a long time."

Speculation about where computers would be placed in the hospital for use by nurses occurred. Seventy-three percent of the first-year, thirty-six percent of the second-year, and thirty-eight percent of the third-year subjects thought terminals would be situated at the nursing station. Three subjects were specific when speculating about the number of terminals at the desk:

1. Probably one or two maximum per ward as there are two R.N’s working at one time so that they can each use them.
2. I’m trying to think of the nursing station on the floor I’m on with two terminals on either side and a keyboard in front of them and one at the desk with access to whatever you need for your patient.
3. Two computers at each nursing station and one by the drug counter.

Four subjects pointed out that the head nurse would have a terminal in her office. A second-year subject stated,
"I would be really surprised if the head nurse didn’t have one sitting on her desk, so she could scan patients’ files, because she likes an overall picture of the patients on her ward." A third-year subject said, "the head nurse would have one on her desk, but doctors will probably get them before us...you know, they’ll say they need them, that’s typical."

Computers at the bedside were mentioned by three first-year, seven third-year, but no second-year subjects. The subjects who discussed computers at the bedside did so in terms of either its use as a monitoring device, or as a vehicle for data entry and retrieval at the bedside. Several subjects talked in terms of constant physiological monitoring of the patient, while one first-year subject noted that you would take the patient’s vital signs and enter the readings directly into the terminal at the bedside. She went on to speculate that "the ultimate" would be having the thermometer and blood pressure connected to the terminal, so that the readings would just be entered automatically. One third-year subject felt there would be a terminal between two beds and each nurse would have an access code to get into it to chart right there as care is completed. Another third-year subject talked about screens and mini typing pads at every bedside. A particularly enthusiastic third-year subject stated, "I hope they are at the bedside!" Not all subjects were as optimistic or enthusiastic, noting that computers would not be at the bedside for a "lot of years."
Four subjects noted a number of creative ways computers may influence the nurses' job of medication administration in the future. These were not included with the three broad areas of usage, as they were the only comments specific to medication administration, and all comments related to methods considered to be unconventional and quite futuristic in terms of how technology is being used today. Three first-year subjects indicated that possibly robots would be used for medication administration in the future. One subject stated, "Maybe we won't be giving the medications personally, instead robots would be attached to computers giving the medications." A third-year subject thought that patients would be able to press a button on a computerized pharmacy machine and the pills would be there. She noted that she felt most patients were capable of taking their own medications, because they do so at home.

In summary, subjects conceptualized three broad areas of computer use by hospital employed nurses in the future. These areas included direct use by the nurse for nursing and communication, and indirect use for administrative functions. One finding under the broad area of nursing use stands alone. The majority of subjects in all three years envision computer use by nurses for documentation purposes (91% first-year, 91% second-year, 69% third-year). Another interesting finding in the nursing area was that all first-year (100%), and the majority of third-year subjects (77%) noted the use of
computers by nurses as a reference source. Only one finding was particularly noteworthy, in terms of its importance to the subjects, in the area of communication. The majority of third-year subjects (69%) noted the use of computers by the nurse for interdepartmental communication. The administrative use of computers was not of particular interest to subjects with less than 25% in each year noting this application. A very small number of subjects discussed where, and when computers would be placed in the hospital setting. The majority of first-year subjects (73%) discussed computers at the nursing station, while a number of third-years (46%) discussed computers at the bedside.

Categories Of Conceptions Of How Computers May Impact Hospital Employed Nurses

The thirty-five nursing subjects readily discussed their conceptions of how computers may impact hospital employed nurses. Lengthy exhaustive lists that were made of comments, ideas and words generated from the transcripts, early in the analysis process, were eventually reduced to 43 themes (see Appendix H). These themes were further reduced to the following four categories of conception: (a) nursing image, (b) patient care, (c) workload, and (d) professionalism (see Appendix I). Four steps were used to note the findings for each category. Firstly, each category was defined, and
secondly, examples taken from the interview transcripts were used to support the existence of the category. Thirdly, the examples cited in each category were grouped in terms of the sub-categories of whether they enhanced or detracted from the job\role of hospital employed nurses. Lastly, frequency counts and percentages were reported, both in descriptive form throughout the section, and in Tables 7 and 8 at the conclusion of the section. These quantitative findings provide a sense of the number of subjects in each year who commented on each main and sub category.

**Nursing Image.**

Nursing image has received considerable attention in the nursing literature in recent years. Nursing image refers to how others see nurses and how the nurse sees herself. The husband and wife nursing research team of Beatrice and Philip Kalisch, at the University Of Michigan, have written extensively of their research findings on nursing image. They note that nursing is an underrated profession in North America which is portrayed negatively in the media (Kalisch & Kalisch, 1983). In an attempt to dispel this negative media image, the professional association in British Columbia has actively undertaken a national media campaign to portray nursing in a positive way to the public.

Nursing has matured as a profession in recent years.
In response to social and technological changes in nursing practice, and an improved theory base, the issue of specialization has gained momentum (Lane, 1985). However, the traditional image is one of the nurse as a generalist. As the specialization issue is debated by nurses, in their professional associations across the country, the effects technology, and more specifically, computer use, will have on the nurses' traditional generalist image as a caregiver will undoubtly surface. Appendix I gives a breakdown of themes included in this category.

Twenty direct quotations have been drawn from subjects' interviews to illustrate their conceptions of the impact of computers on hospital employed nurses, in terms of the image they portray. For clarity of presentation, these quotations have been organized into the two subcategories: enhancement of, and detraction from, the image of the nurse. Quotations 1-5 were felt to illustrate subjects' conceptions of how the traditional caregiving image of the nurse might be enhanced by use of computers in hospitals. Quotations 6 - 20 were felt to illustrate their conceptions of how computer use might detract from the nurses' traditional caregiving image.

Computers ENHANCE The Caregiving Image

1. Most nurses are nurses because they like the personal care. The computer is only a tool to help her look after people. They will allow her to do her job, and to be a better more efficient nurse.
2. Nursing is such a hands-on thing. That can not change. People will still need to be bathed and have their
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dressings changed. That's what they think about when they think of nurses. Computers will give nurses more time for those things, which is what people want.
3. The public's esteem would go up and nurses would be seen as being modern and updated.
4. Computers will never do basic patient care. They will enable the nurse to spend more time at the bedside. The patient wants the human touch along with the computer.
5. You can't substitute the human element. The nurse's touch is important to the patient but he also wants the accuracy provided by modern technology.

Computers DETRACT FROM The Caregiving Image

6. Patients might think that computers are a very impersonal way of doing things.
7. The division of work would change...and so perhaps you would have the world segmented, and somebody would know all about one little small area and somebody would know another, but who would integrate it all and really know the human being as a whole person?
8. I envision two groups of nurses...one doing a lot of the technical things and the other doing the care-giving.
10. Maybe appearing more as a technician or a person who works a computer, instead of a person who is by the bedside as a nurse.
11. Nurses will just be an extension of the computer.
12. All high tech and low touch.
13. Computer job almost...you're dealing with a machine, not a person.
14. Patients will see us as secretaries.
15. Nurses will be more technical.
16. They might depersonalize nursing.
17. Nurses may lose their caring attitude.
18. Now you're not just nurse but, computer terminal operator.
19. Two levels of workers, those who are computer literate and those who are not.
20. Nursing will become machine-oriented.

Although a large majority of second-year subjects (91%) commented on image of the nurse, 50% of those subjects focused their comments on the sub-category of the nurses image, being detracted from or seen as less positive while
only 10% focused their comments on the sub-category of the nurses image being enhanced. The remaining 40% discussed both sub-categories: enhancement, and detraction. Seventy-seven per cent of the third-year subjects made image-related comments and, as with the second-year subjects, more subjects (40%) focused their attention only on how the nurse’s image would be detracted from rather than enhanced (20%). The remaining 40% discussed both sub-categories. A smaller percentage (55%) of first-year subjects commented on image. Of those who commented, 50% discussed only how the nurse’s image would be detracted from, and no subjects discussed only how it would be enhanced. Half (50%) discussed both sub-categories.

Comments from two subjects contrasted the image seemingly portrayed to subjects about the differences between critical care and geriatric nurses:

1. I have this great fear of nursing becoming all high-tech and no-touch. You can see it in the admiration we hold for intensive care nurses who spend most of their time with machinery. We look down on the long-term care nurses who spend most of their time with patients.

2. The basic difference between your geriatric nurse with no equipment and your I.C.U. nurse. The public is in awe of the I.C.U. nurse because of the equipment she is able to handle and control because they feel overwhelmed by it.

Comments from four subjects illustrate their concerns about nurses needing to continue to portray a caring image, where human touch remains important, as the use of computers becomes more widespread in hospitals:
1. The image of the nurse as a caregiver would remain the domain of the nurse because humans need humans.
2. People need human touch.
3. There are some people who are better with machines and there are some people who even though they are good with machines, don’t care to give their life to that kind of work...they prefer to give their life to caring for people.

In summary, the category nursing image was discussed mainly by second (91%), followed by third (77%), and then first-year (55%) subjects. The majority of subjects, from each year, who discussed this category focused their attention on how the traditional caregiving image of hospital employed nurses might be detracted from by increased computer use. Subjects' concerns about the nurses' image being affected, appeared to center around a concern for nurses losing the caring, humanistic qualities which have traditionally been central to the image they've portrayed.

Patient Care.

Nurses working in the hospital setting consistently report that their main area of focus is patient care. The publishers of Nursing magazine's first issue in November, 1971 echoed this when they promised that the magazine would focus on "the true side of nursing..patient care." Fifteen years later, the same magazine published an article entitled, "What's Happened To The Essence Of Nursing: Patient Care? " The author of that article, Olive Burner, focused her
attention on the neglect of the bedside nurse, the silent majority of working nurses. Striving to promote optimum quality of patient care is the stated goal of all health care workers; however, Burner (1986) feels that little attention is given to the intrinsic worth of the nurse who cares for the sick and promotes wellness. She expresses concern that nursing is moving away from the true art and science of providing basic bedside care. With the increased use of computer technology by nurses, others echo these same concerns (Ball & Hannah, 1984; & Romano, 1985). Through the identification of the issues and concerns related to the use of computers by nurses, and by encouraging nurses to openly discuss these issues, attempts are being made to bring the focus of nursing back to its true side...patient care.

The category of patient care refers to functions of the nurses' job or role involved in both direct hands-on patient care, and those that affect her care to the patient in an indirect way. Direct hands-on care include nursing procedures, patient teaching, and communication with patients. Patient care is affected indirectly by such things as communication with other departments and colleagues, the nurses' knowledge base, and attitude toward the job. Appendix I gives a breakdown of themes included in this category.

Thirty direct quotations have been drawn from subjects' interviews to illustrate their conceptions of the impact of
computers on hospital employed nurses, in terms of the delivery of patient patient care. These quotations have been organized into two sub-categories: enhancement of, and detraction from, the delivery of patient care. Quotations 1-18 were felt to illustrate how computer use by the nurse would enhance her delivery of patient care. Quotations 19-30 were felt to illustrate how computer use by the nurse would detract from her delivery of patient care.

Computers ENHANCE The Delivery Of Patient Care

1. Less of the monitoring level of function and more of the interpretation and analysis of data.
2. Up-to-date information would be readily available.
3. Readable print will mean less deciphering errors and time saved. It is annoying to try and decipher doctors' orders.
4. Computers would keep your knowledge about the patient current.
5. It would facilitate communication between doctors and nurses, because now it seems that doctors are just running in and out and you are supposed to catch them whenever you can. It is hit and miss.
6. It could alert nurses to certain things (elevated blood work).
7. The computer could facilitate the development of nursing care plans from standard care plans.
8. It would be like having a teacher on the ward all the time. You could go to it and ask questions.
9. Patient's would be confident that they could get information to the doctor. Now they have to tell the nurse and if she forgets, it's a problem. She could just punch it into the computer.
10. The computer could analyze information that it has and give several possible nursing diagnoses and then the nurse could go to the patient and then come back and compare it with what the computer is telling them. It would force the nurse to go to the patient.
11. Information would be readily accessible and available (about new drugs and things the nurse needs to know to care for the patient).
12. It would be a source of back-up information (alerting the nurse to administer medications if she forgets).
13. Patients would feel safer and more relaxed with monitoring devices rather than worrying if the nurse is going to pop in.

14. The nurse would have an overall picture of the patient and what their status is.

15. There would be more community health ties, which could lead to earlier discharges.

16. I think there would be more time with the patient for bedside nursing and less time writing all of the things in the charts.

17. The patient would be more informed if you used it for spur-of-the-moment teaching.

18. They would catch little errors. If you were charting the medications you gave and you forgot to chart one, it would say..hold it there. You missed that medication.

Computers DETRACT FROM The Delivery Of Patient Care

19. The biggest problem I see is accuracy or putting in the correct data. That’s a mind set. You are either like that or you are not.

20. All that might be required of the nurse might be the nursing procedures themselves, not the interaction anymore with the patient.

21. Nurses would be interacting with the computer, not their colleagues, about their patients.

22. As long as the patients don’t become numbered, you still have that quality of care. I’m afraid we won’t know them as people, but rather just as files.

23. The nurse might have the tendency not to come in and check on them so many times a shift.

24. We might be tempted to see what the computer says, instead of relying on your own judgment (for patient assessment).

25. Time away from the bedside. I can just see the extra time saved being spent sitting around gabbing and being at the nurses station.

26. We might be communicating more with the computer than the patient.

27. A barrier might be set up between the nurse and the patient, with the patient feeling anxious about the machinery.

28. Maybe your assessment skills would get rusty, because you are depending on the computer more than you are depending on yourself to assess.

29. For most people who resist change they will be an extra headache, and the problem you will start to run into will be in regard to quality of care.

30. Too much stereotyping, in the sense that you have a patient come in with C.O.P.D. (chronic obstructive pulmonary disease), and they would have a care plan for
the C.O.P.D. patient and it will be generalized and not specific to the individual.

Over 90% of the subjects in each year (100% first, 91% second, and 92% third-year) made comments under the patient care category. The majority of first (64%), second (80%), and third (67%) year subjects who commented on this category made comments in relation to computer use both enhancing, and detracting from the delivery of patient care. Eighteen percent of the first-year subjects commented only on computer use enhancing patient care, and also eighteen percent commented only on computer use detracting from patient care. Twenty per cent of the second-year subjects commented only on the sub-category, enhancement of patient care, and none of the second-year subjects mentioned only detraction from patient care. Twenty-five per cent of the third-year subjects commented only on computer use enhancing patient care, while eight percent mentioned only how it’s use would detract from patient care.

Several subjects in each year speculated as to whether the nurse would use the time that might be freed up from paperwork to focus on patient care. Comments included:

1. You could be freed up to spend more time at the bedside, but whether or not they did that is something else.
2. It depends on the individual whether they use that time with the patient.
3. It all comes back to the nurse’s personality (how she spends her time).
4. Quality time with the patient is up to the individual nurse.
5. Some nurses will make the adjustments and some won’t.
6. It will free up the nurse to go to the bedside, but
whether or not the nurse will go to the bedside is another matter.
7. I'm thinking I will go to the patient. That's my personality.
8. It is an individual thing. You can't guarantee it (how time is spent) for everybody.
9. I would hope that nurses would use the time not sitting around the desk gossiping, but to sit and talk to patients.

In summary, the category of patient care was discussed by all first-year (100%), and nearly all second (91%), and third (92%) year, subjects. It appears that the majority of subjects in all years can readily identify how patient care would be enhanced with the use of computers by hospital employed nurses (82% first-year, 100% second-year, 92% third-year). There is a definite concern among subjects in all three years in terms of maintaining quality of patient care with the increased use of computers. There seemed to be a consensus among the subjects that attitude and personality affect how the individual nurse would choose to spend the extra time that might be freed up by increased computerization.

**Workload.**

Workload is a universal issue in any job, and nursing is no exception. In the current economic milieu of British Columbia, articles on nursing shortages are frequently featured in the media. The Registered Nurses Association of British Columbia (R.N.A.B.C.) surveys 167 facilities monthly
to obtain data on nursing vacancies in the province. Although the number of vacancies fluctuate from month to month, the data gives a clear sense of trends. In May, 1988, there were 474 vacancies. Of those, 175 were in general duty nursing, 108 in critical care, 85 in other specialties, 75 in long term-care related positions, and 31 in administration and other.

This issue of nursing shortage is uppermost in the minds of most nurses and student nurses, and is discussed in Nursing Perspectives courses throughout the Cariboo College nursing program. Nursing shortages are caused by variables such as: not enough graduates to fill nursing vacancies, and loss of practising nurses due to burnout, lack of recognition and reward for bedside nursing, and low salary scales.

Workload refers to the amount of work performed or expected to be performed by an employee. It seems reasonable to expect that the current nursing shortage would affect the workload of practising nurses. In addition, the nature of a nurse's work and the actual workload is changing. "Today's nurse is working longer and very differently than she did even five years ago" (Banning, 1987, p.3). Appendix I lists the themes included in this category.

Thirty direct quotations have been drawn from subjects' interviews, to illustrate their conceptions of the impact of computers on the workload of hospital employed nurses. Quotations 1-8 were felt to illustrate their conceptions of
how computer use by nurses would enhance, (i.e., have a positive effect on) their workload. Quotations 9-30 were felt to illustrate subjects' conceptions of how computer use by nurses would detract from (i.e., have a negative effect on) their workload.

Computers ENHANCE Workload (Positive Effect)

1. It cuts down on a lot of recording time.
2. It will save time as far as looking through masses of books.
3. Computers could be a time management tool, cutting out a lot of unnecessary running around.
4. There would be an increase of staff at the outset to input data but it won't be R.N.'s.
5. They will not replace nurses. They didn't replace teachers.
6. It could shorten the paperwork that the nurse has to do.
7. Computers are a tool to help you do your job more efficiently or to save time.
8. In a twelve hour shift, how many times do you have to wait for a chart? How many times do you have to wait for a phone order or to get results phoned from the lab. If you add all of that time up, it is really phenomenal. A computer will save a lot of time.

Computers DETRACT FROM Workload (Negative Effect)

9. It is fairly important that nurses who are going to use the system have input into the system. Nurses know the nursing role and must work with the programmer, or it increases nursing workload, not decreases it.
10. You'd definitely need more than one terminal. If we have to wait around to use it, it won't help us.
11. You spend the money and bring in a computerized system, therefore you don't need staff (less staff might increase workload).
12. Downtime. Things do go wrong with computers. It adds to the nurses' work.
13. It isn't cheap but it's cheaper than paying staff (less staff would be employed and the workload would increase).
14. Are they going to have the money to replace the equipment? Old, faulty equipment means more hassle for the nurse.
15. If you are keying in data with the expectation that
you’re going to get information back in some manner that you can use, then if it doesn’t come back in that way, you tend to get frustrated and not use the system.

16. The cost would be astronomical to have enough terminals available to be actually effective. Unless there are enough, the work will increase.

17. It will probably take me ten minutes to chart now and one half an hour on a computer, until I get used to it.

18. Power failure...I know people who have lost stuff they are working on because somebody has pulled out the plug.

19. I can see a lot of things falling on the shoulders of the nurse.

20. They will occupy a lot of time at the beginning for the nurses learning how to use them and getting user friendly.

21. You’d have to learn how to type.

22. If things were more computerized, there would be less need for nurses, because the nurse could then do things quicker and maybe they would cut back on staff and instead of being able to spend more time, you wouldn’t have more time. They’re going to say, you used to be able to do it before with this many nurses and now you can do it with less because there is less to do.

23. The nurse using a lot of computers might be expected to look after more patients.

24. If you are going to have to sit there and wait your turn to chart, they will not decrease the nurses’ workload.

25. You almost wonder if you are getting to the point where you spread a nurse too thin. Everyone will be feeling overworked and can’t work to their full potential. People leave the field or it gets to the point where even the really dedicated ones lose interest or just get that negative attitude.

26. Work will get heavier if the nurse is responsible for putting in the data because we’ll have more clerical duties than we have now.

27. With computers comes the idea that everything should be more streamlined and therefore you’ll probably be required to maybe even do more charting than we do. They will say.."you have a computer, you should be faster!"

28. The perception will be that your workload has decreased but it will have increased.

29. It will be a little more stressful, because it’s just one more thing that you have to do.

30. Roles will be cut and taken over by computers. The more of a good thing you get the more you expect and the more the government expects and the more everybody expects. The demands will be great on the nurse; just political you know. Instead of being at the bedside, you will have to keep up with the latest systems.
The category of workload was discussed by all subjects enrolled in all years of the program. The majority of subjects in each year commented on both the positive, and negative effects of computer use on the workload of hospital employed nurses (91% first-year, 55% second-year, and 92% third-year). Nine percent of subjects in both first and second-year, and none in third-year, commented only on the computer enhancing the nurses' workload. None of the subjects in first-year, and only a small number in second-year (36%) and third-year (8%), commented only on how computer use by the nurse may have negative effects on her workload. A large majority of subjects in all three years cited the fact that if nurses have to learn to use computers in the workplace, it may increase their workload.

In summary, workload was the one category discussed by 100% of subjects in all three years. While all first-year subjects commented on how computer use may enhance the nurses' workload, all third-year, and a number of second-year subjects, discussed detriments to the nurse, in terms of increasing workload. Subjects appeared to feel that initially the nurse will have her workload increased by learning to use computers but that once she becomes proficient, workload may be decreased, unless management decides to cut staff or increase patient care assignments.
The debate over whether or not nursing is a profession has prevailed in nursing circles for years. For the purpose of this study, it is assumed that nursing is a profession, and, as such, has a specific body of knowledge, adheres to a formal code of ethics and is governed by a professional association. In addition, Standards of Nursing Practice were approved by The Canadian Nurses Association (C.N.A.) in July, 1979, and by The Registered Nurses Association Of British Columbia (R.N.A.B.C.) in September, 1984. The assumption is then made that the nurse is a professional, governed by all rules and regulations of the profession. Appendix I outlines the themes included in this category.

Twenty-four direct quotations have been drawn from subjects' interviews to illustrate their conceptions of the possible impact of computers on hospital employed nurses, in terms of their professionalism. Quotations 1-12 were felt to illustrate subjects' conceptions of how the use of computers might enhance the nurses' professionalism. Quotations 13-24 were felt to relate to their conceptions of how the use of computers by hospital employed nurses, might detract from their professionalism.

Computers ENHANCE Professionalism

1. It may be easier to detect nurses who don't perform their tasks properly.
2. Ethical dilemmas will be easier to solve through computers because there is that barrier that separates people.
3. Accountability may change.
4. I guess they can build safeguards into computers to maintain the individual's right to privacy.
5. There is going to be more emphasis placed on nursing decisions; not necessarily nursing diagnosis.
6. I'm really not too concerned about the legal aspects of it because I'm sure that somebody will work that out because it is a very high concern for a majority of people.
7. It would decrease the potential for drug abuse to some degree, because of inventory control.
8. I think that to some degree you'd see more accountability with regards to time management, wastage of supplies.
9. Messages would be documented. I'm just concerned about having everything documented, in case it is your word against the pharmacist.
10. Information in the computer would be accepted practice within the institution.
11. It would be nice to have some legal and ethical scenarios written on the computer that a nurse could access, for review, when faced with a situation.
12. You could use it to cut down on legal problems because you are able to streamline what you are supposed to be saying because everybody would be speaking the same language.

Computers DETRACT FROM Professionalism

13. I don't understand how you are going to avoid going back to edit your patient care notes that are two days old.
14. Right now you rely on the doctor's written orders to protect you in every way. What happens if the system becomes infiltrated by human viruses and the orders are lost?
15. The patient's privacy might be invaded.
16. There might be less responsibility in some ways as far as patient care goes, you can always say it was the computer's fault.
17. Computers do make errors. They're not perfect and if something goes wrong, who do you blame?
18. When doctors hand write orders, if there is an error, then that's their error. If it's on the computer, then you say it's the computer's fault.
19. It won't stand up as well as a chart that was hand written in court because you can alter a computer file, whereas you really can't alter a chart.
20. Big Brother watching over you!
21. People entering into the computer system that have no
right.
22. Computers can keep track of each individual nurse and how he/she spend their day. You will no longer have the nurse who is able to sit down and have a long chat and not feel guilty that she is charging the patient X number of dollars a minute that you are sitting there.
23. I'd be really concerned about being able to convey exactly what I want to say on the narrative chart in the computer, that it remains as concise, and that it says what I want it to say.
24. Keeping track of nurses by the employer. It is going to be like a big club held over your head.

A smaller number of subjects in each year commented on computers as they relate to the nurse as a professional (64% first and second-year, 62% third-year). Most of the subjects who commented, did so mainly in relation to only the detractions placed on the nurse as a professional (86% first-year, 71% second-year, 44% third-year) by the use of computers in her job\role. No first-year, twenty-nine percent of second-year, and eleven percent of third-year, subjects, who discussed this category, commented on how the professionalism of the nurse might be enhanced through the use of computers. Fourteen per cent of first-year, no second-year, and forty-four percent of third-year subjects, discussed the category in terms of how professionalism might be both enhanced, and detracted from through computer use.

In summary, the category of professionalism was commented on by slightly more than half of the subjects in all three years. The overall focus by subjects commenting on this category, was in relation to legal and ethical issues, as well as professional responsibility and accountability.
Two male subjects discussed nursing accountability with the computer being used as "big brother."

Table 7 below indicates the ranking of categories as determined by the percentage of subjects in each year who commented on each category. Number "1" indicates the highest rank and number "4" the lowest. Workload was the major category, and patient care the second category discussed by subjects enrolled in all three years. Image and professionalism alternated between third and fourth place for both first, and third-year subjects. Note that second-year subjects commented equally on patient care and image, and that each was ranked as number "2," thereby eliminating the number "3" ranking.

Table 7.
Ranking Of Categories By Percentage Of Subjects In Each Year Who Discussed The Category

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>FIRST (n = 11)</th>
<th>SECOND (n = 11)</th>
<th>THIRD (n = 13)</th>
</tr>
</thead>
<tbody>
<tr>
<td>WORKLOAD</td>
<td>1 (100%)</td>
<td>1 (100%)</td>
<td>1 (100%)</td>
</tr>
<tr>
<td>PATIENT CARE</td>
<td>2 (100%)</td>
<td>2 (91%)</td>
<td>2 (91%)</td>
</tr>
<tr>
<td>IMAGE</td>
<td>4 (55%)</td>
<td>2 (91%)</td>
<td>3 (77%)</td>
</tr>
<tr>
<td>PROFESSIONALISM</td>
<td>3 (64%)</td>
<td>4 (64%)</td>
<td>4 (62%)</td>
</tr>
</tbody>
</table>
Table 8 provides an overall quantitative summary of the findings discussed in this section on subjects' categories of conception. It allows one to see at a glance the percentages of subjects enrolled in each year who discussed each category and sub-category.

Table 8.
Percentage Of Subjects Who Discussed Each Category And Sub-Category Of Conception

<table>
<thead>
<tr>
<th>CATEGORY AND SUB-CATEGORY</th>
<th>FIRST ((n = 11))</th>
<th>SECOND ((n = 11))</th>
<th>THIRD ((n = 13))</th>
</tr>
</thead>
<tbody>
<tr>
<td>WORKLOAD (TOTAL)</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>enhance</td>
<td>9</td>
<td>9</td>
<td>0</td>
</tr>
<tr>
<td>detract</td>
<td>0</td>
<td>36</td>
<td>8</td>
</tr>
<tr>
<td>both</td>
<td>91</td>
<td>55</td>
<td>92</td>
</tr>
<tr>
<td>PATIENT CARE (TOTAL)</td>
<td>100</td>
<td>91</td>
<td>92</td>
</tr>
<tr>
<td>enhance</td>
<td>18</td>
<td>20</td>
<td>25</td>
</tr>
<tr>
<td>detract</td>
<td>18</td>
<td>0</td>
<td>8</td>
</tr>
<tr>
<td>both</td>
<td>64</td>
<td>80</td>
<td>67</td>
</tr>
<tr>
<td>IMAGE (TOTAL)</td>
<td>55</td>
<td>91</td>
<td>77</td>
</tr>
<tr>
<td>enhance</td>
<td>0</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>detract</td>
<td>50</td>
<td>50</td>
<td>40</td>
</tr>
<tr>
<td>both</td>
<td>50</td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td>PROFESSIONALISM (TOTAL)</td>
<td>64</td>
<td>64</td>
<td>62</td>
</tr>
<tr>
<td>enhance</td>
<td>0</td>
<td>29</td>
<td>11</td>
</tr>
<tr>
<td>detract</td>
<td>86</td>
<td>71</td>
<td>44</td>
</tr>
<tr>
<td>both</td>
<td>14</td>
<td>0</td>
<td>44</td>
</tr>
</tbody>
</table>
The first specific research question was: Is there a difference in complexity between first, second, and third year nursing students' conceptions of the impact of computers on hospital employed nurses? During the analysis process of the study, it became obvious to the researcher that subjects' conceptions differed in terms of their quality or complexity. This is not an original observation, and findings were influenced by the work of Marton et. al. (1984) in Sweden on quality of learning, and Biggs and Collis (1982) in Australia on evaluating the quality of learning through use of the SOLO Taxonomy. Findings will now be presented to answer this question.

All subjects responses were rated as having either a high or low level of complexity based on general criteria outlined in Chapter 3, and specified characteristics presented in Table 5. Three first-year (27%), seven second-year (64%), and nine third-year (69%), subjects were rated as having high level conceptions, while eight first-year (73%), four second-year (36%), and four third-year (31%), subjects were rated as having low level conceptions, in terms of the complexity or quality of their responses. Overall, nineteen (54%) of the subjects were rated high, and sixteen (46%) low. Table 9 gives an indication of how subjects within each year were rated.
Table 9.  
Frequency Of High And Low Level Responses Indicating Complexity Of Conception

<table>
<thead>
<tr>
<th>YEAR</th>
<th>FIRST</th>
<th>SECOND</th>
<th>THIRD</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>COMPLEXITY</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OF CONCEPTION</td>
<td>(n = 11)</td>
<td>(n = 11)</td>
<td>(n = 13)</td>
<td>N = 35</td>
</tr>
<tr>
<td>HIGH</td>
<td>3 (27)</td>
<td>7 (64)</td>
<td>9 (69)</td>
<td>19 (54)</td>
</tr>
<tr>
<td>LOW</td>
<td>8 (73)</td>
<td>4 (36)</td>
<td>4 (31)</td>
<td>16 (46)</td>
</tr>
<tr>
<td>TOTAL</td>
<td>11 (100)</td>
<td>11 (100)</td>
<td>13 (100)</td>
<td>35 (100)</td>
</tr>
</tbody>
</table>

The number of categories of conceptions discussed by subjects in each year was also tabulated, and are presented on the following page in Table 10. It appears that the majority of second (55%) and third-year (54%) subjects, discussed four categories while most (45%) of the first-year subjects discussed three. The distribution for the total sample of thirty-five subjects was: 14% discussed two categories, 37% discussed three, and 49% discussed four categories.
Table 10.
Frequency Of Response Indicating The Number Of Categories Of Conception Discussed

<table>
<thead>
<tr>
<th>YEAR</th>
<th>NUMBER OF CATEGORIES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>FIRST (n = 11)</td>
</tr>
<tr>
<td>2</td>
<td>2 (18)</td>
</tr>
<tr>
<td>3</td>
<td>5 (45)</td>
</tr>
<tr>
<td>4</td>
<td>4 (36)</td>
</tr>
<tr>
<td>TOTAL</td>
<td>11 (99)</td>
</tr>
</tbody>
</table>

Firstly, findings were examined to see if there was any relationship between the number of categories discussed by subjects (see Tables 9 and 10), and the complexity of their conceptions. Three points are relevant in making comparisons between subjects' complexity of conception, and the number of categories they discussed: (a) the number of categories cannot be taken on its own as a measure of complexity of conception, (b) not all subjects rated as having high levels of conception discussed four categories, and (c) some subjects rated as having low levels of conception discussed four categories.
It was interesting to note that overall, the majority of second (64%), and third (69%) year subjects, had a high level of conception about the impact of computers on hospital employed nurses. The majority of subjects enrolled in those years also discussed four categories (55% second-year, 54% third-year). Of the seven, second-year subjects rated as conceptualizing at a high level, four discussed four categories, and the remaining three, discussed three categories. Seven of the nine, third-year subjects, rated as conceptualizing at a high level, discussed four categories of conception, while the remaining three discussed three. Only one of the three first-year subjects rated as conceptualizing at a high level, discussed four categories, while the other two discussed three.

Secondly, the findings of subjects' level of complexity of conceptions (see Table 9), and their year in the program were examined to determine possible relationships. Using a chi-square directional test for statistical significance, it appears that, subjects' responses indicating their level of conception are directly proportional to their year in the program ($\chi^2 = 4.90, p < .05$). First year subjects conceptualized at a lower level, then second, and third-year subjects. There appears to be a significant difference in the complexity of conceptions of first and third-year subjects ($\chi^2 = 4.21, p < .05$), and first and second-year subjects ($\chi^2 = 2.94, p < .05$). However, there appears to be no
significant difference in the complexity of conceptions of second and third-year subjects ($\chi^2 = .066$, $p > .05$).

To answer the research question then, there does appear to be a difference in complexity between first, second, and third-year students' conceptions of the impact of computers on hospital employed nurses. In addition, all subjects with high levels of conception about the impact of computers on hospital employed nurses, discussed either three or four categories of conception.

**Relationship Of Conception To Clinical Experience**

The second specific research question was: What is the relationship between nursing students' conceptions of the impact of computers on hospital employed nurses, and the length of the students' clinical experience? Clinical experience increases each year students are enrolled in the Cariboo College nursing program (190 hours first-year, 408 hours second-year, 744 hours third-year). As reported in the previous paragraphs, the complexity of students' conceptions of the impact of computers on hospital employed nurses appears to be directly proportional to the students' year in the program. Then, the complexity of students' conceptions about the impact of computers on hospital employed nurses also appears to be directly proportional to the length of the students' clinical experience.
Attitudinal Findings

Another question posed at the outset of this study was: Is there a relationship between nursing students' conceptions of the role of computers in hospital nursing and their attitude toward computers? As noted in Chapter 3, this question was revised as the research unfolded to be: Is there a relationship between nursing students' conceptions of the impact of computers on hospital employed nurses, and students' attitudes toward computers?

Because attitude is believed to be reflected in one's behavior (Stronge & Brodt, 1985), the first finding relates to the subject's expressed desire to purchase a home computer or to take a computer course. The second finding indicates subjects' rating on a five point Likert-type attitude scale. Descriptive comments from the subjects' transcripts are included to support these ratings. The third finding supports a relationship between subjects' conceptions and their attitudes toward computer use in hospital nursing.

Desire To Purchase A Computer Or To Take A Computer Course

Six of the thirty-five subjects (17%) reported a desire to purchase a home computer sometime in the future. Of the six, three were first, one second, and two third-year subjects. The following six quotations were taken directly
from subjects' transcripts:

1. We are looking at purchasing one this summer for September for the school season.
2. I'd like to buy my own.
3. I wouldn't mind having my own.
4. We've talked about buying a computer for our home but right now we can't afford it, but maybe one day.
5. I'm thinking of getting one in the future.
6. There are several that I want to buy but I don't have the money now. Maybe after I graduate.

Only five of the thirty-five subjects (14%) expressed a desire to take a computer course. Of the five, two were first, and three were third-year students. No second-year subjects expressed a desire to take a computer course. The following five quotations were taken directly from subjects' transcripts:

1. I would like to learn more about computers personally, even if I have to take an extra course. I looked into it to take a course this summer, just an introduction, and to use the word-processor and the different packages that you can use.
2. I'm considering that I might take a computer course this summer if I can fit it into work.
3. I've tried to take a computer course, but with school you can't, and in the summertime I work, so I haven't had the opportunity. I really would like to learn how to use one! It is not that I don't want to learn. Some people may just shy away from it if they don't know how, but not me, I would like to learn how to use it.
4. I'd like to take a course and learn more about them.
5. One of my goals, once I get my diploma, is to do a course in computing just to learn how to use it and be eloquent in it.

A very small number of subjects enrolled in all three years of the nursing program expressed a desire to purchase a home computer. No second-year, and only a very small number of first and third-year subjects, expressed a desire to take
a computer course. Of those who did comment, time and money appear to be barriers preventing achievement of their stated desire.

Rating On An Attitude Scale

All subjects when, asked to rate their attitude toward computers in hospital nursing, on a five point Likert-type scale, did so without hesitation. A score of "1" was considered to be negative, "2" moderately negative, "3" neutral, "4" moderately positive, and "5" positive.

A score of "1" (negative) was not chosen by a subject enrolled in any year of the program. One second-year subject gave two ratings and qualified her answer with the following statement, "If you look at efficiency it would be "4.5," but if you look at the threat of decreased interaction with the patient, it would be about "1.5." As long as it is kept realistic, I think it will be very good." Because of the very positive comments throughout the interview, this subject was rated a "3."

Only six of the thirty-five subjects (17%) rated their attitude as "2" (moderately negative). Three of those subjects were in first-year, three in second-year, and none were in third year. All were female.

The first-year subjects who rated their attitude as "2" made these comments:
1. I'm not very positive. I think they'll be more accurate and up to date but I think a lot more mistakes are going to be made.

2. I don't like it! I have not had a positive experience with a computer up to this point. If they were introduced into the hospital at first I would be a little resentful until I got used to it and more experienced. Then it would depend on what kind of teaching I had. I don't really like strict teaching where you are penalized for every mistake. I'd have to be forced to use it until I got interested. I'm just not interested in computers at all.

3. I just think that as far as the hospital goes, the big thing is the hands-on care. You can never replace the human touch with anything, and I can see from my little experience how much a good nurse affects the well being of the patient. It would take a lot away from the nurses.

One second-year subject became visibly agitated as she looked at the computer on the researcher's desk during the interview. She said, "I look over there at your computer now and I think, oh God! It looks so typical. It's just looking at you. I'm trying to describe it but it's hard. It looks futuristic. I can't explain it. You want to take a step back instead of a step forward up to computers." When asked what would trigger her to take a step forward toward computers she commented, "Knowing it would help me. Knowing that red lights flashed all over it and I would know what to do. I'm negative because of my past experiences with computers, lack of use of computers, and I can't see any need for it at the moment."

Another second-year subject, who chose "2" on the attitude scale, made these comments: "If I wanted to get into computers, I would have taken "Computers." The people
who go into nursing usually like people and want to talk to people. I don’t think I enjoy the technical things. I don’t mean to sound negative, but personally, I just don’t want to feel that I have to learn them. I don’t like them. I’d rather put my extra energy learning about a prototype before I learned about the computer. But, after years of clinical work, I might want to because I might want the stimulation."

The third second-year subject who was negative noted: "I guess I’m negative about computers but, just at home on the one we have, half the time the thing doesn’t work and I just have that fear that it will be the same thing with computers and nursing. I just don’t trust them."

Eleven of the subjects (31%) rated their attitude as "3" (neutral, wait and see). The majority of subjects in this category, were in third-year (54%). Comments made by these subjects included:

1. I really don’t know yet. I’ll have to get in and work with them myself. I guess I’m a wait and see.
2. I’m not totally against having computers. I guess I will eventually feel comfortable working with computers if I am exposed to them for a long enough period.
3. I’m in favour of them being there, but I’m not knowledgeable enough to really know what’s going on to know what are going to be the problems with them yet.
4. Computers do have a place, it’s just the anxiety towards them.

Thirteen of the subjects (37%) rated their attitude as "4" (moderately positive). Frequencies of those rating themselves at "4" were distributed almost evenly amongst the three years, with four in both first and second-year, and
five in third-year. Comments taken directly from the transcripts of these subjects included:

1. On the whole I'm positive. Let's use it where it has demonstrated that it is definitely of value, and let's not try to force it into areas where it hasn't been demonstrated that it is good.
2. I think they will be more beneficial than they will be negative.
3. I think computers will be positive and they will come.
4. I think they are coming and there is no getting away from them. I feel I've come a long way since my first experience.
5. I don't think we have much choice in the matter. They are going to come and I think that if you can just realize that and not fight it, you'll be ahead of the game because you can at least go into it with an attitude... okay this is going to be part of my job and I'll have to learn it, so I might as well learn it as best I can.
6. I think that if I took time and I had time to learn, I would like it.
7. I would really like to see them come into our hospital.
8. I would be positive if they were to come into the clinical setting.

Five students said their attitude was "5" (positive).

Table 11 provides a summary of the frequencies and percentages of response on a five point Likert-type attitude scale for subjects in each year.
Table 11.
Frequency Of Response Of Rating On A Five Point Likert-Type Attitude Scale

<table>
<thead>
<tr>
<th>YEAR</th>
<th>FIRST (n = 11)</th>
<th>SECOND (n = 11)</th>
<th>THIRD (n = 13)</th>
<th>TOTAL N = 35</th>
</tr>
</thead>
<tbody>
<tr>
<td>RATING*</td>
<td>f (%)</td>
<td>f (%)</td>
<td>f (%)</td>
<td>f (%)</td>
</tr>
<tr>
<td>1</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>2</td>
<td>3 (27)</td>
<td>3 (27)</td>
<td>0 (0)</td>
<td>6 (17)</td>
</tr>
<tr>
<td>3</td>
<td>1 (9)</td>
<td>3 (27)</td>
<td>7 (54)</td>
<td>11 (31)</td>
</tr>
<tr>
<td>4</td>
<td>4 (36)</td>
<td>4 (36)</td>
<td>5 (38)</td>
<td>13 (37)</td>
</tr>
<tr>
<td>5</td>
<td>3 (27)</td>
<td>1 (9)</td>
<td>1 (8)</td>
<td>5 (9)</td>
</tr>
</tbody>
</table>

*1 = negative, 2 = moderately negative, 3 = neutral, 4 = moderately positive, 5 = positive

The overall attitude of subjects was positive toward computers in hospital nursing, with eighteen (51)% of the subjects saying their attitude was positive ("4" or "5"). Eleven (31%) were neutral ("3"), and only six of the thirty-five subjects (17%) were considered to be negative ("1" or "2"). One of the male subjects rated his attitude as "3", and the other four were all positive. Table 12 provides a summary of subjects' attitudes (negative, neutral, positive) toward computer use in hospitals.
Table 12.
Frequency Of Response Of Subjects' Attitudes Toward Computer Use In Hospitals

<table>
<thead>
<tr>
<th>YEAR</th>
<th>FIRST (n = 11)</th>
<th>SECOND (n = 11)</th>
<th>THIRD (n = 13)</th>
<th>TOTAL N = 35</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATTITUDE RATING*</td>
<td>f (%)</td>
<td>f (%)</td>
<td>f (%)</td>
<td>f (%)</td>
</tr>
<tr>
<td>NEGATIVE</td>
<td>3 (27)</td>
<td>3 (27)</td>
<td>0 (0)</td>
<td>6 (17)</td>
</tr>
<tr>
<td>NEUTRAL</td>
<td>1 (9)</td>
<td>3 (27)</td>
<td>7 (54)</td>
<td>11 (31)</td>
</tr>
<tr>
<td>POSITIVE</td>
<td>7 (64)</td>
<td>5 (45)</td>
<td>6 (46)</td>
<td>18 (51)</td>
</tr>
</tbody>
</table>

* Ratings on a five-point Likert-type attitude scale were combined to provide the findings (negative = "1" and "2", neutral = "3", positive = "3" and "4").

Relationship Between Conception And Attitude

A third question posed at the outset of the study was revised to be: What is the relationship between nursing students' conceptions of the impact of computers on hospital employed nurses, and student's attitudes toward computers? In order to assess the relationship between conception and attitude, it was initially decided to focus on subjects who were rated as negative, because the majority of subjects in the study were positive about computers coming into the
hospital setting, and also positive about the nurse becoming more involved with them. Measures of attitude were the subject's rating on the attitudinal scale. Measures of conceptions were: (1) rating of the level of complexity of conceptions, and (2) the number of categories of conception discussed by each subject. These ratings have been reported earlier in this chapter (Tables 9, 10, 11 and 12).

Firstly, findings on the number of categories of conceptions discussed by the six (three first, and three second-year) subjects with negative attitudes, were examined to determine possible relationships. It appears that one of the subjects had discussed two categories, three had discussed three, and two had discussed four. There does not appear to be an obvious relationship between the number of categories discussed and attitude.

Secondly, findings on individual subjects' complexity of conceptions and attitudes were examined to determine relationships. It appears that all six subjects with negative attitudes toward computer use in hospitals, conceptualize the use of computers at a low level. On the other hand, of the eight subjects in first-year considered to have low level conceptions, three had negative attitudes, and five had positive attitudes. Of the four subjects in second-year with a low level of conception, three had negative attitudes, and one had a positive attitude. All four of the third-year subjects with low level conceptions had positive
attitudes.

In examining subjects rated as having a high level of conception, it appears that all (three first-year, seven second-year, nine third-year) these subjects, also have positive attitudes toward computer use in hospitals.

There appears to be a significant relationship between conception and attitude \( (\chi^2 = 7.25, p < .01) \). All subjects with a high level of conception have positive attitudes. Subjects with a low level of conception are divided in terms of having a positive or negative attitude. However, all six subjects who were identified in the study as having a negative attitude, have a low level of conception. Table 13 summarizes levels of conception and attitude toward computers.
Table 13.
Frequency of Response Relating Level Of Conception And Attitude

<table>
<thead>
<tr>
<th>CONCEPTION AND ATTITUDE</th>
<th>FIRST (n = 11)</th>
<th>SECOND (n = 11)</th>
<th>THIRD (n = 13)</th>
<th>TOTAL N = 35</th>
</tr>
</thead>
<tbody>
<tr>
<td>HIGH CONCEPTION:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>POSITIVE ATTITUDE</td>
<td>3</td>
<td>7</td>
<td>9</td>
<td>19</td>
</tr>
<tr>
<td>NEGATIVE ATTITUDE</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>LOW CONCEPTION:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>POSITIVE ATTITUDE</td>
<td>5</td>
<td>1</td>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td>NEGATIVE ATTITUDE</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>TOTAL</td>
<td>11</td>
<td>11</td>
<td>13</td>
<td>35</td>
</tr>
</tbody>
</table>

Secondary Findings

Secondary findings were generated through analysis of the questions on the respondent profile section of the interview schedule. Two types of questions were used: (a) forced-response, requiring subjects to select a response from two or more alternatives; and (b) open-ended, allowing subjects to construct the responses. Because the questions on the profile were designed to obtain an understanding of
the background of the subjects, they sought information on a variety of seemingly unrelated facts. Consequently, this secondary findings section, appears at times to be a disjointed collection of unrelated facts. The relationship of secondary findings to primary findings will be addressed in Chapter 5. In order to present the secondary findings in a succinct fashion, they will be presented under two headings: (a) demographics, (sub-sections A-F), and (b) computer access and usage, (sub-sections A-C).

Demographics

A. Age

At the time of the interviews (March & April, 1988), the majority of subjects, (60%) were between the ages of eighteen and twenty-four. The next largest age group was between twenty-five and twenty-nine (20%). One second-year subject was between ages forty and forty-nine, and one first-year was between ages fifty and fifty-nine. The total "regular" student population who were between the ages of eighteen and twenty-four in March and April, 1988 were distributed as follows: 49% first-year, 57% second-year, and 43% third-year. Table 14 indicates the breakdown of subjects within each year, in terms of age range.
Table 14.
Age Ranges Of Subjects In Each Year Of The Cariboo College Nursing Program

<table>
<thead>
<tr>
<th>AGE RANGE</th>
<th>FIRST (n = 11)</th>
<th>SECOND (n = 11)</th>
<th>THIRD (n = 13)</th>
<th>TOTAL N = 35</th>
</tr>
</thead>
<tbody>
<tr>
<td>18 - 24</td>
<td>5 (45)</td>
<td>8 (73)</td>
<td>8 (62)</td>
<td>21 (60)</td>
</tr>
<tr>
<td>25 - 29</td>
<td>3 (27)</td>
<td>1 (9)</td>
<td>3 (23)</td>
<td>7 (20)</td>
</tr>
<tr>
<td>30 - 39</td>
<td>2 (18)</td>
<td>1 (9)</td>
<td>2 (15)</td>
<td>5 (14)</td>
</tr>
<tr>
<td>40 - 49</td>
<td>0 (0)</td>
<td>1 (9)</td>
<td>0 (0)</td>
<td>1 (3)</td>
</tr>
<tr>
<td>50 - 59</td>
<td>1 (9)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>1 (3)</td>
</tr>
<tr>
<td>TOTAL</td>
<td>11 (99)</td>
<td>11 (100)</td>
<td>13 (100)</td>
<td>35 (100)</td>
</tr>
</tbody>
</table>

In summary, the majority of subjects who participated in the study, in all three years, were between the ages of eighteen and twenty-four. The age group that ranked second for all three years was twenty-five to twenty-nine. The majority of subjects in all three years (80%) ranged in age between eighteen and twenty-nine as did the majority (68%) in the "regular" nursing population. The age range of the sample appears to be representative of the total student population enrolled in each year of the program.
B. Formal Education Prior To Entering The Cariboo College Nursing Program

Twenty-six subjects (74%) have had formal educational experience beyond the high school level prior to entering the Cariboo College nursing program. These educational experiences included: university transfer college courses, non-university transfer college courses, university degrees, non-degree university courses, and other courses, such as correspondence and work related courses.

Only nine subjects (26%) entered nursing directly from high school. Sixteen subjects (46%) had taken university transfer college courses, and three subjects (9%) had university degrees prior to entering the program. While fourteen subjects (40%) with experience beyond high school had one formal educational experience prior to entering the nursing program, eleven (31%) had two experiences. One first-year subject was not typical of the sample, in that she had a large variety of educational experiences from four of the categories. Table 15 indicates a breakdown of the level of formal educational experience of subjects prior to entering the Cariboo College nursing program.
Table 15.
Formal Education Prior To Entering The Cariboo College Nursing Program

<table>
<thead>
<tr>
<th>FORMAL EDUCATION</th>
<th>FIRST</th>
<th>SECOND</th>
<th>THIRD</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(n = 11)</td>
<td>(n = 11)</td>
<td>(n = 13)</td>
<td>N = 35</td>
</tr>
<tr>
<td>HIGH SCHOOL</td>
<td>f (%)</td>
<td>f (%)</td>
<td>f (%)</td>
<td>f (%)</td>
</tr>
<tr>
<td>U.T. COLLEGE</td>
<td>5 (45)</td>
<td>4 (36)</td>
<td>7 (54)</td>
<td>16 (46)</td>
</tr>
<tr>
<td>NON U.T. COLLEGE</td>
<td>2 (18)</td>
<td>2 (18)</td>
<td>5 (38)</td>
<td>9 (26)</td>
</tr>
<tr>
<td>UNIVERSITY DEGREE</td>
<td>2 (18)</td>
<td>1 (9)</td>
<td>0 (0)</td>
<td>3 (9)</td>
</tr>
<tr>
<td>UNIVERSITY NON DEGREE</td>
<td>3 (27)</td>
<td>1 (9)</td>
<td>0 (0)</td>
<td>4 (11)</td>
</tr>
<tr>
<td>OTHER</td>
<td>3 (27)</td>
<td>1 (9)</td>
<td>4 (31)</td>
<td>8 (23)</td>
</tr>
<tr>
<td>**TOTAL *</td>
<td>16</td>
<td>13</td>
<td>20</td>
<td></td>
</tr>
</tbody>
</table>

* The frequency counts reported in these columns do not total the identified n's for each year, as twelve subjects indicated more than one educational experience.

The majority of subjects who participated in this study had educational experience beyond the high school level prior to entering the Cariboo College nursing program. Only one first-year, and four second and third-year subjects entered directly from high school.
Fourteen subjects (40%) had no education specific to computing prior to entering the nursing department. Of the twenty-one who had, nineteen (54%) had only one formal experience, while one first-year subject had two. Another first-year subject had a number of university and college courses, as well as a long history of varied experiences, with computers in the workplace. She was considered to be an EXPERT. Table 16 illustrates the amount of formal computer education subjects have had outside the nursing department.

Table 16.
Amount Of Formal Education Specific To Computers Obtained Outside The Cariboo College Nursing Program

<table>
<thead>
<tr>
<th>YEAR</th>
<th>AMOUNT OF FORMAL COMPUTER</th>
<th>FIRST (n = 11)</th>
<th>SECOND (n = 11)</th>
<th>THIRD (n = 13)</th>
<th>TOTAL N = 35</th>
</tr>
</thead>
<tbody>
<tr>
<td>NONE</td>
<td>f (%)</td>
<td>3 (27)</td>
<td>3 (27)</td>
<td>8 (62)</td>
<td>14 (40)</td>
</tr>
<tr>
<td>ONE EXPERIENCE</td>
<td>f (%)</td>
<td>6 (55)</td>
<td>8 (73)</td>
<td>5 (38)</td>
<td>19 (54)</td>
</tr>
<tr>
<td>TWO EXPERIENCES</td>
<td>f (%)</td>
<td>1 (9)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>1 (3)</td>
</tr>
<tr>
<td>MORE THAN TWO</td>
<td>f (%)</td>
<td>1 (9)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>1 (3)</td>
</tr>
</tbody>
</table>
These educational experiences with computers took place in a variety of types of settings including: university, college, the school system, and the workplace. Only one subject had taken university level computer courses, while two had taken college level courses. Twelve subjects (34%) had taken computing courses while in the school system in either elementary, junior high or high school. Of these twelve, six were second-year subjects, while three were first, and three were third-year. It appeared from discussions with those subjects who had taken computer courses in the school system, that the focus of these courses was on programming. A total of three subjects took computer content incorporated with programs other than nursing, while six took other types of courses, such as correspondence and work-related courses. Table 17 summarizes the frequency and percentage of subjects in each year, who obtained formal education specific to computers, in settings outside the Cariboo College nursing program.
Table 17.

Settings Outside The Cariboo College Nursing Program Where Formal Computer Education Was Obtained

<table>
<thead>
<tr>
<th>YEAR</th>
<th>FIRST</th>
<th>SECOND</th>
<th>THIRD</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>FORMAL COMPUTER</td>
<td>(n = 11)</td>
<td>(n = 11)</td>
<td>(n = 13)</td>
<td>(N = 35)</td>
</tr>
<tr>
<td>EDUCATION</td>
<td>f (%)</td>
<td>f (%)</td>
<td>f (%)</td>
<td>f (%)</td>
</tr>
<tr>
<td>UNIVERSITY COURSE</td>
<td>1 (9)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>1 (3)</td>
</tr>
<tr>
<td>COLLEGE COURSE</td>
<td>2 (18)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>2 (6)</td>
</tr>
<tr>
<td>SCHOOL SYSTEM</td>
<td>3 (27)</td>
<td>6 (55)</td>
<td>3 (23)</td>
<td>12 (34)</td>
</tr>
<tr>
<td>INCORP\COURSE</td>
<td>2 (18)</td>
<td>0 (0)</td>
<td>1 (8)</td>
<td>3 (9)</td>
</tr>
<tr>
<td>CORRESP\WORK</td>
<td>3 (27)</td>
<td>2 (27)</td>
<td>1 (8)</td>
<td>6 (17)</td>
</tr>
<tr>
<td>TOTAL*</td>
<td>11</td>
<td>8</td>
<td>5</td>
<td>24</td>
</tr>
</tbody>
</table>

*Total frequency does not equal n as several subjects had obtained formal education specific to computers in more than one type of setting.

D. Environment For First Hands-On Computer Experience

Subjects reported that their initial experience with a computer (other than with video games) took place in a variety of environments. A large majority of the thirty-five subjects (91%) had their initial experience with a computer
prior to entering the Cariboo College Nursing program. Of that number, eighteen, (56%) described their initial experience positively. Only three subjects had not had a computer hands-on experience prior to the one in the nursing program. These three were all enrolled in third-year.

Table 18 presents a summary of the frequency and percentage of subjects who had their initial experience with computers in nursing or non-nursing environments.

Table 18.
Initial Hands-On Computer Experience In Nursing And Non-Nursing Environments

<table>
<thead>
<tr>
<th>ENVIRONMENT</th>
<th>FREQUENCY</th>
<th>PERCENTAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>NON NURSING</td>
<td></td>
<td></td>
</tr>
<tr>
<td>school/university</td>
<td>17</td>
<td>49</td>
</tr>
<tr>
<td>work</td>
<td>6</td>
<td>17</td>
</tr>
<tr>
<td>home</td>
<td>5</td>
<td>14</td>
</tr>
<tr>
<td>college - non-nursing</td>
<td>4</td>
<td>11</td>
</tr>
<tr>
<td>NURSING</td>
<td></td>
<td></td>
</tr>
<tr>
<td>college - nursing</td>
<td>3</td>
<td>9</td>
</tr>
<tr>
<td>TOTAL</td>
<td>35</td>
<td>100</td>
</tr>
</tbody>
</table>
E. Computer Experience In The Cariboo College Nursing Program

Computer content is incorporated into the Cariboo College nursing curriculum, mainly in the Nursing Perspectives Course, as outlined in Chapter three (Table 4). Several subjects spontaneously voiced opinions on the content presently being taught in the program, even though they were not asked a direct question to elicit specific information. These opinions usually came in the course of subjects describing their initial and subsequent experiences with a computer.

All subjects in each year were exposed to seminars in semester one of first-year. Nine first-year subjects (82%) mentioned the seminars, and six of the nine considered them to be positive. Seven second-year subjects (64%) mentioned the seminars, and four of the seven considered them to be positive. Including the three subjects who had their initial experience with a computer in the first year seminars, only six third-year subjects (46%) mentioned the computer seminars. Of those students, four recalled them as being positive learning experiences. Overall, 62% of all subjects mentioned the first year seminars as a computer experience. Fifty-nine per cent of those mentioning the first year experience found it to be positive.

Twelve third-year subjects (92%) mentioned the Nurse
Star program. Of that number, only four found the experience to be positive. The main reason seemed to be faulty programs, which were a source of student frustration.

F. Views On Computer Content In The Cariboo College Nursing Program

Subjects spontaneously voiced their opinions on computer content in the Cariboo College nursing program. Twenty-two subjects (63%) felt that computer content should be included in the nursing program, either as a separate course, or incorporated into the nursing course. The numbers of subjects (55% first-year, 63% second-year, 69% third-year) wanting more computer content in the nursing program increased with each succeeding year. One male subject thought that a computing course should be a pre-requisite to nursing. One female first-year subject stated that she would force herself to go until she got interested. A third-year subject who has used computers in a job setting, stated, "I definitely would say you really need that training program."

A variety of opinions were expressed when subjects were asked to describe how they like to learn to use a computer. Eleven subjects (31%) expressed the desire to learn on their own in a self-directed fashion. One third-year subject felt that faculty should make sure that everybody does it, by keeping a list. Another subject felt she could be self-
directed once she reached a certain point in terms of proficiency.

Teaching techniques were discussed by several subjects. Thirteen subjects (37%) expressed the desire to have a demonstration as part of the method of teaching. Three subjects expressed a desire for one-to-one instruction. One subject stated emphatically that it should DEFINITELY be one-to-one. That particular subject was very negative towards computers throughout her interview. Another subject indicated she didn't want to be sitting there for half an hour waiting for help and not progressing. "I just don't have that kind of patience," she said.

Thirteen subjects (37%) expressed the desire to have a manual or a booklet. One male subject stated that he liked to learn by reading and by trial and error, but he noted that it is frustrating when the book is incorrect. Twenty-one of those sampled (60%), stated they liked a supervised practise, or having the instructor available to them, while they used the computer. One female subject stated she wanted the instructor to be honest and straight with her. Several subjects stated they preferred a person rather than a book. Another stated she liked to be corrected as she went, as she saw no point in doing something wrong two or three times because it's more difficult to correct an error when you've established a pattern. One subject stated, "I like always having someone there you can ask: What am I doing wrong?"
Sixteen subjects (46%) stated they would like hands-on experience. As one subject noted, "I learn by doing." Nine subjects (26%) stated they liked a step by step approach, from simple to more complex.

Opinions varied as well on the amount of theory and practice needed in programs. Nine subjects (26%) stated they would like theory on computers. One first-year female subject stated that she did not want the technicalities, but rather, she wanted a practical application that she could use right away. A second-year subject stated she believes that you should know the reason why you are hitting a certain key, rather than having whatever happens. While six first and second-year subjects expressed a desire for the practical application, the third year subjects did not mention this. One first-year subject expressed a desire to learn how to edit essays.

Subjects also discussed the rate for learning and the expectations placed on them. Fifteen subjects (43%) stated that they would like to work at their own speed. One second year subject stated that a lot of computer teachers have been using them so long that they don't understand that you don't know how, so they just rush along. Six subjects (17%) expressed the desire for a positive successful experience when learning about computers. One female second year subject stated she did not want to "feel like an idiot." She said: "It's better if I don't touch it at all, rather than
admit that I don't know what I'm doing. I hate being out of control." Several subjects noted the desire to have a course free from grades.

In summary, when asked how they like to learn about computers, subjects expressed a variety of opinions. It appears that the majority of subjects (63%) felt that computer content should be included in the program either as a separate course or incorporated into existing nursing courses, but there did not appear to be consensus among subjects about: (a) preferred teaching techniques, (b) pacing of content, and (c) evaluation of learning.

Computer Access And Usage

A. Computer Access And Usage At Cariboo College

All Cariboo College students have free access to the College VAX main frame system by virtue of their student status. However, 71% of the nursing students sampled do not use the system. Table 19 indicates the breakdown of subjects by year, indicating their use of the Cariboo College Vax system. Of the ten subjects who use it, eight (80%) use it for word processing, and two for mail messages only.
Table 19.
Percentage Of Subjects In Each Year Who Use The Cariboo College VAX System

<table>
<thead>
<tr>
<th>YEAR</th>
<th>FIRST (n = 11)</th>
<th>SECOND (n = 11)</th>
<th>THIRD (n = 13)</th>
<th>TOTAL (N = 35)</th>
</tr>
</thead>
<tbody>
<tr>
<td>VAX USE</td>
<td>f (%)</td>
<td>f (%)</td>
<td>f (%)</td>
<td>f (%)</td>
</tr>
<tr>
<td>YES</td>
<td>3 (27)</td>
<td>2 (18)</td>
<td>5 (38)</td>
<td>10 (29)</td>
</tr>
<tr>
<td>NO</td>
<td>8 (73)</td>
<td>9 (82)</td>
<td>8 (62)</td>
<td>25 (71)</td>
</tr>
</tbody>
</table>

Even though subjects have free access to the Cariboo College Vax system, they identified nine barriers preventing them from using the system. However, one first-year, one second-year and three third-year subjects did not identify any barriers. These subjects all use the system for word processing. Table 20 indicates a summary of the barriers, arranged in descending order of frequency of response, noted by subjects in each year which prevent them from using the Cariboo College VAX system.
Table 20.

Barriers Identified By Subjects To Use Of The Cariboo College VAX System

<table>
<thead>
<tr>
<th>BARRIERS</th>
<th>FIRST (n = 11)</th>
<th>SECOND (n = 11)</th>
<th>THIRD (n = 13)</th>
<th>TOTAL N = 35</th>
</tr>
</thead>
<tbody>
<tr>
<td>TIME\WORKLOAD</td>
<td>5 (45)</td>
<td>5 (45)</td>
<td>7 (54)</td>
<td>17 (49)</td>
</tr>
<tr>
<td>ACCESS\AVAIL</td>
<td>4 (36)</td>
<td>5 (45)</td>
<td>5 (38)</td>
<td>14 (40)</td>
</tr>
<tr>
<td>LACK OF KNOWLEDGE</td>
<td>4 (36)</td>
<td>3 (27)</td>
<td>6 (46)</td>
<td>13 (37)</td>
</tr>
<tr>
<td>NO NEED TO USE</td>
<td>3 (27)</td>
<td>3 (27)</td>
<td>4 (31)</td>
<td>10 (29)</td>
</tr>
<tr>
<td>NEGATIVE ATTITUDE</td>
<td>1 (9)</td>
<td>3 (27)</td>
<td>3 (23)</td>
<td>10 (29)</td>
</tr>
<tr>
<td>PHYSICAL</td>
<td>4 (36)</td>
<td>0 (0)</td>
<td>3 (23)</td>
<td>7 (20)</td>
</tr>
<tr>
<td>FEAR OF UNKNOWN</td>
<td>1 (9)</td>
<td>3 (27)</td>
<td>3 (23)</td>
<td>7 (20)</td>
</tr>
<tr>
<td>NOT MECHANICAL</td>
<td>2 (18)</td>
<td>2 (18)</td>
<td>1 (8)</td>
<td>5 (14)</td>
</tr>
<tr>
<td>TYPING ABILITY</td>
<td>2 (18)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>2 (6)</td>
</tr>
</tbody>
</table>

It is interesting to note that some parallels may be drawn between what subjects identify as barriers to computer use in the college, and what they discussed in terms of their conceptions of the impact of computer use on hospital employed nurses. The major barrier (49%) to use of the Cariboo College VAX computer appears to be time and workload. All subjects (100%) discussed workload as a category of
conception, in terms of the impact computers may have on the workload of hospital employed nurses. Many subjects noted that the workload of the hospital employed nurse would be increased while he/she was learning to use a computer. Accessibility, and availability, which was the barrier ranked second by the subjects, was also discussed by many in terms of possibly increasing the nurse's workload in the hospital. Lack of knowledge was noted as a barrier by 37% of the subjects; thirteen of whom were in third-year. Typing ability was noted as a barrier to use by only two subjects, both of whom were first year, but was not mentioned in the discussion of categories of conception.

A negative attitude toward computers was noted by seven (one first-year, three second-year, three third-year) subjects as a barrier in using the Cariboo College system. Six subjects rated themselves on a five-point Likert-type scale as having a negative attitude toward computer use in hospital nursing (three first-year, three second-year). It appears that, with the exception of the second year subjects, some subjects only have negative attitudes towards the use of a computer in specific settings.
B. Computer Access And Usage At Home

Eighty percent of subjects do not have access to a computer at home. This means 28 subjects either have no computer in their home, or no ready access to that of a friend or relative. Table 21 indicates the subjects in each year with access to a computer at home.

Table 21.
Frequency Of Subjects With Access To A Computer At Home

<table>
<thead>
<tr>
<th>YEAR</th>
<th>FIRST (n = 11)</th>
<th>SECOND (n = 11)</th>
<th>THIRD (n = 13)</th>
<th>TOTAL N = 35</th>
</tr>
</thead>
<tbody>
<tr>
<td>HOME ACCESS</td>
<td>f (%)</td>
<td>f (%)</td>
<td>f (%)</td>
<td>f (%)</td>
</tr>
<tr>
<td>YES</td>
<td>3 (27)</td>
<td>2 (18)</td>
<td>2 (15)</td>
<td>7 (20)</td>
</tr>
<tr>
<td>NO</td>
<td>8 (73)</td>
<td>9 (82)</td>
<td>11 (85)</td>
<td>28 (80)</td>
</tr>
</tbody>
</table>

Of the seven subjects who have access to a computer at home, four (57%) are using them, and three (43%) are not. One of the non-users is a second-year subject who rated herself as having a negative attitude toward computers. The other two non-users stated they were interested in using them, but could not find the time to learn.
C. Family Use - Other Than Video Games

**Spouse Or Significant Other.**

Six of the spouses or significant others of first-year subjects (55%), five of second-year subjects (45%), and three of third-year subjects (23%) use computers. This gives a total of fourteen of the spouses or significant others (40%) of subjects using computers. The number using computers is inversely proportional to subjects' year in the program.

**Children**

Twenty-seven of the subjects (77%) sampled have no children. Of the eight subjects with children, three are in first-year and their children all use computers at school. One second-year subject emphatically stated that she valued a music education for her children over computers.

Access to computers at home is not a reality for most subjects enrolled in the Cariboo College Nursing Program. Even though this group does have free access to the college's main frame VAX system, as students, a number of barriers were noted by the subjects which prevent the majority from using it to any great extent. The main barriers appear to be workload, and accessability and availability. It appears that the spouses and children of subjects are moderate computer users.
Summary Of Primary And Secondary Findings

Findings were reported as being either primary or secondary. Primary findings indicate that the typical subject's awareness of computer use in hospitals today is minimal, and primarily focused on his/her experiences in the local clinical agency (R.I.H.). The majority of subjects were not aware of happenings provincially and nationally in Canada, but several seemed to feel that hospitals in the United States were more advanced in terms of technology. Subjects' knowledge of how computers will be used by hospital employed nurses in the future centered around three broad areas of usage: (a) nursing, (b) communication and (c) administration. The majority of subjects in all three years noted the use of computers for documentation purposes.

Subjects' conceptions of how computers will impact on hospital employed nurses fell into four categories: (a) nursing image, (b) patient care, (c) workload, and (d) professionalism. Subjects' comments, within each of these four categories, were further classified into three sub-categories indicating whether subjects felt that the increased use of computers would: (a) enhance, (b) detract from or (c) both enhance and detract from the category. The relationship of sub-categories to categories is represented in Figure 2.
All subjects commented on either two, three, or four categories of conception but overall, the majority of second and third-year subjects discussed all four categories. Subject's conceptions differed in complexity or quality, in direct proportion to the year in which they were enrolled in the program.

A very small number of subjects spontaneously expressed a desire to purchase a computer, or to take a computer course. The overall attitude of subjects toward computers in hospital nursing was positive. All six of the subjects who were rated as having negative attitudes were female. Three were in first-year and three were in second-year. In addition, there appears to be a relationship between a subject's complexity of conception, and his/her attitude. All six subjects with negative attitudes had a low level of conception, and all subjects with a high level of conception
had positive attitudes.

Secondary findings indicate that the majority of subjects were between the ages of eighteen and twenty-four, and had education beyond the high school level. Prior to entering the Cariboo College nursing program, the majority of subjects had a hands-on computer experience (excluding video games). However, 40% had no formal computing education. A number of subjects expressed views, both positive and negative, about the experience they had with computers in their nursing program, with some even making suggestions for change. While access to computers at home is not a reality for most subjects (80%), all subjects, as students have free access to the Cariboo College VAX computer system, but few are using this system (21%). A number of barriers were cited for this lack of use; workload (49%), accessibility and availability of terminals (40%), and lack of knowledge (37%) appear to be paramount.
Discussion Of Findings

This study set out to answer one broad, and three specific research questions. As anticipated at the outset, due to the phenomenologic nature of the study, the questions were refined during the data collection and analysis phase to read:

1. How do nursing students in a community college nursing program conceptualize the impact of computers on hospital employed nurses?

   (a) Is there a difference in complexity between first, second, and third-year nursing students' conceptions of the impact of computers on hospital employed nurses?

   (b) What is the relationship between nursing students' conceptions of the impact of computers on hospital employed nurses, and the length of students' clinical experience?
(c) Is there a relationship between nursing students’ conceptions of the impact of computers on hospital employed nurses, and students’ attitude toward computers?

Findings were presented in Chapter 4 as either primary or secondary. In this chapter, primary findings are discussed by focusing on each of the refined research questions separately. This is followed by a discussion of secondary findings on demographics, and computer usage. Then, the generalizability of the findings, as well as the limitations, and significance of the study are addressed. Finally, the chapter ends with both general, and local recommendations and conclusions.

Discussion Of Primary Findings

Research Question 1

Because conceptions are formed by one’s awareness of "what is," and by a knowledge of "what may be," questions were asked at the outset of the study to determine subjects’:(a) awareness of computer use in hospital nursing today, and (b) knowledge of how computers may be used by hospital employed nurses in the future. These views provided a context for understanding students’ conceptions about the
impact of computers on hospital employed nurses.

Overall, it appears that subjects enrolled in the Cariboo College nursing program, have a lack of awareness of computer use in hospital nursing today. Subjects' lack of awareness may be partially explained by the fact that nurses are not presently using computers at Royal Inland Hospital (R.I.H.), the facility where the majority of their clinical experience takes place. In that local facility, at the time of the interviews, computer use consisted of individual department systems in non-nursing areas. In addition, subjects' lack of awareness appears to indicate that the computer awareness content presently included in the Nursing Perspectives course in the Cariboo College nursing program is inadequate.

Most subjects were aware of the presence of computers in the lab at R.I.H.. This finding is not surprising, as all subjects have access to, and refer to the computerized lab reports in patient charts during their clinical experience. The Travenol Hospital Patient Management System is expected to be piloted at R.I.H. in the admitting, payroll, medical records, and business departments in October, 1988. Although data is presently being entered into the system, subjects did not seem to be aware of that fact, however several subjects did know that there were plans for the installation of a total patient system at R.I.H sometime in the future.

Because of their present lack of direct hands-on use of
computers in the hospital, subjects at this point in their career, do not appear to relate personally to the use of computers in nursing. While all subjects are exposed to computerized equipment such as intravenous controllers, thermometers and monitors, during their clinical experience, most do not appear to relate this to computer use. Instead, they discussed computers in relation to actual terminals with keypads. Perhaps this is so because subjects have not been informed regarding various types of computers, and computer applications presently being used.

It was interesting to note that many of the subjects, prior to the commencement of the interviews, made blanket statements informing the researcher of the fact that they knew nothing about computers, and for her not to expect them to know much in the interview. After the interview, many of these same subjects, expressed thanks for the opportunity to express their views, and several expressed surprise that they had so many views to offer. One second-year subject said, "I didn't think I knew much. You made me think." This was an unanticipated outcome of the research, and indeed it probably served to heighten the awareness of a number of subjects by drawing their attention to computer use by hospital employed nurses. Several subjects expressed an interest in seeing the study when it was completed.

Even though a general introduction to computer use in nursing is part of the computer seminars in semester one, and
computer use is discussed informally in the Nursing Perspectives course, subjects in all years lacked knowledge of computer use by nurses in other parts of the province, and the country. These findings are consistent with those of other researchers who studied nurses with different types of educational backgrounds and work experience (Heller et al., 1985; Ronald, 1983; & Parkes et al., 1986).

Most Cariboo College nursing students do not subscribe to The Canadian Nurse publication and, even if they had access to it, one particularly relevant article (Webber, 1988) which noted the hospitals in Canada which are computerized, was not published until after the subjects had been interviewed. Subjects were vaguely aware of happenings in the United States, probably due to the fact that most of the articles, and books pertaining to computers in nursing are American in origin. The film that has been used yearly in the semester one seminar on computer awareness discusses the total hospital system at an American hospital, El Camino Medical Center in California.

Two first-year subjects raised the point of not yet knowing the role of the nurse. This raises the question of how, and when to sequence computer content in the nursing program. It might be too early to introduce students to use of a total hospital system in semester one, as they: (a) have only had a very limited number of clinical hours (95 hours), (b) do not currently see a system in operation at R.I.H., and
(c) are just beginning to be socialized into the role of a nurse. If a student is unsure of what his/her role as a hospital employed nurse will be, it is difficult to see himself/herself in that role, and to know how computers might be used to assist him/her in carrying out that role.

Subjects' knowledge of how computers may be used by hospital employed nurses in the future, centered around three broad areas of usage: (a) nursing, (b) communication, and (c) administration. The most frequently mentioned uses were in the area of nursing. Computer use for documentation purposes was cited by the majority of subjects in all three years. This is not surprising because of: (a) the emphasis placed on the importance of documentation, and (b) the expectation that all students document the care they give their patients from their first clinical experience, to their last, while enrolled in the program. Students in all years, historically, complain about not having sufficient time to document the care they give as soon as it is completed. When bombarded by advertising in the media touting the efficiency of computers for information management, it is easy to see how subjects would think about the utility of computers for documentation purposes.

One surprising finding was that very few subjects in either first (36%) or third (38%) year, and none in second year, discussed the use of computers as teaching tools. Teaching and learning principles are taught in the first year
of the nursing program, and students are evaluated after each clinical rotation, on their ability to incorporate patient teaching into their delivery of patient care. However, students are not introduced to, or expected to use computer assisted instruction (C.A.I.) packages at any point in the Cariboo College nursing program, and consequently appear to have difficulty envisioning the use of computer assisted patient teaching packages in hospital nursing. Use of C.A.I. learning packages by nursing students to facilitate their learning in the educational environment might increase their ability to understand how computers may be used as a teaching tool by both staff, and patients in the hospital environment.

While the majority of first (100%), and third (77%) year subjects discussed the use of computers as a reference source, only 36% of the second-year subjects noted this application. Most subjects, in all years, who discussed this use for computers did so in relation to its use as a source of drug information. First-year subjects, at the time of the study (March and April, 1988), were just completing their first Pharmacology course in which they were exposed to a tremendous amount of drug information in a relatively short time span. Given the volume of information first-year students are required to become familiar with, it is not surprising then, that all first-year subjects noted the use of computers as a reference source, for drug information.

It is surprising though that only 36% of the second-year
subjects noted the use of computers as a reference source. Second-year students administer a large number of regularly prescribed medications to a group of patients in the hospital for the first time, and are required to research and be familiar with these drugs prior to administering them. Most second-year students presently: (a) purchase commercially prepared drug information cards which they carry in their uniform pockets for easy reference while in the clinical area, (b) refer to drug texts on the nursing unit, and (c) call the hospital pharmacy for drug information if they are unable to obtain it elsewhere. The absence of computer facilities in the hospital at the time of the study, and the perceived relative ease of obtaining drug information might explain why second-year subjects did not appear to discuss use of the computer as a reference source.

At the time of the study, third-year subjects were working side-by-side with preceptors in the hospital in order to learn the role and expectations of a hospital employed nurse. At that point in the program, they are responsible for administering large numbers of all types of drugs, by all drug routes, including the direct intravenous route. They receive little or no supervision from the instructor, and are responsible for knowing about the drugs they administer. Historically, at this point, when students are expected to function independently, they become acutely aware of the tremendous responsibility placed on them for safe drug
administration. The majority of third-year subjects appeared to see the utility of a computer as a tool for obtaining drug information, which would enable them to perform their role safely, and efficiently.

Very few subjects discussed use of the computer by hospital employed nurses for communication purposes. The exception was the third-year subjects. Sixty-nine percent of them commented on its use as a means of communication between hospital departments. This is not surprising as third-year subjects, at the time of the study, were doing their clinical preceptorship where they are expected to begin to make the transition from the role of a student to that of a graduate nurse. Their preceptorship includes more team leading functions which entails increased responsibility for communicating with other hospital departments. Administrative nursing applications are not stressed in a community college nursing program, and this was reflected in the low numbers of subjects who cited use of a computer to facilitate these functions.

Despite their apparent lack of computer awareness and knowledge, subjects enrolled in each of the three years conceptualized the impact of computers on hospital employed nurses in four categories: (a) nursing image, (b) patient care, (c) workload, and (d) professionalism. It is interesting to note that all of these categories relate to topics which historically are discussed in the Nursing
Prespectives course throughout the three years of the Cariboo College nursing program.

There are two reasons why it is not surprising that the majority of subjects, in all years, commented on the category of workload. Firstly, as nursing students they are expected to not only carry an academic workload, in terms of contact hours, which is considered to be heavy by college standards but secondly, they are also expected to carry an increasingly larger, and more complex patient-care load in their clinical experience, in each succeeding semester of the program. With recent media coverage, and increased attention in the Nursing Perspectives course on the issue of nursing shortages, and nurses leaving the profession due to burn out brought on by heavy workloads, it is small wonder that this category received the most attention.

Patient care, the category receiving the second largest amount of attention by subjects, is the focus of the clinical component in all years of the program, although more desk related types of duties, such as team leading, are introduced in second and third-year. It is interesting that 100% of the first-year subjects commented on patient care, which is the main focus of attention in the clinical component of first year. A slightly smaller number of the second (91%), and third (91%) year subjects commented on patient care. This possibly reflects a shift in attention toward more team-leading types of activities as students progress through the
Although the majority of first (55%) second (91%), and third (77%) year subjects commented on the category of nursing image, the percentages of first-year subjects commenting was noticeably less. This might possibly be related to first-year subjects' lack of: (a) understanding of the role of hospital employed nurses, (b) awareness of how nurses are often portrayed in the media, and (c) knowledge of the attention the issue of nursing image is receiving from the professional association.

A small majority of subjects in each year (64% first, 64% second, 62% third-year) discussed the category of professionalism. This finding supports the belief, held by many, that even though the socialization process of adopting the characteristics of a professional nurse begins in the educational setting, it is often not until a student graduates that he/she starts to identify himself/herself as being a professional who is bound by a professional code of ethics.

Subjects' choice to discuss how each of the four categories (image, patient care, workload, and professionalism) could be: (a) enhanced, (b) detracted from or (c) both enhanced and detracted from, was analyzed in a superficial way in this study. The frequency of subjects, in each year, commenting on each of the three sub-categories was tabulated. Although this unsophisticated quantitative
measure allowed for some comparisons to be made between years, it might have proven more interesting, and informative had some correlations been done between individual subjects' attitudes toward computers, and whether they focused their discussion on how computer use: (a) enhanced, (b) detracted from, or (2) both enhanced and detracted from, each category of conception discussed.

Research Questions (a) and (b)

There appears to be a difference in complexity between first, second, and third-year subjects' conceptions of the impact of computers on hospital employed nurses. This difference appears to be directly proportional to the year in which subjects are enrolled in the program. Because the number of clinical hours increases significantly with each additional year of the program (see Chapter 1, Table 2), specific research questions (a) and (b) will be discussed together.

Learning the role and expectations of the nurse, occurs through a gradual socialization process over time. Therefore, intuitively, one would expect that as students progress through the nursing program, their conceptions would become more sophisticated in terms of knowing: (a) what their role as a hospital employed nurse might be, and (b) how their role might be impacted on by a variety of variables. This
study verified these expectations. Subjects in each succeeding year of the program were able to conceptualize the impact computers may have on hospital employed nurses at a higher level. Thus the finding is consistent with the curriculum design of the Cariboo College nursing program which sequences nursing content to be taught starting from the simple and then moving to the complex.

Even though there is attention drawn to the computer learning needs of nurses in the literature, (Anderson et al., 1974; Walker, 1981; Ronald, 1983; Hannah, 1983; Heller et al., 1985; Merrow, 1985; & Parks et al., 1986) there does not appear to be either: (a) a consensus of required competencies for nurses with regard to computer knowledge and use, or (b) a widely accepted approach for teaching nurses to use computers.

Presently, there are no stated provincial or national norms of what is expected in terms of the level of computer knowledge or use for nurses. This lack of a more global direction has served to focus the identification of computer learning needs at the local level. The issue of lack of provincial, and national norms is a concern to educators who feel that students, upon graduation, should be prepared to work not only in local hospital facilities but also in other hospitals across the country.

The Ministry Of Advanced Education And Job Training in British Columbia, is moving a little closer to some
standardization of programming by supporting the Computers In Nursing Project, and by making three learning modules available free of charge to all nursing programs in British Columbia. This again, is a "what to" and a "how to" approach similar to those described in the literature by a number of authors (Edmunds, 1982; Skiba, 1983; Ronald, 1983; Hannah, 1983; & Ronald & Skiba, 1987). These modules, with their stated objectives, are expected to be incorporated into existing nursing programs in the province by September, 1988.

Even though the intent of the modules is commendable, problems are inherent in this approach for a number of reasons. Firstly, nursing programs, in British Columbia, use a variety of curricula frameworks. Unless an attempt is made to incorporate the modules into these existing frameworks, and to provide follow-up to individual programs as they attempt to use them, the modules are doomed to sit on a shelf collecting dust in someone's office. Secondly, even though the modules are designed to be adapted by individual programs to fit their particular local needs, there is a danger that without follow-up, these adaptations will not be made. Thirdly, this packaged approach assumes that the computer learning needs of all students are the same. This we know to be a fallacy, along with the notion that one approach will work for all (Skiba, 1982).

The dimension missing in this thrust, and in other approaches chronicled in nursing literature, is how to
evaluate learning which takes place as a result of such efforts. With no agreed upon criterion of adequacy existing, it is difficult to evaluate if the expected level of learning has occurred. This study demonstrates that the quality of conceptions differs between students enrolled in different years of a community college nursing program. By subscribing to the notion that learning is a change in conception (Dahlgren, 1978), one must then ask two questions: How can learning be measured?, and how can the quality of learning be changed? Within the context of nursing programs in British Columbia, not only must attention be placed on the curricular content (modules) but also on how curricula can be operationalized to allow for the inclusion of these modules in a way which will enhance the quality of student learning.

One approach that can be used to operationalize curricular goals is to use a taxonomy like the SOLO Taxonomy of Biggs and Collis (1982). SOLO, or a similar taxonomy, may be used to specify acceptable or unacceptable levels of performance with regard to nurses' knowledge of, and use of computers in each semester, and year of community college nursing programs. When attempting to sequence computer content for nurses in the curricula of nursing programs, it would seem logical to build on existing knowledge by attempting to use a tested taxonomy, such as the SOLO taxonomy.

Although this study formally grouped subjects' conceptions
into two levels of complexity: high, and low, it was intuitively obvious that in fact a range of levels, from high to low existed. The SOLO taxonomy identifies five levels of learning outcomes which represent a shift in complexity of conception from low to high. Because the sequencing of curricular content from the simple to the complex appears to be inherent in the curricula of most nursing programs, use of a taxonomy of learning outcomes to facilitate sequencing computer content seems to be long overdue.

Hands-on experience to increase students' comfort levels using a computer, as well as theoretical discussions about the impact of computer use on nurses can be sequenced through use of a taxonomy, which is aimed at changing students' level of conception. It appears that unless a student has experience in a particular area, high level responses are not expected. This is supported by Merrow's (1985) finding that individuals who were rated as minimally knowledgeable about computer use in nursing practise had never used a computer. This two pronged approach should serve to increase computer awareness and knowledge which should serve to increase the complexity of students' conceptions of computer use by hospital employed nurses.

Use of a taxonomy of learning outcomes then, would allow for: (a) the organization of learning components into a hierarchy of levels of increased abstraction, (b) systematic ordering of components in the appropriate order, and (c) the
evaluation of the success of the total instructional episode.
The inclusion of computer content in nursing curricula in
community college programs in British Columbia, and
elsewhere, could therefore be achieved in a logical fashion.
Ultimately, the curriculum framework of individual programs
would serve as the blueprint for incorporating computer
content which is organized according to a taxonomy.

The question of how the quality of students' learning
can be changed addresses the notion of moving students from a
certain level of learning to one which is qualitatively
higher. Several possible ways to move students from a low
level of conception to a higher one are: (a) increase their
awareness about the use of computers both within, and outside
their immediate environment, (b) discuss the four categories
of conception in terms of how each may be enhanced and
detracted from, and (c) teach about non-keyboard operated
computer applications which are being used in hospitals. An
effort must be made to broaden the context of computer use so
that students do not become too set in their own small
nursing world, but rather are able to relate happenings in
their field to the world at large. By doing this, educators
open the door for cross-fertilization of ideas among
disciplines which in itself enhances quality of conception.
The majority of subjects in this study had a positive attitude toward computer use in hospital nursing. This is congruent with the trends indicated in the nursing literature of nurses becoming more positive (Ronald, 1983 & Merrow, 1985). This study found that subjects rated as having negative attitudes toward computer use by hospital employed nurses were: (a) all female, and (b) enrolled in first, and second-year.

It was not surprising that the subjects with negative attitudes toward computer use by hospital employed nurses were female, given the attention paid by some authors in the literature to the notion of women having a negative "mind set" toward technology (Menzies, 1982). It is essential to point out though, that the small sample size of male nurses in this study may have skewed the findings. Previous experience has been found by some (Houle, 1980 and Chang, 1984) to affect attitude. Comments, taken from the transcripts of the subjects in this study with negative attitudes (see Chapter 4), lend support to this notion.

However, it was surprising that third-year subjects were more positive than both first and second-year subjects. Based on a review of the literature, it was felt, at the outset, that third-year subjects might have more negative attitudes toward computer use. More attention seems to be
focused on computers use now, in the educational environment, work setting, and media, than three years ago when that group entered the nursing program. The positive attitudes of third-year subjects might be explained by the fact that they now have more of an understanding of what their role as a nurse is, are more comfortable with it, and consequently, appear to be able to see the positive effects that computers may have on them as hospital employed nurses.

One of the most significant results of this study is the finding that there is a relationship between subjects' attitudes toward computer use by hospital employed nurses, and the complexity of their conceptions. All subjects who were able to think complexly about the impact of computers on hospital employed nurses, had positive attitudes. Subjects who conceptualized about such things at a lower level were divided in terms of both positive or negative attitudes; yet, all six subjects with a negative attitude had low levels of conception.

In looking at the transcripts of the six negative subjects with low level conceptions, it was obvious that their attitude seemed to "block" them from being able to discuss their conceptions in any depth. They kept coming back to the fact that they "did not like computers," and were unable to move beyond that point. On the other hand, subjects who had positive attitude and low levels of conception, may not have been able to articulate their ideas
or may have been preoccupied as indicated by the examples of two subjects discussed in Chapter 4.

Discussion Of Secondary Findings

Secondary findings in this study were reported on demographics, and computer usage. The more significant findings, under each heading, are singled out and discussed in the following paragraphs.

Demographics

This sample differed from that of other studies reported in the nursing literature. The subjects in this study were enrolled in a Canadian community college nursing program whereas other studies, with the exception of Hannah (1983), have been American and dealt with subjects enrolled in university programs (Walker, 1981; Heller et al., 1985; & Parks et al., 1986).

The majority of subjects who participated in this study were between the ages of eighteen and twenty-four, followed by the group ranging between ages twenty-five and twenty-nine. Inman (1983) noted that experts have found that individuals in their mid-thirties, and younger, tend to adapt quickly to the computer while those fifty and over are more likely to be intimidated. Krampf and Robinson (1984) found
that most older adults do not appear to be threatened by the computer. This study found that of the six subjects who displayed a negative attitude toward computers, five were in the age range of eighteen to twenty-four, and one was between twenty-five and twenty-nine. This is contradictory to Inman’s (1983) reporting. All seven of the older subjects (between ages thirty and fifty-nine) had positive attitudes toward computers which supports the findings of Krampf and Robinson (1984).

The nursing faculty at Cariboo College intuitively feel that the trend appears to be for students to take some sort of formal education prior to entering the nursing program. The findings in this study lend support to this belief. The assumption one often hears in casual conversation is that students coming out of high school today are computer literate. This study found that while the majority of subjects had hands-on computer experience prior to entering the nursing program, 40% had no formal computing experience, and only 34% had exposure in the school system. If this sample is typical, the common assumption then that students coming out of high school are computer literate, appears to be questionable. The nursing faculty must be aware that students have developed an attitude toward computers in general (based on their previous experience), prior to entering the nursing program, and this must not be assumed to be positive.
Subjects' verbalization of wanting increased computer content in the nursing program reflects societal trends, and possibly their perception that they will need this knowledge to perform their role as hospital employed nurses in the future. Findings that subjects prefer a variety of learning approaches, if faced with having to learn to use computers, are consistent with the characteristics of adult learners and the principles of teaching and learning documented in the adult education literature.

Computer Access And Usage

Even though all subjects have access to the Cariboo College computer system, few are using it. This discovery is vital for nursing faculty who are charged with curriculum planning for the integration of the B.C.I.T. learning modules into the Cariboo College nursing program in September 1988. Faculty's expectations regarding student use of computers, and their relative comfort with computers in educational settings must be carefully examined. If it is believed that computers are to become another tool, which nurses must be comfortable with in order to practise nursing, felt barriers identified by subjects preventing their use of computers in the educational setting should be examined, not ignored. With the increased use of computers by nurses employed in hospital settings, becoming a reality, it is up to educators
to provide students with opportunities to use computers in
the educational setting so that they will be better able to
transfer that knowledge to the hospital setting.

Generalizability Of Findings

In considering the generalizability of the results of
this research, several points must be considered. The
subjects used in this research were all enrolled in a
community college diploma nursing program, and as such were a
self-selected sample. Community college diploma nursing
programs, in British Columbia, differ not only in length,
context, and practicum experience but also in terms of the
emphasis on computer content in their curricula. However,
all of these community college diploma nursing programs: (a)
must meet the approval criteria of the Program Approvals
Committee of the Registered Nurses Association of British
Columbia, and (b) are charged with educating beginning
practitioners who meet a minimum standard for safe practice.

This study focused on one particular setting which means
the findings are grounded in that setting. This researcher
is interested in the accuracy and comprehensiveness of the
data collected, and is especially interested in the "fit"
between what is recorded and what was actually occurring with
Cariboo College nursing students at the time of the study.
However, it is the researcher's belief that community
colleges in British Columbia share more similarities, than differences, in that all are preparing beginning practitioners. Therefore, generalizability of these results may be possible. It is now up to other researchers to look at these findings in light of the peculiarities of their own community college nursing programs.

As already noted, the primary findings of this study have implications for all community college nursing programs. In addition, the primary findings, coupled with the secondary findings, (specific to the Cariboo College nursing program) may be acted on locally to affect change which is grounded in research based on the students' perspective.

Limitations Of The Study

There are several limitations of this study that have become evident as the study unfolded. The major limitation is that it is weak on cross-comparisons between institutions. Although attempts were made to make comparisons within and between years, the study focused on one institution only (Strauss, 1987).

A second limitation is inherent in the interview method of data collection. A couple of subjects commented on the fact that it was difficult to "think on the spot." However, the presence of a tape recorder did not appear to make any of the subjects nervous, probably because subjects were familiar
with using both audio and video equipment throughout the nursing program.

The timing of the interviews might have been detrimental to the quality of responses. Interviews were held in March and April 1988. This time period was not ideal as subjects may have been preoccupied with final examinations which were scheduled early in April. Two subjects in particular, appeared to be preoccupied during the interviews: one by recent news of her father's illness, and the other with a job interview.

A final limitation was a personal one for the researcher in her first attempt to do qualitative research. At times the volume of information obtained during the interviews, and generated by the formative and summative data analysis, was overwhelming. In particular, the volume of data generated by the forced-response questions on the respondent profile section of the interview schedule (although of benefit in understanding the sample) tended to challenge the researcher to remain focused on the research questions.
Recommendations

General Recommendations

A number of recommendations are offered for consideration by community college nursing programs:

(1) Effort should be placed on providing factual information on current happenings with regard to computer use in nursing, to students enrolled in community college nursing programs. The intended purpose of this recommendation is to heighten student nurses' knowledge and awareness of local, provincial, and national trends.

(2) Comparative research needs to be done:
   a. In hospitals, both before and after computers are actually used by nurses, to determine the quality of nurses' conceptions and their attitudes about computer use. This data could then be used to develop and evaluate computer learning experiences with the intent of fostering positive attitudes and high levels of conception.
   b. To determine if the conceptions and attitudes of students enrolled in other community college nursing programs, both within, and outside this province, are similar to those of students at Cariboo College.
   c. To determine if student nurses' conceptions of and attitudes toward computer use by hospital employed
nurses differ from those of nurses already employed in Canadian hospitals.

(3) Further work needs to be done to either develop, or adapt the use of an existing taxonomy of learning outcomes which may be used in community college nursing programs to facilitate the sequencing and evaluation of the quality of students' learning about computers.

(4) Attention needs to be focused provincially, and nationally on determining desired levels of conception of computer use for students enrolled in each year of nursing programs, and also attention needs to be focused on the level of computer competency expected at the completion of community college nursing programs.

(5) Research is needed to determine teaching techniques to facilitate moving students' conceptions of computer use from one level to another which is qualitatively distinct.

Local Recommendations

A number of recommendations are offered for consideration by the Cariboo College nursing program:

(1) Faculty should strive to integrate more computer awareness content throughout the nursing program in an attempt to decrease the mystique of computers.
(2) The faculty needs to build expectations into the nursing curriculum that students use a computer for such things as producing papers or weekly anecdotal notes in order to increase their comfort level with using computers.

(3) The nursing department should lobby college administration more assertively for greater accessibility and availability of computer terminals for use by nursing students.

(4) The curriculum committee should co-ordinate the inclusion of computer content throughout the nursing program by using a taxonomy which would allow for the quality of learning to be evaluated.

(5) Faculty should strive to incorporate the use of nursing C.A.I. learning packages as a method of instruction (where applicable) in order for students to experience this computer application. One intent in doing this is that students who used computers to facilitate their own learning might be more able to identify with the computer as a valuable teaching tool for use in the hospital.

(6) An attempt should be made to ascertain students' attitudes toward computers by using a tool to measure attitude like the one developed by Stronge and Brodt (1985). This could be done on entry into the program so that faculty could develop strategies to help negative students become more positive.
Significance Of Research

Results of this study will provide guidance for nursing faculty in community colleges, locally, provincially and nationally, who are responsible for implementing computer content into nursing curricula. The results will also be valuable for hospital in-service co-ordinators, who are responsible for planning computer education programs for nurses who have graduated from community college nursing programs. They will be of immediate benefit to nursing faculty in British Columbia who are expected to implement the three modules developed as a result of the COMPUTERS IN NURSING PROJECT into their curricula in September, 1988.

This study was based on the premise that learning is a change in conception, and that there is a qualitative shift from one conception to another when learning has occurred (Dahlgren, 1978). Students enter community college nursing programs with established conceptions of computers and computer use by nurses. It appears logical then, that upon entrance to a community college nursing program, attempts should be made to identify and assess students' conceptions of computer use so that curricula decisions may be made.

This study found that the complexity of students conceptions was directly proportional to their year in the program, and to the length of their clinical experience. This finding provides evidence that computer content in
community college nursing curricula should be sequenced to move from more simple concepts early in the program, when the clinical hours are relatively low, and students are just being introduced to the role of a nurse, to more complex concepts later in the program, when the clinical hours are greater, and students are more aware of their role as nurses.

This study also found that there is a relationship between the quality of students' conceptions of the impact of computers on hospital employed nurses and students' attitudes toward computers. It appears that students with high levels of conception toward computer use also have positive attitudes. Based on this finding, attempts must be made to foster positive attitudes in nursing students, if the intent of nursing programs is to facilitate the development of high level conceptions among its' students.

The findings of this study are specific to one setting (Cariboo College) and time (1988). By using the nursing informatics (NI) research pyramid (Schwirian, 1986), at the outset, to identify research questions, this study has contributed to our present knowledge about student nurses conceptions of, and attitudes toward computer use in hospitals. However, change is inevitable and therefore the search must continue for a deeper understanding of student nurses' conceptions of the impact computers are presently having and will continue to have on them as hospital employed nurses.
Given the emphasis today for research-based nursing practice and education, this study will provide guidance, from the students' perspective, as to where the focus of educational programs must lie and will stimulate educators to provide both sides of the issues to enable students to develop more complex ways of viewing computer use in their work world. Because this study is the only one of its kind known to the researcher, the qualitative data generated will serve as a foundation for other studies.

Conclusion

As computer technology moves into hospitals, across this country, nurse educators are expected to prepare students to incorporate its use into their nursing practice. With the Canadian Nurses Association (C.N.A.) stand on entry to practise that, by the year 2000 beginning nurses will require a baccalaureate degree to enter the nursing profession, increased attention is being placed on preparing a nurse who can cope with these and other trends in nursing. The nature of these proposed changes in nursing programs is receiving considerable attention in nursing circles and attempts are being made to make recommendations based on scientific knowledge and research.

This study has pointed out that as we develop these programs, we must constantly pay attention to how we
socialize nurses to assume their role in the profession. Presently, nurses appear to be concerned about a Catch 22 position in terms of feeling the pull between technology and the patient (see Figure 3). One third-year subject became very emotional as she noted, "I feel that the patient is more important. With computers, the fear is getting away from the patient."

![Figure 3. Nurse And Technology](image)

The onus is on educators to socialize student nurses so that they can maintain their equilibrium within this push-pull situation. We must listen to our students and respond to them as individuals, with varied attitudes toward, and conceptions of computer use. Above all, we must strive, to enhance the quality of their conceptions through the use of a taxonomy in programming computer content.
REFERENCES


### Appendix A

**COMPUTER SYSTEMS IN CANADIAN HOSPITALS**

#### PROVINCE AND HOSPITAL

British Columbia
- Peace Arch District Hospital
- Grace Hospital
- Lions Gate Hospital
- Shaughnessy Hospital
- U.B.C. Health Sciences Centre

Alberta
- Fort McMurray Regional Hospital
- Calgary General Hospital
- Charles Camsell General Hospital
- Glenrose Rehabilitation Hospital
- Forest Grove
- University Of Alberta Hospital
- Red Deer Health Care Centre

Ontario
- Kenora District For The Aged
- St. Joseph's Health Centre
- Chedoke-McMaster Hospitals
- York Central
- Sunnybrook Medical Centre
- Mississauga Hospital
- "The Hospital For Sick Children"
- University Hospital, London

New Brunswick
- Restigouche Nursing Home
- Saint John Regional Hospital
- United Church Home For Seniors
- Loch Lomond Villa
- Chaleur Regional Hospital
- K. E. Spencer Memorial Home

Nova Scotia
- Victoria General Hospital

Newfoundland
- Valley Vista Nursing Home
- St. Clare’s Mercy Hospital
- General Hospital Corp. (HSC)

#### HARDWARE

- IBM
- Data General
- VT 220
- UNISYS (Burroughs)
- Tandem
- CADO
- Electronic Data Systems
- Beehive
- DEC
- IBM
- Telex
- Data General
- Hewlett Packard
- Esprit Systems
- CADO
- Technicon
- IBM PC AT
- IBM System 36
- Burroughs
- CADO
- Sperry
- Burroughs
- Data General
- Data General

Because of the time constraints dictated to me by the university, and my own commitment to finish this research while working half-time this semester, I would appreciate a reply at your earliest convenience. Please forward to my attention, a letter authorizing permission for me to interview Cariboo College nursing students. This letter should be addressed to:

Dr. S. Coren  
Chairman, Behavioral Sciences Screening Committee  
The Office of Research Services  
Room 331, IRC Building, U.B.C.

I will then send all the necessary documentation to the committee as one submission, after consulting with my thesis advisors.

Thank you in advance for your help in this matter. Please do not hesitate to contact me for further clarification.

Sincerely,

Karen Abbott  
Nursing Faculty
Appendix E

CONSENT FORM

Student Nurses And Computers In Hospitals

As part of my Masters Program at the University of British Columbia, I am conducting a research study to learn more about how nursing students view the use of computers in hospital settings.

Several studies have been completed which deal with student nurses’ perceptions about computers. These studies are predominantly American, and the students are enrolled in either baccalaureate or masters degree programs. This leaves a void of information available on Canadian student nurses, most of whom are educated in community colleges, and employed in hospitals. This study focuses on this particular group.

Your cooperation is vital to the study’s outcome. You have been randomly selected to take part in this study. The interview will take 30 minutes or less. It will be taped and will be scheduled at a mutually convenient time. Following the taped interview, a written transcript will be made of the interview and returned to you for your verification. With the exception of myself, and my supervisory committee at the University of British Columbia, no one will have access to the interview tapes or transcripts.

You may be assured of complete confidentiality. You will be identified by a number on the transcript, and the data will be available only for the use of the researcher. Data eventually may be made available to other research groups. However, all identification will be deleted. You have the right to refuse to participate or to withdraw from the study at any time. If you choose not to participate, you can be assured that this will in no way effect your student status at Cariboo College.

This research will be written in the form of a Masters thesis and, upon completion, will be available, in the library system at the University of British Columbia.
INTRODUCTION

Thank you for agreeing to be interviewed. I am working on a research project that looks at nursing students' thoughts about the role of computers in hospital nursing. I'm going to ask you questions about your own experience with computers, and about how you view their use in hospital nursing.

The whole interview should take 20-30 minutes or less. I'd also like to tape record it so that I can listen to you more carefully now, and later on I'll review what you said. Is that all right with you?

QUESTION 1

First I'd like you to think back to the first time you can recall using a computer. It could be recently, or it could be some time ago, maybe in school or maybe outside of school. Think back to your first experience with a computer. Tell me about it.

a. If not able to recall the first time of computer use, use these probes:
   - automatic bank teller?
   - home computer?

b. What happened as you set about using it?
   (1) What was difficult?
   (2) What was the best part?
   (3) How did you feel?

c. Now, tell me about a recent experience (as recent as possible) when you used a computer.
   (1) What was it like?
   (2) Was it different from your initial experience?
   (3) If different, do you recall a turning point?
   (4) Tell me about........

d. Was learning to use a computer a typical learning experience for you?
   (1) What was typical?
   (2) What was unusual?
   (3) Tell me more........

I'd like to move on to the next question.....
QUESTION 2

You are a nursing student at Cariboo College, and your nursing program is preparing you to work in a hospital setting. I’d like you to take some time to think about the hospital setting as you know it to be from your clinical experience as a student nurse, and as you understand it to be from your reading. Think of yourself as a nurse working in a hospital today. I’d like to know.....

a. What do you think computers are doing for you, in your job as a nurse, working in a hospital?
   (1) What are the benefits?
   (2) What are the limitations?
   (3) Tell me more...........

b. How do you think your role as a nurse, working in a hospital, is affected by computers?
   (1) Is it positive?
   (2) Is it negative?
   (3) Describe more about........

I’d like to move on to the last question....... 

QUESTION 3

Take as much time as you need for this last question. I’d like you to project into the future. Think about yourself, employed as a nurse in a hospital five years after you graduate. That would be ------ (year 1 - 1995, year 2 - 1994, year 3 - 1993).

a. What do you think computers will be doing for you then, in your job as a nurse in a hospital?
   (1) How will it differ from the present?
   (2) What do you think the benefits will be?
   (3) What do you think the limitations will be?
   (4) Tell me more about........

b. How do you think your role as a nurse working in a hospital will be affected by computers in the year------?
   (1) How will it differ from the present?
   (2) Will it be positive?
   (3) Will it be negative?
   (4) Describe more about........

I’d like to conclude this interview with a few general questions. Is that all right with you?
RESPONDENT PROFILE

DEMOGRAPHICS

1. Sex: _____ Male _____ Female

2. Age: _____ 18-24
   _____ 25-29
   _____ 30-39
   _____ 40-49
   _____ 50-59
   _____ 65+

3. What was your educational experience prior to entering the nursing program?
   _____ High School
   _____ Degree
   _____ Other (specify) __________________________
   ________________________________
   ________________________________

4. Have you had education specific to computing?
   _____ Yes _____ No
   Please describe ________________________________
   ________________________________
   ________________________________

COMPUTER USAGE

5. Do you currently have ready access to a computer?
   (a) at home? _____ Yes _____ No
      If yes, what type? ________________________________
   (b) in the community? _____ Yes _____ No
      If yes, what type? ________________________________
6. If you currently use a computer system, how did you learn to use it?

____ self taught
____ computer company rep
____ on the job training
____ other (specify) _______________________

7. Does your spouse/significant other use a computer?

____ Yes ______ No

8. If yes, how often?

____ every day
____ once a week
____ once a month
____ less often

9. Do you have children?

____ Yes ______ No

If so, how many? ______________________

Are any of them computer users (excluding arcade games)?

____ Yes ______ No

If yes, where?

____ school
____ home
____ other

10. Feel free to make any additional comments.

THANK YOU!
APPENDIX H: THEMES

Themes from Interviews 1 - 35

CAREGIVING ROLE
DIVISION OF LABOUR
TIME MANAGEMENT
ACCURACY
AVAILABILITY\ACCESSIBILITY
SOPHISTICATED SOFTWARE
COMPETENCE OF NURSE
COST
EFFICIENCY
SPACE
TYPING ABILITY
TEACHING
COMMUNICATION
SPECIALIZATION
LEGALITIES
CONFIDENTIALITY
RESPONSIBILITY
RESISTANCE TO CHANGE
FEELINGS ABOUT JOB
DECISION MAKERS AGENDA
STEREOTYPING PATIENTS
MACHINE ORIENTED

ARTICULATE NEEDS
HUMAN ERROR
WORKLOAD
INFORMATION TAMPERING
LEARNING TO USE
STAFFING
DOWNTIME
PATIENT FEELINGS
CURRENT INFORMATION
COMPUTER DEPENDENCY
NATURE OF WORK
DEPERSONALIZATION
QUALITY OF PATIENT CARE
MODERNIZATION
PROMPTING NURSE
ACCOUNTABILITY
ETHICAL DILEMMAS
TECHNICIAN
NURSE’S PRIORITIES
CLERICAL
INDIVIDUALIZED CARE
## APPENDIX I: CATEGORIES GROUPED

<table>
<thead>
<tr>
<th>IMAGE</th>
<th>PATIENT CARE</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Caregiver</td>
<td>- Accuracy</td>
</tr>
<tr>
<td>- Division Of Labour</td>
<td>- Competence Of Nurse</td>
</tr>
<tr>
<td>- Specialization</td>
<td>- Teaching</td>
</tr>
<tr>
<td>- Machine oriented</td>
<td>- Communication</td>
</tr>
<tr>
<td>- Nature Of Work</td>
<td>- Resistance To Change</td>
</tr>
<tr>
<td>- Depersonalization</td>
<td>- Feelings About Job</td>
</tr>
<tr>
<td>- Modernization</td>
<td>- Stereotyping Patients</td>
</tr>
<tr>
<td>- Technician</td>
<td>- Patient Feelings</td>
</tr>
<tr>
<td>- Nurse’s Priorities</td>
<td>- Current Information</td>
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<tr>
<td>- Clerical</td>
<td>- Computer Dependency</td>
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<tr>
<td></td>
<td>- Prompting Nurse</td>
</tr>
<tr>
<td></td>
<td>- Individualized Care</td>
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<tr>
<td></td>
<td>- Quality Of Patient Care</td>
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<tr>
<th>WORKLOAD</th>
<th>PROFESSIONALISM</th>
</tr>
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<tbody>
<tr>
<td>- Time Management</td>
<td>- Responsibility</td>
</tr>
<tr>
<td>- Availability\Accessibility</td>
<td>- Articulate needs</td>
</tr>
<tr>
<td>- Sophistication Of Software</td>
<td>- Human Error</td>
</tr>
<tr>
<td>- Cost</td>
<td>- Information Tampering</td>
</tr>
<tr>
<td>- Efficiency</td>
<td>- Accountability</td>
</tr>
<tr>
<td>- Space</td>
<td>- Ethical Dilemmas</td>
</tr>
<tr>
<td>- Typing Ability</td>
<td>- Legalities</td>
</tr>
<tr>
<td>- Decision makers Agenda</td>
<td>- Confidentiality</td>
</tr>
<tr>
<td>- Learning To Use</td>
<td></td>
</tr>
<tr>
<td>- Staffing</td>
<td></td>
</tr>
<tr>
<td>- Downtime</td>
<td></td>
</tr>
</tbody>
</table>
A. NURSING

- teaching tool
  - patients
  - staff

- physiological monitoring

- documentation
  - charting
  - patient care notes
  - flow sheets

- nursing care plans
  - assessment
  - problem statement

- reference source
  - drug information
    - calculations
    - compatibilities
  - policies and procedures
  - past histories
  - old charts
  - lab results
  - admissions

B. COMMUNICATION

- nurses
  - daily assignments
  - shift report
  - Kardex

- doctors
  - orders

- hospital departments
  - order drugs
  - order supplies
  - schedule tests
  - dietary

- other hospitals

C. ADMINISTRATION

- scheduling
  - staffing\P.C.U’s
  - rotations
  - O.R. bookings
  - O.P.D. bookings

- finance
  - payroll
  - billing
  - inventory control

- statistics
  - bed availability