ATTITUDES
OF
SECOND YEAR DIPLOMA NURSES IN THREE COMMUNITY COLLEGES
TOWARD
THE USE OF COMPUTERS IN THE NURSING ROLE

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ABSTRACT

The effectiveness of various kinds of computer programs is of concern to nurse-educators. Using a 3x3 experimental design, ninety second year diploma student nurses were randomly selected from a total population at three community colleges in Ontario. Data were collected via a 20-item valid and reliable Likert-type questionnaire developed by the nursing profession to measure perceptions of nurses about computers in the nursing role. The groups were pretested and posttested at the beginning and end of one semester. Subjects attending College A group received a computer literacy course which comprised word processing with technology awareness. College B students were exposed to computer-aided instruction primarily in nursing simulations intermittently throughout the semester. College C subjects maintained their regular curriculum with no computer involvement. The student's t-test (two-tailed) was employed to assess the attitude scores data and a one-way analysis of variance was performed on the attitude scores. Posttest analysis revealed that there was a significant difference (p<.05) between attitude scores on the use of computers in the nursing role between College A
and C. No significant differences (p > .05) were seen between College B and A in posttesting. Suggestions for continued computer education of diploma student nurses are provided.
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CHAPTER ONE

Introduction to the Study

As the world moves rapidly into the technologic era, it is increasingly argued that computer usage is a rationale way to manage and control information (Ball & Hannah, 1984; McCormick, 1984; Naisbett, 1982). While this has been especially true for business and finance this axiom now applies equally to the field of nursing.

Many health care institutions are adopting computerized information systems and advocating the use of computers in patient care areas. Daria and Moran (1985) state that in the United States every nursing station will have a computer by 1990. In Canada, Desborough (1986) states that 10% of all registered nurses are currently using computers for managing patient care information. In 1986 the Toronto Hospital purchased a Hospital Information System (HIS). Other smaller hospitals are following the trend (Webber, 1986).
While many hospital administrators and medical personnel have purchased computer operating systems for hospital use, there has been little regard for the prime user of the technology - the nurse (McCormick, 1984).

Currently in Ontario, the nursing education system does not provide student nurses with computer instruction. With the advent of computer courses in the high schools in Ontario, it would seem probable that some computer literate students will emerge from the elementary and secondary school system. It is apparent then that colleges should prepare student nurses for hospital computer use. Unfortunately, the problem is compounded because there are few knowledgeable nurse consultants to assist nurse-educators in the design and implementation of computer models suitable for nursing education. It would seem that at present, nurses and nurse-educators are faced with the problem of preparing student nurses to cope with the new technology while struggling with it themselves.

The fact remains that it is no longer a question of whether nurses should know about computers but a question of how educators can provide students with the necessary computer
knowledge and skills. Computer literacy is an important skill which must be included in nursing education.

Research has shown that many nurses are hesitant to begin using computers (Ronald, 1979; Happ, 1983; Ball, Snelbecker & Schechter, 1985). According to Worthley (1982), computer resistance seems to be the most negative phenomenon associated with computer use. An area of recent research interest is the study of attitudes toward computer use. A major thrust of this research has been to overcome the unfavourable attitudes toward computers. Hamby (1986) states that attitudes are important in the learning process because they influence the learning rate, the retention and the application of learning as well as the student's motivation to learn. Viers (1983) identified that a well supported learning experience can overcome the diffidence of the computer user. Paulanka (1986) found that when students are socialized to accept the computers as part of a teaching-learning environment, there is less negative discourse. Findings suggest that the best method of teaching student nurses about computers has yet to be determined (Ronald & Skiba, 1986; Zielstorff, 1985; Grobe, 1986). Existing literature suggests that a "hands-on" approach leads to a more positive outcome (Ronald, 1983; Skiba, 1985).
The salient point of this study is to determine the computer-use attitudes of student nurses, in Schools of Nursing in Ontario Community College Diploma Programs.

Statement of the Problem

The purposes of this study are to:

(1) determine the attitudes of second year diploma student nurses toward the use of computers in the nurses' role, using a self-reported questionnaire.

(2) determine the extent to which a computer-assisted type of program will influence the attitudes of second year diploma student nurses.

(3) determine the extent to which a compulsory computer literacy program involving word processing will influence the attitudes of second year diploma student nurses.

(4) determine the necessity for providing an educational computer course in the nursing curriculum.

(5) provide further reliability and validity for a questionnaire developed by the nursing profession (Stronge & Brodt, 1985) to determine its usefulness with student nurses.
Rationale for the Study

It is anticipated that "almost every hospital over three hundred and fifty beds in size is going to have some kind of computerized system in place within the next few years" (Charbonneau, 1985, p. 21; Lacroix, 1986). The need to provide computer training for the nurse-user has been described by several authors (Ronald, 1979; McCormick, 1983; Grobe, 1984; Ball & Hannah, 1984). Robinson (1982) believes that computer literacy must be included as part of the liberal education provided to students by all colleges and universities. Happ (1983) argued that nursing students are among the important group of students who require training and inservice.

Hassett (1984) emphasized that nurse-educators must lead the way in familiarizing others with computer nursing applications. Unfortunately, most nursing programs fail to provide the most basic computer literacy skills (Hardin & Skiba, 1982). Hospitals are finding it increasingly difficult to comply with the educational costs associated with instructing nurses to use the new technology (McCormick, 1983). At the National League of Nursing's biennial convention in Washington, D.C., June 1987, the following resolution was adopted.
WHEREAS, computer technology is becoming more sophisticated in health care and nursing; and
WHEREAS, the nurse's role with computers will expand with the increasing use of computers in health care and nursing; and
WHEREAS, nurses need to be proactive in the use of computer technology in nursing; and
WHEREAS, nurses need to have knowledge and skills to maximize the use of computers in health care and nursing; and
WHEREAS, nursing educators influence the learning experience of their students; therefore, be it
RESOLVED, that nursing school administrators explore the learning of the faculty and students with respect to computers and identify ways in which these needs can be met; and be it further
RESOLVED, that the committee on Accreditation of the National League of Nursing be requested to examine that issue of computer education and make recommendations about its inclusion in the accreditation criteria to all nursing education councils. (National League for Nursing, 1987, p. 422)

The nursing profession is in the preliminary stages of formalizing policies and procedures with associated ethical considerations in order that computerization of health care services can enhance patient care. The computer search for this study revealed a dearth of Canadian literature on computer courses taken or given by nurses. As well, there is a deficiency of testing material formulated by nurse educators or researchers which would be suitable for research on the topic of computer use among nurses.

The arguments presented by Ronald (1983), Paulanka (1986), and Skiba (1985) give strong support to researchers to examine the following questions:

(1) What is the current attitude of the student nurses in the Ontario College system toward the use of
computers in the nursing role?

(2) Does the current curriculum offered by two schools of nursing facilitate positive attitudes toward computer use in the student users?

(3) Are current programs effective in helping to develop student nurses who will be positively inclined toward computer use?

It is obvious that there is a need to graduate students who are receptive to computer use; however, it seems that a major problem is finding an appropriate way to accomplish this goal. Unfortunately, most nursing programs are unable to meet the need, primarily because there is a lack of faculty preparedness and expertise (Hassett, 1984). To increase efficacy in the health care system, it is apparent that nurse educators should ensure that student nurses hold positive attitudes toward the use of computers in a patient care setting.

Assumptions and Limitations

This study focused on diploma nurses whose usual place of employment is the hospital setting. Therefore, its generalizability does not include the baccalaureate nurses whose interests in computers may include research functions. This is not required in the diploma program.
It is recognized that there is a limitation of a four-month time span in which to detect an attitude change. Fishbein & Ajzen (1975) indicate that affective learning changes may require years.

Allen (1986) states that the influence of motivation and anxiety on student achievement is well documented but less well documented is the relation of attitude toward the learning experience and learning outcome due in part to the lack of available measurement tools. There are few attitude scales in nursing research from which to choose (Stronge & Brodt, 1985). Further testing of the instrument would be helpful to determine its validity and reliability.

**Definition of Terms**

**Attitude**

A review of the literature reveals an abundance of definitions of the term attitude as well as various points of view regarding the differentiation of attitude from terms such as belief, opinion and behavioural intent. For this study the definition by Fishbein & Ajzen (1975) has been adopted as the most acceptable for nursing. It is defined as "a learned predisposition to respond in a consistently favorable or unfavorable manner with respect to a given object" (p. 6). Furthermore, these authors
noted that the major characteristic that distinguishes attitude from other concepts is its evaluative or affective nature (p. 11).

**Computer Anxiety**

Computer anxiety is defined by Grobe (1984) as "a hesitancy associated with individuals beginning use of computers" (p. 232).

**Computer Literacy**

A commonly accepted definition of literacy for nurses has yet to be established (Mikan, 1984; Walker, 1981; Skiba, 1985). Happ (1983) suggests that nurses need both functional level literacy which is an awareness of the meaning of computer technology as well as an awareness of moral and human issues that arise with the use of computers. However, for the purposes of this study, the basic concepts presented by Clark, Sheafor and Crain (1984) have been adopted. These authors state that computer competency should include

- the ability to use computer applications related to nursing practise, education, administration and/or research as appropriate to the role of the individual, including the ability to
  1) log on and direct the mainframe or microcomputer to access desired software
  2) apply computer software for individual needs e.g. word processing, ... CAI
3) act as the content specialist in the content specialist/programmer relationship when creating a unique program.

4) seek out appropriate resources when confronted with a computer hardware/software problem. (p. 699)

This definition encompasses levels of understanding that are appropriate for diploma level nurses who are not usually involved in research or computer design. In summation, the best general definition of computer literacy is offered by Haigh (1985) as "that compendium of computer knowledge and skill which people need to acquire in order to function effectively at work and in their personal lives" (p. 168).

Diploma Nurse

A diploma nurse is a student who is in a three-year community college program leading to the graduate designation of Registered Nurse. In this study, community college refers to the Ontario Community Colleges of Applied Arts and Technology system. There are twenty-two community colleges which are non-degree granting institutions.
Hospital Information System - (HIS)

As defined by Hannah (1976), "an HIS is a communications network linking terminals and output devices in key patient care or service areas to a central processing unit that coordinates all essential patient care activities. Thus the HIS provides a communication system among various hospital departments; a central information system for receipt, sorting, transmission, storage, and retrieval of information; and a high speed data processing system to provide information in its most useful form" (p. 558).

Nurse Educator

A nurse-educator refers to a registered nurse with advanced education who is employed to disseminate information to nurses whether in a school of nursing, a university setting or in the hospital environment. Ontario standards require that a teacher in a school of nursing who is teaching nursing subjects must have an undergraduate degree and a minimum of two years of relevant experience. These criteria may vary.

PLATO

The term refers to Programmed Logic for Automated Teaching Operations and is a computer-assisted program used with a computer which is larger than a microcomputer (Alderman, Appel & Murphy 1978).
Staff Nurse

This term is in common usage in hospitals and refers to any nurse who is employed by the hospital who is involved in patient or bedside care. It may refer to a diploma nurse or a baccalaurate nurse but is differentiated from any nurse who is employed in order to be involved with administration or managerial functions.

Statement of the Hypotheses

The literature reveals that nurses, in general, hold negative attitudes toward involvement with computers. To be fully functional in a technological society nurses need to be computer literate. Educators of the students in diploma nursing programs must provide an opportunity for students to take an active role in using existing computer tools. In order to determine a basis for a computer curriculum, it is important to first assess needs, current knowledge and attitudes of potential clients for this. The following hypotheses are tested.

1) There will be no significant difference on scores of a perceptions of computer-use questionnaire between second year diploma nursing students who have taken a computer literacy course and those who have not taken a course.
2) There will be no significant difference on scores of a perception of computer-use questionnaire between second year diploma nursing students who have varying amounts of exposure to computer-assisted instruction and those who have had no experience.

3) There will be no significant difference on scores of a perception of computer-use questionnaire between second year nursing students who have taken a one semester computer literacy course and those who have had varying amounts of experience in a computer-assisted instruction format.

Summary of Chapter One
A need has been established for nurse candidates to become computer literate in order to meet the technological challenges of the nursing workplace. It is anticipated that student nurses would benefit greatly if they receive computer training and experience before their graduation. One benefit would be to decrease the time and cost of hospital orientation periods. Prior computer experience can also minimize the stresses that thwart new graduates as they face increased responsibility in patient care. The ease with which new graduate nurses utilize the nursing station computer may demonstrate to the apprehensive staff that computers are facile.
Nurses who leave college with computer expertise can contribute to nursing knowledge in the field and increase the possibilities for the growth of nursing computer systems. This will decrease the dependency of nursing professionals on medical and business computer systems and lead to expansion of software relevant to nursing.

Nurses have the ability to adapt to changes in their work. Computers are a change to which adaptation is necessary. To ensure successful computer use in nursing, nurses must develop a positive attitude toward computers and take an active role in using existing computer materials. Unless nurses are receptive to computers, potential benefits will never be realized. Computer classes provide excellent opportunities for changing negative attitudes to positive ones.

Bloom (1971) stated that student attitude toward learning situations is affected by methods of instruction. A positive attitude increases learner motivation and interest in future learning, thus improving overall achievement and performance.

An assessment of student nurse attitudes provides a glimpse of knowledge and affective characteristics of potential graduate nurses. The education of these students is important to the growth of the nursing profession as an important consumer of computer technology.
CHAPTER TWO

Review of the Literature

Introduction
The topic of computers and student attitudes has been studied extensively in elementary and secondary schools since the late 1960's; however, it has just recently become a focus of health care agencies and training facilities. As hospitals purchase Hospital Information Systems (HIS), health care administrators and educators are becoming increasingly aware that today's nurses are not adequately trained to cope with the sophisticated technology presently being introduced to hospitals and other patient care facilities.

Computers were initially installed in hospitals for utilization by the financial and personnel departments. Only recently have computers influenced nurse-related duties and responsibilities.
In North America, the sales of computer systems to hospitals have accelerated at a rate of 20% per year (Rauchman, 1987). This trend demonstrates that computers are rapidly becoming a priority in health care expenditures. Prior to the availability of microcomputers, there was little need to focus attention on the use of computers in the health care area since student nurses and educators had little access to them. With the introduction of powerful software, computer programming is no longer a prerequisite for computer users such as nurses who utilize the technology in a field setting. However, nurses, nurse-educators and nursing students do require instruction in the use of computers in order to accommodate the needs of employing agencies.

It is important to assess the readiness of student nurses to interact and use computers in order that computerized health care technology can be used effectively with patient care. When nurses are compared with physicians and allied health professionals, McCormick (1984) states that they are the most frequent computer users in hospitals. Hassett (1984) states that nurses are generally unprepared to record or retrieve data. Data recording includes nursing assessments, nursing care plans and nursing histories. Fause (1986) reported that introduction of an HIS to one
hospital reduced chart deficiencies and resulted in more accurate records and more effective inventory control.

The literature demonstrates that although nurses are hesitant toward the use of computers in the hospital setting, with encouragement, training, and experience, attitudes become positive and potential computer use for the enhancement of patient care can be seen. The literature review is documented in light of these findings and focuses on the following areas:

- Attitudes
- Measurement of Attitudes
- Nurses' Computer Use In Hospitals
- Graduate Nurses' Attitudes In Health Care Settings
- Age, Experience and Education of the User
- Gender as a Variable Influencing Computer Attitudes
- Inservice, Training and Continuing Education
- Change
- Acceptance of Innovation
- Computer Use in Nursing Education Settings
- Attitudes of Nurse-Educators in the Educational Setting
- Attitudes of Baccalaureate Student Nurses
- Attitudes of Student Nurses in Diploma Schools
Attitudes

There are certain characteristics of attitudes that generally pervade the literature. Shaw & Wright (1967) stated that:

1) Attitudes are based on evaluative concepts regarding characteristics of the referent object and give rise to motivated behaviour.
2) Attitudes are construed as varying in quality and intensity on a continuum from positive through neutral to negative.
3) Attitudes are learned, rather than being innate or a result of growth and development.
4) Attitudes are relatively stable and enduring.

Fishbein & Ajzen (1975) stated that attitudes appear to be learned through interaction in social events or situations. Attitudes were seen as the precursor of behaviour by Shaw & Wright (1967). "It is this relationship between attitude and behaviour that has served as the focus for the study of the measurement of attitudes" (Stronge & Brodt, 1985, p.155).

Measurement of Attitudes

Operationally, an individual's attitude toward a given concept can be measured by having the individual rate the concept using a pencil and paper instrument. Cook & Seltiz (1964) stated that in attitude measurement, self-report techniques are the most widely used. The self-administered questionnaire ensures the anonymity of the respondents and
"does not allow the investigator an opportunity to change or distort the respondents' attitudes" (Stronge & Brodt, 1985, p.155). "Self-report measures are only valid to the degree that the respondent is honest and selects responds that truly characterize him or her." (Gay, 1981, p. 126)

Oppenheimer (1966) states that the self-administered questionnaire may be presented by an interviewer and the purpose of the inquiry explained. "Contamination through talking, copying or asking questions is a constant danger" (p.36). "This method of data collection ensures a high response rate, accurate sampling and a minimum of interviewer bias.....while providing necessary explanations (but not the interpretation of questions) and giving the benefit of a degree of personal contact" (p.36).

"Reliability of Likert scales tends to be good and, partly because of the greater range of answers permitted to respondents, is often higher than that of corresponding Thurstone scales" (Oppenheimer, 1966, p.140). Oppenheimer (1966) also states that it is possible to include "items whose manifest content is not obviously related to the attitude in question so that subtler and deeper ramifications of an attitude can be explored" (p.141).
Change in attitude toward a given concept can readily be determined by administration of a test at two different points in time, for example, before and after exposure to an experimental treatment. According to Stronge & Brodt (1985), "the measurement of attitudes becomes an integral part in gaining an understanding of an individual's behaviour" (p.155).

Myers (1986) distributed a 10-item Likert-type attitude survey at a one year interval to 238 randomly selected hospital employees who represented all staff levels at a suburban hospital. The purpose of the study was to identify staff attitudes toward the change process when part of the hospital went "on-line" with an HIS. The majority of respondents felt positive about using the computer as part of their job.

**Nurses' Computer Use in Hospitals**

Farlee & Goldstein (1971) used a Likert type questionnaire to access attitudinal data from nurses who were exposed to an HIS system in a target hospital. The authors tried to rank the order of acceptance of data entry by determining the nurses' satisfaction with it. Results showed that the nurses were positive about the introduction of a computer to the laboratory (74%) but unhappy with using the system
for nursing orders (41%). This outcome was inconsistent with the order of computer installation planned for the hospital. As a result of this study, the sequencing of the installation of the computer system had to be restructured. The computer system's implementors recommended that a needs assessment be conducted before planned change. This study demonstrates the need for nurses to be involved in the change process for a successful implementation of HIS. Myers (1986) confirmed this finding.

Goldstein and Farlee (1972) collected data from thirteen nursing units for six weeks. Assessed variables included satisfaction, centralization, productivity and efficiency of the computers in place. Adaptiveness was found to be inversely related to the number of beds on the unit - the smaller the unit, the greater the adaptiveness of the nurse - employees to technological computer change.

Goodwin & Edwards (1975) studied the impact of different types of data base programs. They found that when diploma nurses were required to use a long computer program in order to facilitate patient assessment, they became frustrated. On the other hand, Masters' graduates found the system challenging and helpful.
Zielstorff, Roglieri & Marble (1977) investigated a computer-based, problem-oriented, medical record system in a Massachusetts outpatient facility. Assessment of the system after one year of use showed that the automated system had improved its stated objective of improved assessibility of data. However, the nurse user reported that the system was unacceptable because it did not contain enough relevant information to assist in patient care. Furthermore, there was a concern that note taking was too time-consuming. The project was withdrawn until improved technology permitted more rapid interaction and more health care providers were able to enter information into the data base.

Dowling (1980) in a survey of forty hospitals in the United States with computerized information systems found that staff resistance and interference with the computer occurred in nearly half the participating hospitals. Three cases of staff resistance in one hospital were reported. This was possibly due to nonexistent psychological support. In other instances, support available for staff was withdrawn too soon.
Oliver (1983), Cook (1982), & Reilly (1982) state that a computerized system in a hospital will only be fully functional if managers are aware of the attitudes of the nurses who will be using them. Ball (1982) stated that the early versions of HIS did not develop as rapidly as expected due to a lack of communication between data processing individuals and health care professionals.

Jordan-Marsh & Chang (1985) assessed staff readiness to work with computers. Seventy-five hospital workers including forty nurses and eighteen administrators were surveyed with respect to staff readiness to working with computers in the health care setting. Using Hall's Stages of Concern Model for analysis (Hall, Wallace & Dossett 1973) the authors found that "one third or more of the staff nurses responses were categorized at the indifference or consequences level" (p.269) when queried about professional expectations of computers in hospitals. Comments were made by the respondents about the impact of computers on individualization of care. Staff nurses who had not yet been asked to use the computers were more likely to respond with "indifference" whereas, less than 20% of the unit manager nurses were in this category.

Hall, George & Rutherford (1977) suggest that a predominance of concerns at the "indifference stage may
indicate that the respondent has not yet decided to become involved with the innovation" (p.270). The authors stated that there was a need for inservice education to address the nurses' needs prior to computer implementation. They viewed one of the consequences of computerization as creating an increase in individualized patient care and stated that inservice sessions should begin here. The suggestion was also given that staff groups should be assessed at varying points in the process of introducing computers as a means of ascertaining changes.

Graduate Nurses' Attitudes in Health Care Settings

Startsman & Robinson (1972) showed that staff nurses employed at a university medical center expressed the least willingness to use data processing systems when compared with medical record librarians and medical faculty. Three hundred and thirty-eight staff were included in the survey. Responses were subjected to factor analysis. A split-half method was employed in determining the reliability of the instrument. A coefficient of 0.87 was achieved. The mean total score for all persons was 51.38 with a standard deviation of 9.67. The seven groups designated by the authors were then placed in two cluster groups on the basis of total scores. There was no pattern to indicate an unfavourable opinion becoming favourable over time among
the nursing group as there was with the physician group. Second year diploma student nurses were more favourably disposed to computers than staff nurses. Four interpretable factors represented 42% of the total test variance. The majority of statements which dealt with willingness to use computers were designated as Factor II. Low mean standardized factor scores for this factor indicated unpopularity with the idea. The standardized mean of the medical record students who scored the highest was .87 while the mean of student nurses was -.09 and the staff nurses' mean was -.26. (p<.01). None of the nurses in this study indicated any previous experience with computers. Findings showed that "the differences in the attitudes...can be attributed in part to familiarity with computers" (p.225). It is also suggested by the authors that nurses may view the computer as a threat to job security. An interesting observation is that a college education may assist in developing a less reserved attitude toward computers. Assessment of users' attitudes is recommended before major computer implementation is commenced.

Melhorn, Legler & Clark (1979) replicated this study and found similar results. In particular, the negative attitude held by staff nurses and student nurses toward the computer was supported.
Employers and hospital systems experts assume that nurses are willing and ready to begin learning the technical skills involved in computer usage. Gluck (1979) and Whitehouse (1981) suggested that nursing administrators should assess the impact that computers will have on users and their degree of willingness to accept them.

Brodt and Stronge (1986) studied graduate nurses' attitudes toward use of computer using their questionnaire developed for that purpose. They employed the instrument with 185 nurses at one hospital. Using four groups of nurses divided by educational preparation, results showed a significant difference (p<0.001) between groups. The analysis of variance resulted in an overall F ratio significant at the p<0.001 with the means of the four groups as follows: licensed practical nurses (LPN) 63.9; associate degree nurses 72; diploma nurses 72.92; baccalaureate nurses 74.29. A Scheffe multiple comparison analysis was used to determine where significant differences existed among the means of the groups. This analysis revealed that significant differences existed between the LPN's and all levels of other nurses with the more favourable attitudes held by the registered nurses.
Summary

The rapid inclusion of computers into the hospital setting has influenced a variety of tasks that were previously executed on a manual basis by telephone or requisition. These tasks include recording assessment data (Goodwin & Edwards, 1975) and nursing care plans (Farlee & Goldstein, 1971) charting medications and relevant data for individual patients (Zielstorff, Roglieri & Marble, 1977) retrieval of information from health care records, pharmacy, dietary, physiotherapy and other hospital areas as well as data entry for doctors' orders and nursing diagnoses. Since these are required activities done by nurses within a time constraint, completing the tasks by computer could conceivably add to the stress.

In the past, graduate nurses have been more negative toward the use of computers in hospitals than other personnel (Startsman & Robinson, 1972) and documentation reveals that some nurses continue to be negative (Brodt & Stronge, 1986) or indifferent (Jordan-Marsh & Chang, 1985). Several studies show that nurses need to be consulted if HIS is to be implemented with success (Farlee & Goldstein, 1971, Myers, 1986). An assessment of attitudes is recommended by several authors before computer utilization occurs (Cook, 1982; Reilly, 1982; Oliver, 1983). Variables that need
further discussion include the previous education, age, length of employment of the users as well as type of nursing unit on which the computer is employed and gender of the nurse.

**Age, Experience and Education of the User**

Thies (1975) found a more positive attitude among employees who had more education and years of employment at the surveyed hospitals. Resultant data from an attitude scale distributed to 146 hospital employees revealed that the nurses were significantly (p<.05) more negative than technicians or physicians. No association was found between age and attitudes.

In a study of 238 full-time graduate nurses, Krampf & Robinson (1984) selected educational achievement in order to discern whether previous education would influence compliance with computer use. Data revealed that while adults over 40 were more challenged than frustrated by a computer problem 66.5% of the time, nurses who were aged 20-30 were equally divided on the following question. "If you run into a problem when using a computer, what would you do?" (p.32). The options were "be frustrated or be challenged". Fifty-four percent of the diploma graduates were challenged rather than frustrated by a computer
problem while 62% of the baccalaureate prepared nurses stated that they would be challenged. Sixty-four percent of nurses in this survey were receptive but still hesitant towards personal use of computers in nursing. "Those with actual computer experience felt more comfortable when faced with a computer problem than those perceiving themselves as having no computer experience" (p.33).

In this regard, several studies have found a strong correlation between computer experience and positive user attitudes (Reid, Palmer, Whitlock & Jones, 1973; Hedlund & Casolara, 1986; King, Raghunathan & Teng, 1986).

Chang (1984) surveyed 156 nurses attending a continuing education workshop. They were asked to complete a questionnaire rating themselves on their willingness to interact with computers for a variety of tasks. This topic was part of a Computer Use Expectations Scale developed by the author and colleagues. "A correlation matrix of the coefficients indicated that Higher Frequency With Which Respondents Had Used Computers was positively correlated with Greater Willingness to Interact with Computers (r=.16; p<.05) and negatively correlated with Age (r=-0.19; p<0.05). Younger age was significantly correlated with Greater Willingness to Interact with Computers (r=0.16;
The author stated that although the younger nurses tended to use computers more frequently, and were more willing to use computers, "it is conceivable that given the opportunity for hand-on (sic) experience and greater familiarity, the older subjects could progress in their adoption of innovations" (p.235). She suggested that administrators and educators include hands-on experience during inservice or orientation. The author concluded that, based on the narrow perspective and expectations concerning computer use expressed by the groups surveyed, widespread dissemination of information concerning computer use needs to be continued.

The study by Brodt & Stronge (1986), previously mentioned, also found that "educational preparation, length of service in the nursing profession and type of nursing unit statistically implied a difference in nurses' attitudes toward computers" (p.85). With respect to nursing experience, nurses who had worked for twenty-one years or more, held a more positive attitude toward computer use than those who had worked in nursing less than ten years. An ANOVA revealed a significant difference (p<0.01) among four groups determined by length of service in the nursing profession. The means of the four groups were as follows: < 10 years, 68.87; 11-20 years, 70.22; 21-30 years, 76.29;
and > 31 years, 77.5. The Scheffe multiple comparison was employed to determine significant differences between groups. The authors stated that these results may indicate that the more mature nurses feel secure in the profession, and are more willing to accept computers since they are no longer threatened by them.

A one-way analysis of variance was employed to determine differences between means on education variables. Results indicated a significant difference ($p<0.001$) between groups tested. The more educated nurses obtained higher scores on the questionnaire. The authors suggested that if successful HIS programs were to be implemented, "nurses with one to two years of education after high school should receive the most intense orientation to computers" (p. 86). With respect to age, ANOVA results revealed no statistically significant data among groups.

Desborough (1987) conducted a Canadian study of 393 graduate nurses who answered a questionnaire "related to computer education factors, organization factors, computer system factors, personal factors and perceptions of effects on the nurse, the delivery of nursing care and on patients" (p. 10). The questionnaire allowed a score for groups of questions related to the seven identified factors." In
this way it was possible to calculate correlations between
different groups of factors" (p.10). A correlation was
considered significant at the 0.01 (1%) level. Comparisons
between groups of factors were completed. Data were
subjected to Chi-square analysis. Findings revealed that
the older nurses (over 45) reported that the training to
use the computer had been inadequate more frequently than
the younger nurses.

Summary
Computer users who are more experienced express positive
responses to the use of computers in the work place (Reid,
have worked for more than 20 years in the nursing
profession were also more secure in their acceptance of
computers in the workplace (Brodt & Stronge, 1986). While
Chang (1984) found that older nurses were less willing to
adapt to computer use, Krampf and Robinson (1984)
demonstrated that the older (over 40) adult is challenged
by the use of computers. Desborough found that older (over
45) nurses need more orientation than younger nurses. The
use of "hands-on" experience to increase greater
receptivity is identified. Results of studies which
focused on educational preparation, revealed that more
positive attitudes are the norm for those with the most
education (Krampf & Robinson, 1984; Brodt & Stronge, 1986).
Brodt & Stronge (1986) stated that diploma students would appear to require the most intense computer orientation.

**Gender as a Variable Influencing Computer Attitudes**

Winkle & Matthews (1982) and Howlett (1986) showed that female students are disadvantaged and are less positive toward computer use. Winkle & Matthews (1982) state that women may require special treatment with respect to their orientation to computers. The authors reviewed the literature related to computer use and women, and found that female students inherited what might be considered a "culturally derived anxiety toward computers" (p.314). They suggested that this overwhelming perception may prevent some women from taking advantage of opportunities to learn about computers. Despite marketing efforts to include men, in the main, student nurses are primarily female and this may have contributed to the problem of computer negativity. Interestingly, Reid, Palmer, Whitlock, & Jones (1973) found that homogeneous groups performed better than mixed groups on computer orientation activities.

Jackson & Yamanaka (1985) found that similar computer anxiety states existed with a randomly selected sample of one hundred adult women in London, Ontario. A Computer
Enjoyment questionnaire was employed. Responses were subjected to a multiple regression analysis. It was found that younger women who had been exposed more frequently to computer vocabulary were only slightly more positive in their responses than older women. Furthermore, it was found that most women were content to let others in the group do the learning. The authors concluded that classes for adult women are needed and that older women may need more instruction than younger women. Although it may be expected that younger women would be more willing to use the computer, this apparently is not the case. Desborough (1987) found this attitude of unwillingness among both younger and older nurses who were trying to cope with computers in the workplace. She states that nurses tend to give away functions involving information handling to ward clerks. Both Desborough (1987) and Walker & Schwartz (1984) expressed concern that the effect of delegating computer activities to ward clerks could have major implications for nursing. Desborough (1987) states that "information is often perceived to be the key to power in nursing" (p. 20).

Roy & Noel (1988) confirm that if nurses are to maintain control of their work and profession "they must get involved in the selection design and evaluation of programs to be used in their setting" (p. 38).
Gulmond, Begin & Arguin (1986) reported their findings of a study of the attitudes of one hundred and fifty-two Canadian male and female college students. They found that females were more negative than males toward computers. They attributed this to the fact that females may feel more personally threatened by computers than males do. This finding was also stated by Anderson, Welch, & Harris (1984). They suggested that one explanation for this phenomenon is that females gain less access to computers than males. The finding that males hold more positive attitudes than females has been reported in a number of other studies (Fetler, 1985; Lockheed, 1985 and Wilder, Mackie & Cooper, 1985). In a hospital worker survey, Thies (1975) reported that female respondents were significantly \( p<0.05 \) more negative than male respondents.

**Summary**

Most authors suggest either an applications course (i.e., use of word processors and data-based management linked to the remainder of the curriculum) or an applications software course to stimulate positive affective response in a broader range of students.
Winkle & Matthews (1982) and Jackson & Yamanaka (1985) demonstrated that women are anxious regarding the use of computers and that classes for these students warrant further investigation. Several studies show that female college students are more negative regarding computers than male college students. Desborough (1987) expresses concern that if nurses, who are primarily female, remain negative toward computers, then the handling of information, which can be seen as a manipulation of power, may be dispersed and not kept for and by nurses.

**Inservice Education, Training and Continuing Education**

Hospital orientation training sessions are a major component of the instructional strategy for training graduate nurses.

Zielstoff (1976) concluded that effective orientation is a critical aspect in the successful implementation of automated systems. She suggested that staff inservice difficulties are due to the large numbers of staff nurses who have varying learning needs and learning styles as well as different educational training prior to employment.
Continuing education faculty are also actively interested in teaching computer technology to nurses. Huckabay, Anderson, Holm & Lee (1979) tested the effect of computer-assisted learning on thirty-one graduate nurses who were enrolled in a nurse-practitioner course. A ten-item Likert type attitude scale measure was administered. The Spearman rank correlation test-retest coefficient was 0.6310 (p<0.01). Interrater reliability was obtained with agreement at 100%. Each hypothesis was tested by means of a t-test, significant at p<0.05, for significant differences between the two groups on the dependent variables. The hypothesis that computer-assisted instruction students would demonstrate affective behaviours at a significantly higher level than the control group was not supported by the t-test but the trend observed was in the direction of the hypothesis. The authors reasoned—that although the "faculty did not oppose outwardly the use of CAI in their course, it may have been apparent to the students that the teachers did not believe that CAI was worth the effort" (p.232).

Butters, Feeg, Harman & Settle (1982) described a two and one-half year inservice program that trained 1000 nurses for hospital computer use. One problem area noted was that, in class, the slower apprehensive learners became
frustrated while the faster learners became impatient and disruptive. These authors concluded that in these days of increasing health care costs, the amount of time and money to train the nurses could not be justified as being of sufficient benefit to the hospital. Due to high labour costs it was eventually decided to develop self-teaching methods for new staff and students at the hospital.

Ball, Snelbecker and Schechter (1985) showed that an inservice program can produce statistically significant changes in nurses' perceptions of computer usage. Utilizing a 24-item questionnaire, the authors collected data from two hundred and five nurses before and after the subjects attended a two-hour lecture and discussion on computer literacy. Of the seven items used to identify the facility of computers, "three changes were statistically significant at the reduced alpha level of 0.0021 and one exceeded the p<0.05 level. These changes reflected improved attitudes about uses of computers" (p.30).

In Bethesda, Maryland, Boykin & Romano (1985) provided educational instruction and support to hospital staff when a computer system was introduced into the nursing department. Training included a total of twenty-four hours in the classroom with individual follow-up support for two
weeks. As computer competency skills improved, nurses moved from blaming the computer to totally unrealistic expectations of the computer. More inservice programs became unnecessary. A Nursing Information Specialist was hired to meet affective learning needs. This confirms the statement by Chang (1984) that more dissemination of information is necessary.

Andreoli & Musser (1985) state that a disadvantage of the HIS for staff nurses is the time involved to actually learn the system. While actual classroom time may require only a few hours, an additional week of simulated bedside experience is often necessary. However, learning to interpret and trust the data may take longer.

In the March-April edition of Nursing Life magazine (1985), a recent American survey was reported. Three hundred and forty-one readers of this periodical responded. One hundred and sixty-eight nurses were using computers, and of these, 87% stated that computers were located in the nursing stations. The nurses felt that they had received inadequate training for a variety of tasks. The most discussed was input data order entry. Forty-four percent of the nurses were staff in hospitals under three hundred beds and most were diploma nurses. Some nurses reported
phobia for a few weeks when the hospital in which they worked initially went on-line.

Howard (1987) investigated the cognitive and affective gains by 97 registered nurses who held a baccalaureate degree in nursing. The subjects used a CAI software program which simulated a cardiopulmonary arrest and the events that occur just before and after the discovery of the patient. The subjects completed an adjective rating scale to assess attitudes in five areas: practical value, emotional appeal, dullness, interest value and difficulty. This is the same scale used by Kirchoff & Holzemer (1979) and is taken from Kelly, Pascarella, Chapman & Terezini (1976). The measure contained a four-point Likert scale with assigned values of one to four. The hypotheses tested were that a) the average rating for the dullness of the simulation would be less than 2.5 and b) the average rating for each of practical value, emotional appeal and interest value would be greater than 2.5. One-tailed and paired t-tests were computed to test the hypotheses. All four one-tailed t-tests were significant. At the p<0.001 level, the dullness factor had an average rating of 1.0. The nurses' attitudes toward the simulation were favourable. The author states that "attitudes are important when one considers the special needs of the adult
When evaluating methods aimed at meeting the learning needs of practising nurses, attitudes toward instructional methods cannot be underestimated.

Plummer & Warnock-Matheron (1987) studied the training of 1200 full-time Canadian nurses at Calgary General Hospital when an HIS was implemented. By including nurses and clerical staff together in a training program, the authors stated that they avoided speculation, and misinterpretation of computer potential and alleviated fears concerning security of employment. Here again, nurses with little experience at the keyboard were at a distinct disadvantage. Further prerequisite activity had to be developed before the learners could start the proposed training sessions. Although attitudinal change was not measured formally, the successful pilot project ensured that the initial implementation was successful and the benefits of computerization were disseminated throughout the hospital.

Desborough (1986) interviewed forty-five female nurses who used a computer in either acute or chronic care agencies across Canada. Most of the subjects were prepared at the diploma level with 20% at the baccalaureate level and 2% at the Masters level. All age groups were represented. Data from each interview were analyzed using the constant
comparative analysis technique. She found that introducing computers to an agency resulted in initial frustration and apprehension by the nurses. In some instances these perceptions remained for up to a year before increased efficiency was acknowledged. The diploma nurses had little experience using computers in other situations. Nurses without adequate training expressed concerns about their own inefficiency. "Most nurses who received a comprehensive training program commented that they were soon able to use the system efficiently and that this enabled them to carry out their nursing responsibilities more effectively" (p.150).

Gonzales (1987) reported that after judging software simulations which demonstrated a variety of nursing problems, five clinical specialists at Baylor University-Medical Center stated that the software was not appropriate for staff nurses. The hospital was heavily populated with new graduates and inservice training simulations were necessary. "The simulations expect more nursing autonomy than is realistic in the clinical environment" (p.5) and this poses a problem in a self-directed environment. The nurse educators in this setting were unable to use simulations with their 1200 employees when employing CAI. This reveals a need for staff nurse software suitable for their work environment.
Atack (1988) stated that teleconferencing among graduate nurses tends to familiarize students with computer technology and develops confidence and interest in the computer. She indicated that computer phobia is reduced, because "students view the computer as a tool for communication, rather than for mathematics, which for many is a threatening perspective" (p. 25).

Summary

Huckabay et al. (1979) and Howard (1987) both stated that positive attitudes toward computers are important for the adult learner in a graduate setting.

The literature demonstrates that with training, graduate nurses can achieve user competence and acceptance of HIS, with potential for increasing their efficiency with client care (Boykin & Romano 1985; Plummer & Warnock-Matheron 1987; Ball, Snelbecker & Schechter, 1985). Areas of concern for these programs include cost of the labour involved (Butters, Feeg, Harmon & Settle, 1982), meeting the needs of the participants with various learning styles, (Plummer & Warnock-Matheron, 1987) and lack of previous computer experience on the part of the learners (Desborough, 1987). These items of concern limit the expansion of hospital and agency training sessions.
Change

Change is represented by computer installation in a hospital setting. Hofmann (1971) reported that hostility, sabotage and other destruction should be anticipated when this change is implemented. Shires (1985) stated that "the constancy of change inherent in the implementation of HIS creates problems" for the users. They are uncertain about their coping with and benefiting from the impact (p.175).

Walleck (1975) showed that nurses who were assigned to a critical care unit utilized a computer monitoring system only after being assured that the machine would not replace the nurses.

Zielstorff (1985) stated that hospital administrators experience great difficulty with the continual need to try to find ways to effectively prepare and constantly update staff. Crecine (1986) also argued that uncertainty exists about what expertise will be required of the nurses as they participate more fully in the user capabilities of the HIS.

According to Janet Lord, Director of Nursing Science at York Central Hospital in Toronto, the greatest impact of the introduction of computers to nursing stations is that
the nursing profession perceived the technology as arousing anxieties and fears of the unknown (Labranche, 1987).

Myers (1986) discussed the effect of change on hospital employees at a suburban Canadian hospital during HIS implementation. She found that nurses who were involved in choosing computer equipment were more positive than those who were less involved in the decision making process. When the hospital began pilot projects for computer use on the nursing units, implementators involved nurses in change rather than subjecting them to it. This involvement led to less anxious employees.

Acceptance of Innovation

Change may occur with any innovation. Theorists involved in change include: Lewin (1951); Hall, Wallace & Dossett (1973); Hall & Loucks (1976); Houle (1980) and Rogers (1983). The conceptual framework for the present study is derived from Rogers (1983). He states that acceptance of innovation is a five-step process, which commences with the acquisition of basic information and continues through to the actual use of the concept. Ascension of the steps leads to a high level of acceptance. These main steps include: knowledge, persuasion, decision, implementation and confirmation. This can be visualized symbolically in the following figure.
FIGURE 1

Rogers' Five-Step Process


The user must pass through the first four steps before a true decision for acceptance can be made. This could be a model for student nurses and their acceptance of computers in their working lives.

The dissemination of knowledge is imparted through participation in various computer programs. This researcher suggests that a modified version of Rogers' model is possible with awareness as the bottom step. Before knowledge can be acquired, there must be acknowledgement that a deficit exists. This deficit can be determined by a survey such as the one undertaken in this study. Those who meet a predetermined standard of unawareness should then proceed to choose a course to meet
deficits. Courses which increase awareness globally of the uses of the computer in the hospital setting should be undertaken in students courses. Courses in the educational setting should assist the student to proceed to the persuasion stage. Rogers states that before the third stage of decision is reached there is usually momentum and enthusiasm. Without reinforcement, no decisions are usually made. Rogers emphasized that reinforcement at the third stage is necessary to convince individuals and groups of the rightness of their decision. Combined with other life experiences with computers, diploma student nurses might be expected to proceed to the decision phase but it would be more realistic to expect this phase after exposure to computers in the hospital setting. This would provide the reinforcement. It is conceivable that reinforcement could be provided by a peer group or a nurse-educator role model. The student nurse may or may not reach full implementation or step four while in the educational setting. This would be preferable and then confirmation may occur with the employing agency upon graduation.

At this time, the diploma nurses are only given the opportunity to reach step two. After extended exposure in the educational setting, student nurses should be aware of the advantages of computers in their personal lives and of
the uses on a regular basis. This study will not show
students beyond step one. With an awareness of this model,
nurse-educators could develop a computer course which could
meet the learners' need to accept change. A positive
change in attitude toward acceptance of the innovation may
be assisted by involvement. Increased knowledge of an
object may result in increased familiarity with the object
and therefore a decrease in feelings of anxiety and fear
surrounding that object. This anxiety could be measured by
a change in attitude toward the object, in this case,
computers in the nursing role.

Summary
One area of concern related to the use of computers is the
constant change produced by rapid technology development.
Nurses have difficulty accepting change due to inherent-
fears of the unknown as well as fears concerning job
security. An orientation which meets the needs of various
nurse populations is essential. Rogers' (1983) model may
provide a guideline for nurses in accepting innovation.

Computer Use in Nursing Education Settings
Bitzer & Boudreaux (1969) found that when lessons in
maternity nursing were taught, equal learning occurred by
students who used the computer and students who were taught
in a classroom setting despite the fact that the computer program group required less time to complete activities. Bitzer & Bitzer (1973) supported this view. Alderman, Appel, & Murphy (1978) concluded that the potential for CAI was not being realized.

Kuramoto (1978) suggested that students can experiment with responses to CAI without harm to the patient. This can be of considerable benefit in nursing education. Ronald (1979) concurred with the previous study that CAI provides students with relevant learning about a computer that may be applicable to their future professional and personal life. Oliveri & Sweeney (1980) agreed.

PLATO (Programmed Logic for Automatic Teaching Operations) was used by Kirchoff & Holzemer (1979) to teach postoperative nursing care. This study supported the hypothesis that CAI was as effective as other methods. The sample comprised 100 third year nursing students at the University of Illinois. Students were asked to learn material on the PLATO program. "Fifteen variables were entered into a stepwise multiple regression analysis with learning as the criterion variable. Students' perception of the degree of dullness of learning on the computer system was found to be inversely related to learning"
Attitudes were assessed by a 24-adjective rating scale (ARS) prior to and after a three-week period during which the subjects completed a unit on nursing care of a routine postop patient. After factor analytical development, five factor scores emerged on the ARS which were practical value, emotional appeal, dullness, interest value and difficulty. "Residual scores were calculated via regression analysis with the pretest score equivalent to the dependent variable and the posttest score equivalent to the criterion variable. Regression analysis calculates a predicted posttest score" (p.26). The variance within the data was examined by a Pearson correlation matrix. Of the fifteen variables, 13 were significant in explaining the variance of residual learning. The less dull the students perceived learning on PLATO, the more they learned.

The cost effectiveness of computer-assisted instruction was studied by Larson (1981). She found that students who utilized a computer simulation to learn intravenous rate calculations and regulation completed significantly more problems in a significantly shorter period of time (p<.01) than students who received traditional instruction.
Other studies have shown that CAI is effective as a teaching tool in nursing (Ronald, 1983; Conklin, 1983; and Murphy, 1984). Spector (1984) found that of the majority of nursing programs they surveyed, most would be introducing microcomputers to nursing schools within the year. She stated that the national average use of CAI in schools of nursing surveyed is 39.9%. Uses of microcomputers ranged from drill and practice to tutorials and simulation training. Faculty use the computer for ward processing and planning. It was found that computers are used for educational purposes but not as orientation to a hospital system (e.g., data base entry).

Chang (1986) examined the impact of CAI in nursing education. Twenty-one of the thirty research articles from 1966 to 1983 in which student attitude toward CAI was addressed were reviewed. Her findings regarding attitude suggested that the impact of CAI was generally inconclusive. However, she did suggest that perhaps the effects of novelty may have influenced the results. She did concur with other studies that nurses using CAI completed material in one third to one half the time.
The results of Bolwell's (1986) survey supported Thomas's (1985) conclusion. Both surveys examined the various uses of computers in nursing programs throughout the United States. Thomas found that only 27% of the Deans of the baccalaureate Schools of Nursing (N=157) reported current use of computers by faculty, staff and students. She also stated that results showed that incentives and provisions are needed for faculty development to aid computer receptivity and usage. Eighty-nine percent of deans surveyed reported that lack of faculty skills was a very important deterrent to implementation. Several respondents to her survey replied that computing was not compatible with their curricula.

Bolwell (1986) found that 54% of the 102 respondents were using CAI. This represents a substantial growth in two years, in spite of factors reported by educators as inhibiting the growth of micro use. Nurse-educators in hospitals reported that their use of micros was curtailed by the cost of hardware and software.

In her study of administrators of baccalaureate-level accredited nursing programs, Murphy (1984) identified similar barriers to increased computer use. In 1986, Hebda surveyed 441 National League for Nursing accredited
baccalaureate Schools of Nursing. She reported that, from 339 returned surveys, 164 were using CAI. Ninety-two percent of these schools were using commercially developed software.

The Canadian study of Day & Payne (1987) surveyed 99 first year baccalaureate students at the University of Alberta. A quasi-experimental design was used to assess the difference between groups on cognitive performance between those who completed the Computer managed instruction and those who received the traditional lecture. The learning theory involved a Health Assessment course. Results revealed no significant difference (p>0.05) between groups as measured by written and practical examination scores. Among the variables examined were the learners' attitudes toward the instructional strategy. An attitude —— questionnaire consisting of a semantic differential scale was administered prior to and after the unit. The mean scores of the students on the attitude scale demonstrated that the students found CMI to be "less useful, less appropriate, less stimulating, more disturbing, less enjoyable, less satisfying and ineffective" (p.34).
Attitudes of Nurse Educators in the Educational Setting

Stevens (1980) reported that resistance to learning computer skills and lack of desire to accommodate necessary classroom and curriculum changes exists.

Ronald (1983) indicated that while faculty had a positive attitude toward the efficiency of computers and recognized their importance to society, they were less positive in their willingness to use and accept computers in teaching nursing. Results of a survey of one hundred and fifty-nine nurse-educators who completed a learning needs assessment showed a low level of knowledge about computers and a desire to focus on the use of computers in education.

Gothler (1985) found that fifty percent of all nurse training programs surveyed had few faculty prepared to integrate computer applications into their nursing courses. With a response sample of 1559 out of the 1684 population of nursing education programs in the U.S., eighty-eight percent of those facilities who do not employ a teacher for computer applications had no plans to do so.

Armstrong (1985) concluded that the most important use of the computer as seen by nurse educators was as a tool. Fifty-six nurse educators were asked to judge forty-five
present computer competencies and forty-four future computer competencies for nurse educators.

Thiele & Baldwin (1985) stated that faculty were less knowledgeable than the students when the authors initiated a hands-on orientation to the use of computers in health care facilities.

A study by Lindseth (1986) utilized a true experimental design to study undergraduates' attempts to master safe medication administration skills and theoretical knowledge levels. Mean differences were minimal between the methods of instruction. The control group and CAI group sought extra texts and resource manuals and viewed other audiovisuals because they thought they were being disadvantaged. Faculty who observed these groups "expressed concern over usage of the computer at the student's (sic) expense" (p. 58). A need for more faculty orientation to CAI was apparent by the negative responses to the newer teaching strategy.

**Summary**

In many studies, CAI and PLATO have been shown to be as effective as other teaching strategies in the transfer of cognitive skills. It is less time consuming. Studies of attitudes toward CAI are reported by Chang (1986) as being inconclusive. The use of microcomputers in use in schools of nursing continues to increase.
While nurse-educators see use of the computer as a tool in the nursing profession as important, they are not encouraged by administration to become more knowledgeable and some still view CAI as disadvantaging students.

**Attitudes of Baccalaureate Student Nurses**

Day & Payne (1984) used a quasi-experimental design and an Attitude Questionnaire semantic differential scale rating with posttesting. They found that 54.9% of their baccalaureate students (n=82) preferred traditional lecture to the CMI format. When student attitude was measured by Dixon & Judd (1977) the analysis of results revealed that the subjects were less resistant to the CMI format. Day & Payne suggested that this effect was due to the initial orientation structure. They concluded that the orientation sessions to computer training should not be underestimated. This finding is supported by Thiele & Baldwin's (1985) study of a hands-on orientation to Apple computers for senior baccalaureate nursing students. The learners were placed in the role of new employees being oriented to "Computerville Regional Hospital". One half of the students admitted avoiding computers prior to the laboratory demonstration program. Upon evaluation of the program, one hundred percent agreed that the initial goal
of viewing the computer as a valuable tool for providing nursing care was met.

Ronald (1979) found that undergraduate student nurses were very negative toward the use of computers in the beginning of their training; however, they later reported it as one of their most valuable learning experiences. Some researchers suggest that part of the negative attitudes may be explained in terms of the types of training experiences provided in the initial computer courses. Original "Computers in Nursing" courses did not include "hands-on" experience but were simply sessions discussing computers (Ronald, 1979; Armstrong, 1986).

Neil (1985) compared CAI with reading by observing attitude differences toward instructional methods for two groups of learners. Thirty-two student nurses received a score on the affective measures scale used by Huckabay et al. (1979). Results were subjected to nondirectional t-testing, yielding a nonsignificant difference (p>.05). The hypothesis that student attitudes toward CAI and reading material would be the same for both groups was not rejected.
Skiba (1985) stated that a "hands-on" experience is critical in order to induce more positive attitudes. Few articles address any specific examples of interactive computer experience. This strategy is not consistently being employed, yet Skiba states that "without this component, nursing education will not....meet the challenge of integration" (p.583).

Paulanka (1986) administered a two-page attitudinal instrument to 109 third year nursing students enrolled in a psychopharmacologic nursing course at the University of Delaware School of Nursing. Findings revealed that most of the students did not enjoy working with PLATO. "Analysis of the attitudinal items showed that this group exhibited low levels of motivation and minimal expectations for achievement" (p.250). Findings were considered significant p<0.10. "More than four-fifths of the students viewed their lack of technical skills as a source of frustration" (p.249). When the high scores were subjected to chi-square analysis, it was found that the students making better marks liked the PLATO system because it was perceived as less likely to cause embarrassment in the event of a mistake. The low levels of motivation were attributed to the fact that many students procrastinated until the last two weeks of the program to complete the assignment.
Paulanka concludes that nursing educators should provide more attention to the needs and attitudes of individual nursing students.

Day & Payne (1987) replicated their previous study which examined CMI and lecture format in order to determine if the attitude and cognitive learning of health information by first year nursing students was influenced by the mode of teaching. The replication results showed that students again preferred traditional learning strategies and were more comfortable with teacher-directed activities than computer managed learning activities. No significant difference (p>0.05) was found between groups on cognitive test performance but results of an Attitude Questionnaire using a semantic differential point scale indicated that 46 percent wanted either less CMI or none at all and 51 percent found CMI useless in helping them learn content. The authors concluded that first year students require more interaction and feedback than the computer provides and either CAI or a combination of teaching methods would be more appropriate. Results obtained in similar studies by Ludwig (1987) and Ostmore, Van Hoozen, Scheffel & Crowell (1984) support this conclusion.
Ludwig (1987) sampled 185 volunteer students from eleven schools of nursing and found that 57 percent of the students preferred lecture format over CAI for learning new material. Seventy-four percent of these students preferred CAI over programmed instruction and small group discussion. There was no significant relationship between learning style and CAI preference. Mean age of the group was 26. These results suggest that it is important to consider teaching strategies that match content expectation and student needs such as individual differences among the learners.

Darla and Moran (1985) state that in the 1990's "the new graduate will no longer be courted by the hospitals; rather she will have to sell herself" (p.27). Nursing education needs to prepare students for the new job market where "every nursing station will have a computer" (p.26).

Clark, Sheafor & Crain (1984) stated that integration of CAI programs into nursing courses was a contributing factor in assisting the school's nursing graduates to move into clinical agencies quickly with a minimal orientation.

Soja & Lentz (1987) found that an elective in-hospital computer course for student nurses resulted in self-reported enhanced self-confidence and decreased
computer fear. As well, when students' charting no longer had to be entered on computer by faculty members, the faculty were each saved 1-3 hours per week.

Gaston (1988) compared the effects of CAI and lecture upon knowledge, retention and attitudes of baccalaureate nursing students. She used a two-group posttest design (Phase 1) with a second posttest eight months later (Phase 2). The null hypothesis that there will be no significant difference \( (p>0.05 \text{ NS}; \ df 41; \ t - 0.63 \text{ NS}) \) toward CAI of students instructed by CAI or lecture was supported. Attitudes did not change from Phase 1 to Phase 2. The CAI group used an interactive tutorial concerning a nursing research problem and the lecture group received the same material via overheads. Attitudes were measured by a seven-point Osgood semantic differential scale. Student-attitudes toward CAI were positive, confirming previous findings (Bitzer & Bitzer, 1973; Bratt & Vockell, 1986). She concluded that attitudes of the orientation faculty or the orientation content may be critical factors in developing positive student attitudes toward CAI. These latter effects have not been investigated.
Summary

Several studies (Day & Payne, 1984; Paulanka, 1986; Ludwig, 1987) indicate that university educated student nurses prefer traditional lectures to CMI and CAI while other studies (Gaston, 1988) demonstrate that CAI evokes positive attitudes. The study by Neil (1985) did not indicate a significant difference in attitude between nurses who learned using CAI and those who read the same material. It is important for nurse-educators to develop hands-on relevant computer orientation programs that meet content needs and individual learning styles in order to foster positive attitudes in nursing students.

Attitudes of Student Nurses in Diploma Schools

Rosenberg, Reznikoff, Stroebel & Ericson (1967) indicated that diploma student nurses held the most negative attitudes toward computerized nurses' notes when this method of recording was introduced at the hospital. In an experimental design, the group exposed to computers changed attitudes more substantially than the non-exposed group (p<.001, df 25, t=5.13). Data reflected a significant shift in a favourable direction in the exposed group. The shift in the non-exposed group was not significant (p=NS, df=27, t=0.99).
Bitzer & Boudreaux (1969) who used CAI in the classroom found that negative attitudes became positive when computers were used as a teaching aid.

Happ's (1983) study to determine if previous exposure to automation influenced knowledge concerning computers, correlated the variables of experience with computers, and knowledge about computers. Results of data retrieved from thirty-nine female student nurses who responded to a twenty-item questionnaire showed no significant ($p < .05$, df 37) relationship among the two variables. The study implies that past experience should have no great importance when planning for computer education of nurses. It was found that the students were concerned that the humanistic quality of nursing would deteriorate with machines. Fears of decreased quality of care were expressed by the majority of respondents. "Readiness to become computer-literate ...... will have to come from other sources than the nurses' current state of experience" (p.32).

Hamby (1986) compared the effectiveness of lecture and work sheets to lecture and CAI and found no difference in knowledge of vocational nursing students. She reported that students who used CAI had the more positive attitudes
but concluded that results were due to the disappointment of lecture and work sheet group not being able to use and evaluate the CAI.

Schleuterman, Holzemer & Farrand (1983) reported no preference between CAI and paper-and-pencil simulations.

Zemke (1984) states that people with a tendency to become anxious in other situations such as test taking and facing changes in their lives also tend to become anxious about computers. Students, especially adult learners, learn best when they can draw on past experience. There are few similar experiences to use as background with computers.

It has been shown that other students in college programs using computers are more amenable to computer use (Tsaï & Pohl, 1978). In a study with 45 college students who were separated into three instructional groups (CAI, lecture, and computer plus lecture) it was found that there was a significant ($p<0.05$) difference in favour of automation.

Kulik, Kulik & Cohen (1980) utilized a meta-analysis approach and investigated 59 independent studies on computer-based and conventional teaching in the college setting over a ten-year period. The conclusion was that
college students tend to like their subject matter and courses somewhat more when the instruction is computer-based.

Summary
The literature shows that student nurses are negative or indifferent to the use of computers in hospitals and schools of nursing. Students in other college programs are more positive in their perceptions of computer use. It would appear that diploma student nurses are more susceptible to computer problems than other college students. Diploma student nurses are concerned about using computers for patient care but not ready to become computer literate (Happ, 1983). Exposure to computer use can result in a statistically significant positive difference (Rosenberg et al. 1967; Bitzer & Boudreaux, 1969; Hamby, 1986).

Summary of Chapter Two
The literature reviewed in this section has focused on the attitudes of nurses as users of computers, both in the hospital and in the educational setting. Clearly the findings demonstrate that when a hospital information system (HIS) is to be instituted or when computer-assisted learning is to be introduced in an educational setting, it
is important that the change be implemented carefully. Attitudes can significantly influence an individual's response to products (Shaw & Wright, 1967). The results of attitude testing of the potential users may alert hospital administrators and nurse educators to potential problems which may arise as a result of computer usage. Satisfactory solutions may then be pursued.

Nurses, as a group, have generally been found to be resistant to computerization (Startsman & Robinson, 1971; Farlee & Goldstein, 1971; Thies, 1975; Melhorn, Legler & Clark, 1979; Jordan-Marsh & Chang, 1985). This negative or indifferent attitude has resulted in little commitment to computer usage and therefore, slower adaptation in hospital use by the professional nursing staff - an event not foreseen by computer implementors. While increased experience with computers has led to greater receptivity by hospital nurses (Krampf & Robinson, 1984; Chang, 1984), areas of concern continue to be addressed by nurses. These include being replaced at the bedside (Walleck 1975) and fear of the unknown (Labranche, 1987). Ball, Snelbecker & Schechter (1985), Brodt & Stronge (1985) and Plummer & Warnock-Matheron (1987) demonstrated that educational preparation can assist graduate nurses to attain positive computer attitudes. Since it has proven expensive to teach
computer use in the hospital setting (Butter et al. 1982), the onus to develop computer-literate nurses has been passed to nursing education.

Programs in place range from CAI at 39 percent of nursing schools surveyed (Spector, 1984) to one semester courses (Thompson, 1987) to none. In response to Thomas' (1985) survey, several schools of nursing replied that computers were not compatible with their curricula. According to Thomas (1985), the potential for computer use by students is not being realized at the present time. It has been argued that faculty members at schools of nursing are neither prepared with the necessary skills (Gothler, 1985; Thiele & Baldwin, 1985) nor affectively willing to use computers in the curriculum (Lindseth, 1986; Stevens, 1980). Resistance by students has been documented. Studies show that both baccalaureate and diploma student nurses prefer traditional methods of instruction (Day & Payne, 1984; Day & Payne, 1987; Paulanka, 1986; Ludwig, 1987).

Bitzer & Boudreaux (1973), Ronald (1979) and Gaston (1988) stated that after their computer experience students' attitudes become positive. It has been suggested that hands-on experience is vital to effect change in computer
attitudes (Skiba, 1986). The profession of nursing is still primarily female-oriented, and females have been shown to be disadvantaged when introduced to computers (Winkle & Matthews, 1982; Howlett, 1986). Classes for these computer users need to be implemented (Jackson & Yamanaka, 1985). Students with a computer background are readily employable and have increased self-esteem after classes (Soja & Lentz, 1987). In order to meet the computer knowledge needs of student nurses and adjust a curriculum to reflect their learning styles, it would seem important to know which students might require the most assistance with this technology.

Studies show that an attitude assessment questionnaire can provide efficient and accurate data to which educators can respond with planned intervention strategies designed to meet students' needs in terms of computer acceptance and use. The literature demonstrates that as more knowledge is gained about the type of computer programs to which student nurses respond, then the nursing schools can adjust their curricula and graduate computer-literate nurses for the 1990's marketplace. This paper attempts to assist in this endeavor.
CHAPTER THREE

Method

Subjects

The subjects selected for this study were second year, female student nurses enrolled in three different community colleges in Ontario. Figure 2 indicates the locations of the Ontario community colleges. Figure 3 indicates the relationship of the colleges under the aegis of the Ministry of Colleges and Universities. Thirty subjects from an available population of 315 diploma students were randomly selected from each college. The College A population was 65, College B was 196 and College C was 54. Table 1 provides demographic information about the subjects.

Students from College A (Program A) were selected as the treatment group because of the curriculum which has an existing computer program in place. The students receive a sixteen-week (one semester) course on word processing in
MINISTRY OF COLLEGES AND UNIVERSITIES ORGANIZATION CHART WITH SPECIFIC REFERENCE TO COLLEGE AFFAIRS BRANCH

MINISTER

DEPUTY MINISTER

ASSISTANT DEPUTY MINISTER

DIRECTOR UNIVERSITY RELATIONS BRANCH

DIRECTOR COLLEGE AFFAIRS BRANCH

DIRECTOR STUDENT AWARDS BRANCH

GENERAL MANAGER OPERATIONS

ADMINISTRATION SECTION

FINANCE SECTION

EVALUATION SECTION

COLLEGE SYSTEMS SECTION

FRANCOPHONE AFFAIRS

COLLEGE PROGRAMS SECTION

STAFF RELATIONS/ BENEFITS
groups of ten with two hours per week per student being the norm. Students are able to complete assignments for the nursing course and receive marks in both the computer course and the nursing course. Oral and written testing is done. The course is required and is not an elective.

This college (Program A) is located in a large suburban area adjacent to Toronto. The students use five hospitals as settings for clinical experience. Two of these hospitals have computers in the nursing stations at present although only one hospital is fully functional in using a HIS. The students have not been able to use the computers because specific pilot studies are being undertaken on some floors in one hospital and in other only the clinical teacher has been able to complete the time commitment for a full week's orientation. Also, the problem of student--passwords has yet to be solved. The staff assist the students, if access to the computer for input or data collection is necessary. Only eight students from the total population at College A have been exposed to this latter clinical setting.

College B (Program B) is located in the north end of an established metropolitan area of Toronto. During the current semester, Program B students were introduced to a
computer-assisted instruction (CAI) package. The school of nursing had purchased thirty-six pieces of software related to various components of the students' programme. The experience involved manipulating software programs encompassing a diversity of patient problems affecting nursing. Titles of the software ranged from Urinary Problems, to Maternity Simulations, to Care of a Patient with a Cleft Palate. These software simulations were available for student use in the Computer Application Learning Laboratory (C.A.L.L.) using the Janet 3 network system. This C.A.L.L. opened in February, 1985. In the weekly timetable, each group of students was given an orientation to the "hands-on" computer lab. Then the students were instructed that they could use the lab on their own time during the evening or weekend. The Health Science Division has access to the lab only three days-a-week for scheduled time tabling. Students were assumed to be self-directed. A student monitor would record the software use in a log book. All the students in the general population did not take advantage of the software provided. All the students in the sample group did attend the C.A.L.L. on one or more occasions. There is no testing of computer knowledge although the record book in the computer lab may be checked. None of the hospitals used by the nursing students for clinical experience has computers in the nursing station.
The students in the control group attended College C (Program C). This college is located in a "bedroom" community physically furthest from Toronto. The students attending this college are taught a standard nursing curriculum with no computer instructional component. Several of the faculty have word processors in their offices. There are other disciplines on campus using computers, but none of the hospitals designated for clinical practice are computerized.

**Instrument**

The subjects were invited to respond to a modified twenty-item questionnaire which featured a Likert-type scale response modality. The original instrument was developed by Stronge & Brodt (1985) and was designed to gain information about graduate nurses' attitudes toward various aspects of computerization within the context of in-hospital use (Appendix A). Permission for use was granted by the senior author (Appendix B). Reliability and validity data were determined on the basis of responses provided by sixty faculty and student nurses in a pilot study conducted in 1984 in Illinois. A Spearman Brown Split-half reliability coefficient was reported at $r = .90$. Content validity involved identification and assessments of six major topics relative to computerization of nursing
tasks. These included time, patient care, record keeping, job security, ethics and the law and cost. A panel of expert judges made recommendations.

The questionnaire used in this study was adapted in the following ways:

Question 1: - A computer increases costs by increasing the nurses' workload.

Adapted - Only a few nurses will need to learn how to use computers.

Question 4: - Part of the increase in cost of health care is because of computers.

Adapted - Computers are probably more useful to professions other than nursing.

The replacement of the original items by items from a questionnaire by Ball, Snelbecker & Schechter (1985) was warranted, as hospitalization costs have no relevance for the Ontario student nurse. Other items, question eight, fifteen, sixteen and eighteen were revised to reflect the decreased experience of the student nurses with hospital procedures such as hospital orientation and hospital nursing data.

Question 8: - Computerization of nursing data offers nurses a remarkable opportunity to improve patient care.

Adapted - The use of a computer should result in better patient care.
Question 15: - Orientation for new employees takes longer because of computers and, therefore, unnecessary work delays occur.

Adapted - It takes as much time to maintain patient records by computer as it does by hand.

Question 16: - Nursing data does not lend itself to computers.

Adapted - A computerized record of nursing notes is usually more accurate than a hand written record.

Question 18: - The more computers in an institution, the less number of jobs for employees.

Adapted - Using computers in a hospital is likely to put a lot of nurses out of work.

Validity

These revisions were piloted and referred to expert judges for verification of content analysis. Face validity of the revised version was judged to be acceptable by a panel of five judges who had previous experience with research methods, a background knowledge of hospital computer use and also an awareness of the machinations of diploma student nurses.
The internal consistency was not reassessed. Stronge & Brodt (1985) reported the interrater reliability on the original questionnaire at 0.55.

Test-retest analysis was employed with a sample of 20 first year female student nurses. The instrument was administered at one week, two weeks, and three weeks. The test-retest method employed in this study is supported by Gay (1981) who argued that one week is too short and one month too long when assessing reliability by the test-retest method (p. 118). The results from this sampling yielded a reliability of 0.39.

The Ball, Snelbecker & Schechter (1985) scale had four questions which were significant at the p<.05 level and these were included in this study. Gay (1981) states that Likert scales are used more frequently than Thurstone or Guttman scales. This author also states that while the researcher can never be certain that the individual is expressing his or her true attitudes rather than a "socially acceptable" attitude, the honesty of the responses will be increased if appropriate direction is given to those completing the instrument (p. 128).
The final questionnaire required that respondents indicate their first reaction to the question by selecting the appropriate response to each of twenty statements. Additional space for comments was provided. Demographic data were included on the last page. This included age, experience working with computers, previous computer courses, and use of the computer for CAI. Note that this latter query was added at the request of College B in return for access to the college.

Caveat: Individual student profiles with scores are not displayed since the schools used requested that such data were not to be made available.

Design

A pretest-posttest procedure was employed. For the purpose of this study, which utilized a random sampling procedure, College A nurses who were enrolled in a computer literacy course were considered the treatment or Program A group. College B nurses who have several hours of access to computers used for Computer-Assisted Instruction (CAI) are used for comparison as the Program B group. College C nurses are identified as the control group or Program C since there are no computers used in this nursing program.
The nurses were matched for pre- and posttesting but as the caveat implies, the individual scores are not displayed with individual student profiles.

Procedure

During the weeks of December 6th, 1986 and April 20th, 1987 the students were surveyed. The former week was prior to first semester final examinations and the beginning in January of the sixteen-week computer literacy course at the treatment College A. The latter week was the last week that the control group would be available before semester two final examinations and summer vacation dispersal. The semesters are equal at the colleges but College C omits "Spring Break".

Instruction

The students were asked to read the covering letter (Appendix A) for an explanation regarding the purpose of the study and the right of the subjects to refrain from participating. It was anticipated that each person would be able to complete the questionnaire in twenty minutes.

The survey was administered and supervised by the researcher in each instance but one. One section of College A students during the pretest phase was given the
survey by a colleague who had previously obtained her M. Ed. from Brock University and thus understood research requirements. The students were asked for their assistance verbally, and, as well, were asked to read the covering letter. They were informed that this study might advance nursing research and that their college would receive a report of the results. In all instances, the teacher of the participating class was present and introduced the researcher.

The researcher made every effort to increase honesty by giving appropriate directions to and a standarized environment for those completing the questionnaire. The researcher has no evaluative or teaching function with any of the respondents. This should avoid the common tendency to select responses that are the most socially acceptable.

The contamination mentioned by Oppenheim (1966) was not apparent at the time of administration of this questionnaire. In enlisting cooperation for the questionnaire, respondents were given assurance of anonymity.
Method of Analysis

The responses to the twenty statements included in the questionnaire were assigned a value of one through five as follows: 1=strongly disagree; 2=disagree; 3=uncertain; 4=agree; and 5=strongly agree. The assigned values were inverted for negative statements which were questions 3, 8, 12, 14, 17, and 19. A range of twenty to one hundred points was possible on the questionnaire with twenty being the least favourable.

The computer program used for analysis was EPISTAT version 3.0 (1984) which is in the public domain for the IBM-PC. It is a collection of programs written in BASICA for statistical analysis of small to medium-sized data samples. The user must have some familiarity with required data. Common statistical tests or functions are performed. ---

Statistical analysis in this study includes the mean, and standard deviations of the populations sampled as well as student's t-test and one way analysis of variance. Raw scores for each question were analyzed for each group and general descriptive statistics were determined. As well, standard deviation and variance were calculated for each question. Furthermore, t-tests were employed in order to determine any trends.
Summary
Second year female diploma nursing students attending three suburban Toronto community colleges were surveyed in a pretest-posttest experimental design in December, 1986 and April 1987. They were asked to complete a Likert-type questionnaire concerning their attitudes toward the use of computers in the nursing role. The adapted questionnaire was previously assessed for content validity and by a test-retest method for reliability. The sample population was randomly determined. Questionnaires from thirty students from each college were matched. The community colleges were chosen on the basis of their curricula. Program A had a computer word processing course in place, Program B had just introduced CAI and Program C had no computer component. Statistical analysis was completed using ANOVA and the students' t-test. Demographic data and descriptive statistics are provided.
CHAPTER FOUR

Data Analysis and Results

Introduction
In this chapter data are presented in both numerical and graphic form. Demographic data are examined (Table One). Descriptive data are identified (Table Two). Results of t-test between groups are examined (Table Three) and then results of ANOVA (Table Four) are presented. T-tests were also employed to analyze each survey question. The results of this data are displayed (Tables Five, Six, Seven) and discussed. Comparison of answers to six survey questions of particular interest to student nurses is illustrated and examined. Results of the three proposed hypotheses conclude this chapter.

Demographic Data
The majority of students who attend College A are in the age range of 21-24 years (Figure 4). The number of these students previously exposed to computers was twenty-one or seventy percent of the sample group.
Fourteen or 46.6 percent of this sample group stated that they had completed a computer course in high school (Figure 5). The type of computer course previously taken was not required information on the demographic portion of the questionnaire.
TABLE ONE

DEMOGRAPHIC DATA

<table>
<thead>
<tr>
<th></th>
<th>COLLEGE A</th>
<th>COLLEGE B</th>
<th>COLLEGE C</th>
</tr>
</thead>
<tbody>
<tr>
<td>TREATMENT GROUP</td>
<td>C.A.I.</td>
<td>GROUP</td>
<td>CONTROL</td>
</tr>
<tr>
<td>ACTUAL</td>
<td>ACTUAL</td>
<td>ACTUAL</td>
<td></td>
</tr>
<tr>
<td>ACTUAL %</td>
<td>ACTUAL %</td>
<td>ACTUAL %</td>
<td></td>
</tr>
<tr>
<td>AGE</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17-20</td>
<td>12</td>
<td>7</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>40</td>
<td>23.3</td>
<td>43.3</td>
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<td>21-24</td>
<td>12</td>
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<td>9</td>
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<td></td>
<td>20</td>
<td>46.6</td>
<td>26.6</td>
</tr>
<tr>
<td>Previous Computer Course in High School</td>
<td>14</td>
<td>46.6</td>
<td>3</td>
</tr>
<tr>
<td>Previous Experience with Computers</td>
<td>21</td>
<td>70</td>
<td>1</td>
</tr>
<tr>
<td>C.A.I.</td>
<td>N/A</td>
<td>Pre 21</td>
<td>70</td>
</tr>
<tr>
<td></td>
<td></td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Post 30</td>
<td>100</td>
</tr>
</tbody>
</table>
Program B students are represented by a greater percentage of students over 25 (Figure 4). The higher number of students in the upper age range may indicate a larger number of self-supporting students who have part time employment and therefore less time to spend on school work outside of class time. Also, College B students have less previous computer experience than students at College A. Only one or 3.3 percent of the sample group indicated prior computer experience (Figure 5). This reflects the fact that these students were in the work force prior to the introduction of computers in the Ontario school system.

The students attending College C were similar in age to those students receiving Program A (Figure 4). Twelve—students (40%) stated that they had some previous computer experience (Figure 5). Twelve (40%) of College C students selected a computer course in high school. This is only 6.6 percent less than the group from Program A.

Descriptive Statistics

Statistics which include the mean, median, standard deviation and variance were calculated for each group separately (Table 2). Data are graphically illustrated in
Figure 6, Figure 7, and Figure 8. When the pretest sample groups were compared statistically according to raw scores on the questionnaire, the mean for Program A was 73.53 with a standard deviation of 11.59291 while Program B had a mean of 67.26 with a standard deviation of 9.627294 and Program C had a mean of 65.63 with a standard deviation of 10.90502. Results showed a median of 76, and scores which ranged from 54 to 95 for Program A; a median of 67.5, and a score range of 52 to 87 for Program B; a median of 65.5, and a range of 45 to 90 for Program C. The range of responses in College C is broader.

When each sample of posttest raw scores is compared to the pre test format, it is apparent that the means, standard deviations and medians have changed (Figure 6).
Figure 5

Program A

Program B

Program C

Previous Computer Experience

Previous with Computer Experience

Demographic Data
### TABLE TWO

**Descriptive Statistics for Diploma Nurses**

<table>
<thead>
<tr>
<th>PROGRAM</th>
<th>MEAN</th>
<th>MEDIAN</th>
<th>STANDARD DEVIATION</th>
<th>VARIANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre</td>
<td>73.53</td>
<td>76.0</td>
<td>11.59291</td>
<td>136.3956</td>
</tr>
<tr>
<td>Post</td>
<td>73.96</td>
<td>75.0</td>
<td>8.434267</td>
<td>71.1263</td>
</tr>
<tr>
<td><strong>B</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre</td>
<td>67.26</td>
<td>67.5</td>
<td>9.627323</td>
<td>92.6853</td>
</tr>
<tr>
<td>Post</td>
<td>70.66</td>
<td>70.6</td>
<td>8.116972</td>
<td>65.8852</td>
</tr>
<tr>
<td><strong>C</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre</td>
<td>65.63</td>
<td>65.5</td>
<td>10.90502</td>
<td>118.9195</td>
</tr>
<tr>
<td>Post</td>
<td>63.83</td>
<td>63.0</td>
<td>12.66976</td>
<td>160.4884</td>
</tr>
</tbody>
</table>

Total Population = 30 for each pre and post testing group.
The mean test scores of the three groups and the changes over time are illustrated in Figure 7.

The posttesting results reveal that the mean (X) for Program A was 73.96, standard deviation (SD) 8.43, with a median of 75 and a score range of 57 to 91. Program B now has a mean (X) of 70.66, S.D. 8.11, median of 70.6 with scores ranging from 50 to 96. Program C has a (X) of 63.83 with a median of 63, SD of 12.66 and a range of response scores from 34 to 96. The range of responses from Program C is now more polarized than in the other programs and there is a difference in the standard deviation to indicate this (Figure 7). The mean has decreased by 1.8, indicating less positive responses. Program B mean has increased by 3.4 with a similar median change indicating a more positive response on the scores. Program A scores have become more positive by .13 and the standard deviation has decreased to 8.43. This change of 3.15 in the College A SD is important to note as it may indicate that the program met the needs of some students.
This change is not as apparent in the other two college results. Program B and C SD changes were changes of 1.51 and 1.76 respectively. While the SD at College B became narrower as might be anticipated with a group receiving a new program, the SD at College C widened. This may be indicative of the fluctuating or increasingly negative opinions of the subjects who were again asked to comment on a survey but had received no other knowledge or treatment except time in the interim.
FIGURE 7
MEAN TEST SCORES OF THREE GROUPS OVER TIME

Pre Test Time

- WORD PROCESSING GROUP - COLLEGE A
- CAI GROUP - COLLEGE B
- CONTROL - COLLEGE C
Figure 8

Pretest and Posttest Standard Deviations of Three Groups
ANOVA Results

ANOVA confirmed and revealed significant differences between the pretest and posttest samples.

When pretesting scores were subjected to ANOVA, the mean score \((X)\) of the students in Program A was 73.53, program B \((X)\) was 67.2 while Program C \((X)\) was 65.6. With \(p<0.05\), the results of the three groups are shown in Table Five. The mean variance is 115.33 and the variance of means is 17.28.

The means of these samples are significantly different. Table Three shows the differences between each group on pretesting.

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Means Squares</th>
<th>(F) Ratio</th>
<th>(p^*)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between</td>
<td>1037.188</td>
<td>2</td>
<td>518.594</td>
<td>4.49</td>
<td>1.38</td>
</tr>
<tr>
<td>Within</td>
<td>10033.97</td>
<td>87</td>
<td>115.3329</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>11071.16</td>
<td>89</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\(p<0.05\) The means of these samples are significantly different.
The ANOVA comparing the posttest scores of the three programs indicated the means of the samples were significantly different \((p<0.05)\). The mean variance is 99.17 and the variance of means 26.71. Table 4 shows posttest results. Data analysis indicated that the means of the students attending College A and B were significantly different from those of the students attending College C.

**TABLE FOUR**

ANOVA of Student Nurses' Attitudes Posttest (3 Groups)

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Squares</th>
<th>F Ratio</th>
<th>p*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between</td>
<td>1602.719</td>
<td>2</td>
<td>801.3595</td>
<td>8.08</td>
<td>6.04</td>
</tr>
<tr>
<td>Within</td>
<td>8627.781</td>
<td>87</td>
<td>99.1698</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>10230.5</td>
<td>89</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*\(p<0.05\) The means of these samples are significantly different.

In reviewing the statistics, an analysis of covariance (ANOVA) might have been used had we been able to identify the students individually.
**T-Test Results**

The scores on the questionnaire of the three groups of second year diploma student nurses were analyzed. The student's t-test (two-tailed) which involves computing the ratio between experimental variance and error variance was attempted since the sample size was small. The scores of the groups were analyzed using a t-test for paired samples.

When the pretest descriptive statistics data of the three groups were subjected to the student's two tailed t-test format, a significant difference between the means of Program A students and the Program C students was revealed \((p<0.05, df = 58, t = 2.7)\). Table Five shows the differences in pretesting with t-test results.

Demographic study does not indicate any differing criteria that might indicate why College A, B, and C students are not more similar on pretesting. The minimum requirement for entrance to a diploma school of nursing is an Ontario Secondary School Diploma with two sciences taken at the Grade 11 or 12 level. All programs expect this standard to be met. Proximity to a major tertiary care hospital center is one explanation. Program C students are furthest away
from a major health centre. The total population of the school of nursing of College C is about 13% less than College A with the resulting decrease in faculty members. This might result in a decrease in numbers of faculty who might reasonably be expected to be interested in or aware of computer use in nursing. The College B student intake is 100% higher than either College A or B with a larger faculty. The total pool of students from which each class is chosen is unknown. Each community college tends to admit the students of the surrounding counties first with those in other counties being accepted in turn. Program B students differ in age and degree of previous computer experience from both Colleges. While they might be expected to be different from both College A and College C, this is not the case. When reviewing the numbers statistically, there is a large difference on t-tests — between Program A and C while there is a barely significant difference between College A and B students. The increased awareness of computers in the nursing role by the Program A students may be a result of their proximity to the two hospitals undergoing computerization, even though the students were unable to use them.
TABLE FIVE

Results of Students' T-test (Two-tailed) Pretest

<table>
<thead>
<tr>
<th></th>
<th>t-test</th>
<th>p*</th>
<th>Means</th>
<th>Variance</th>
</tr>
</thead>
<tbody>
<tr>
<td>PROGRAM A</td>
<td>2.27</td>
<td>2.64</td>
<td>73.53</td>
<td>134.3956</td>
</tr>
<tr>
<td>PROGRAM B</td>
<td>67.26</td>
<td></td>
<td>67.26</td>
<td>92.68478</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The means of these two samples are significantly different.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PROGRAM A</td>
<td>2.7</td>
<td>8.89</td>
<td>73.53</td>
<td>134.3956</td>
</tr>
<tr>
<td>PROGRAM C</td>
<td>65.6</td>
<td></td>
<td>65.6</td>
<td>118.9195</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The means of these two samples are significantly different.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PROGRAM B</td>
<td>0.6</td>
<td>0.05</td>
<td>67.26</td>
<td>92.68478</td>
</tr>
<tr>
<td>PROGRAM C</td>
<td>65.66</td>
<td></td>
<td>65.66</td>
<td>118.9195</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The means of these two samples are NOT significantly different.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* p = <0.05, df 58
The t-test analysis on the posttesting groups showed that while the Program A and B students' scores were similar, again the posttesting scores of Program C when compared to A and B groups were significantly different (p<0.05, df 58, t=3.6; p<0.05, df 58, t=2.4; Table 4).

Program B then had an effect on the students with the result that the means of this group are now more positive and approach the means of Program A students. There is no significant difference between the means of the students receiving Program A and Program B. There is a significant difference between the means of the students of Program C when compared with either Program A or B. The decline in the means of Program C and the resultant rise in the means of Program B can be explained by the difference in curriculum.
TABLE SIX

Results of Students' T-test (Two-tailed) Posttest

<table>
<thead>
<tr>
<th>t-test</th>
<th>p*</th>
<th>Mean</th>
<th>Variance</th>
</tr>
</thead>
<tbody>
<tr>
<td>PROGRAM A</td>
<td>1.5</td>
<td>.12</td>
<td>73.96</td>
</tr>
<tr>
<td>PROGRAM B</td>
<td>70.6</td>
<td></td>
<td>65.88523</td>
</tr>
</tbody>
</table>

The means of these two samples are NOT significantly different.

| PROGRAM A | 3.6 | 5.6   | 73.96      | 71.13686  |
| PROGRAM C | 63.83 |     | 160.4884   |

The means of these two samples are significantly different.

| PROGRAM B | 2.4 | 1.5   | 70.6       | 65.88523  |
| PROGRAM C | 63.83 |   | 160.4834   |

The means of these two samples are significantly different.

*p < 0.05, df 58
Question Analysis

Raw total scores were determined for each question by each group. This is outlined in Table Seven. Figure 9 indicates graphically the difference between pre- and post-testing answers given by College A students. College B students' answers to each question are illustrated in Figure 10 and College C students' answers are provided in Figure 11. A t-test was then employed to determine any differences among the three groups from the answers to the questions. Each question was subjected to a t-test.

Results of this analysis are shown in Tables 8, 9, and 10. Data from College A and B students identified two topics as being significant when subjected to t-tests. Students attending College A identified question one; students attending College B identified Question ten.
# TABLE SEVEN

**RAW TOTAL SCORES FOR EACH QUESTION FOR ALL GROUPS**

<table>
<thead>
<tr>
<th>QUESTION</th>
<th>PROGRAM A PRE</th>
<th>PROGRAM B PRE</th>
<th>PROGRAM C PRE</th>
<th>PROGRAM A POST</th>
<th>PROGRAM B POST</th>
<th>PROGRAM C POST</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Only a few nurses will need to learn how to use computers.</td>
<td>135</td>
<td>115</td>
<td>114</td>
<td>120</td>
<td>103</td>
<td>107</td>
</tr>
<tr>
<td>2. Computers cause a decrease in communication between hospital departments.</td>
<td>119</td>
<td>99</td>
<td>96</td>
<td>122</td>
<td>103</td>
<td>91</td>
</tr>
<tr>
<td>3. Computers will allow the nurse more time for the professional tasks for which he/she is trained.</td>
<td>104</td>
<td>102</td>
<td>102</td>
<td>106</td>
<td>102</td>
<td>88</td>
</tr>
<tr>
<td>4. Computers are probably more useful to professions other than nursing.</td>
<td>94</td>
<td>95</td>
<td>85</td>
<td>105</td>
<td>94</td>
<td>90</td>
</tr>
<tr>
<td>5. The time spend using a computer is out of proportion to the benefits.</td>
<td>89</td>
<td>104</td>
<td>96</td>
<td>107</td>
<td>101</td>
<td>98</td>
</tr>
<tr>
<td>6. Computers represent a violation of patient privacy.</td>
<td>114</td>
<td>110</td>
<td>112</td>
<td>115</td>
<td>111</td>
<td>97</td>
</tr>
<tr>
<td>7. Only one person at a time can use a computer terminal and therefore, staff efficiency is inhibited.</td>
<td>85</td>
<td>89</td>
<td>79</td>
<td>94</td>
<td>92</td>
<td>86</td>
</tr>
<tr>
<td>8. The use of a computer should result in better patient care.</td>
<td>109</td>
<td>96</td>
<td>93</td>
<td>117</td>
<td>103</td>
<td>95</td>
</tr>
<tr>
<td>9. Computers contain too much personal data to be used in an area as open as a nursing station.</td>
<td>115</td>
<td>96</td>
<td>88</td>
<td>110</td>
<td>102</td>
<td>92</td>
</tr>
<tr>
<td>10. Computers cause nurses to give less time to quality patient care.</td>
<td>119</td>
<td>106</td>
<td>118</td>
<td>119</td>
<td>118</td>
<td>96</td>
</tr>
<tr>
<td>11. If I had my way, nurses would not ever have to use computers.</td>
<td>121</td>
<td>114</td>
<td>115</td>
<td>126</td>
<td>120</td>
<td>106</td>
</tr>
<tr>
<td>12. Computers should only be used in the financial department.</td>
<td>121</td>
<td>115</td>
<td>123</td>
<td>128</td>
<td>124</td>
<td>104</td>
</tr>
<tr>
<td>13. Computers make nurses' jobs easier.</td>
<td>105</td>
<td>91</td>
<td>93</td>
<td>98</td>
<td>87</td>
<td>90</td>
</tr>
<tr>
<td>14. Paperwork for nurses has been greatly reduced by the use of computers.</td>
<td>116</td>
<td>99</td>
<td>117</td>
<td>115</td>
<td>109</td>
<td>104</td>
</tr>
<tr>
<td>15. It takes as much time to maintain patient records by computer as it does by hand.</td>
<td>93</td>
<td>100</td>
<td>96</td>
<td>107</td>
<td>100</td>
<td>90</td>
</tr>
<tr>
<td>16. A computerized record of nursing notes is usually more accurate than a hand written record.</td>
<td>85</td>
<td>89</td>
<td>90</td>
<td>89</td>
<td>94</td>
<td>91</td>
</tr>
<tr>
<td>17. Computers save steps and allow the nursing staff to become more efficient.</td>
<td>112</td>
<td>99</td>
<td>115</td>
<td>114</td>
<td>103</td>
<td>101</td>
</tr>
<tr>
<td>18. Using computers in hospitals is likely to put a lot of nurses out of work.</td>
<td>116</td>
<td>115</td>
<td>115</td>
<td>114</td>
<td>112</td>
<td>105</td>
</tr>
<tr>
<td>19. Computers will enable nurses to spend more time with patients.</td>
<td>110</td>
<td>102</td>
<td>93</td>
<td>107</td>
<td>107</td>
<td>99</td>
</tr>
<tr>
<td>20. Because of computers, nurses will face more lawsuits.</td>
<td>113</td>
<td>107</td>
<td>110</td>
<td>105</td>
<td>110</td>
<td>103</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mean</th>
<th>108.75</th>
<th>110.7</th>
<th>102.15</th>
<th>105.75</th>
<th>98.8</th>
<th>96.4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Med</td>
<td>112.50</td>
<td>112.0</td>
<td>101.00</td>
<td>104.50</td>
<td>98.0</td>
<td>96.5</td>
</tr>
<tr>
<td>S D</td>
<td>13.42</td>
<td>12.0</td>
<td>8.49</td>
<td>9.92</td>
<td>9.6</td>
<td>6.6</td>
</tr>
</tbody>
</table>
COLLEGE A

FIGURE 9

Raw Total Scores for Each Question

Pretest and Posttest

Question
### TABLE EIGHT

**Results of T-test Analysis**

<table>
<thead>
<tr>
<th>QUESTION</th>
<th>SCORE</th>
<th>MEAN</th>
<th>STANDARD DEVIATION</th>
<th>VARIANCE</th>
<th>T-TEST</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre</td>
<td>135</td>
<td>4.5</td>
<td>0.682288</td>
<td>0.4655173</td>
<td>p=1.6</td>
</tr>
<tr>
<td>1. Post</td>
<td>120</td>
<td>3.9</td>
<td>1.066200</td>
<td>1.136882</td>
<td>T=2.570016</td>
</tr>
<tr>
<td>Pre</td>
<td>119</td>
<td>3.9</td>
<td>0.944433</td>
<td>0.8919541</td>
<td>p=0.5</td>
</tr>
<tr>
<td>2. Post</td>
<td>122</td>
<td>4.0</td>
<td>0.827682</td>
<td>0.6850575</td>
<td>T=2.701089</td>
</tr>
<tr>
<td>Pre</td>
<td>104</td>
<td>3.5</td>
<td>1.042213</td>
<td>1.086208</td>
<td>p=0.7</td>
</tr>
<tr>
<td>3. Post</td>
<td>102</td>
<td>3.4</td>
<td>1.003443</td>
<td>1.006828</td>
<td>T=0.361158</td>
</tr>
<tr>
<td>Pre</td>
<td>94</td>
<td>3.1</td>
<td>1.224276</td>
<td>1.498852</td>
<td>p=0.1</td>
</tr>
<tr>
<td>4. Post</td>
<td>105</td>
<td>3.5</td>
<td>0.973795</td>
<td>0.9482759</td>
<td>T=1.632819</td>
</tr>
<tr>
<td>Pre</td>
<td>89</td>
<td>3.6</td>
<td>0.855006</td>
<td>0.731035</td>
<td>p=0.9</td>
</tr>
<tr>
<td>5. Post</td>
<td>107</td>
<td>3.6</td>
<td>0.971421</td>
<td>0.9436782</td>
<td>T=0.171238</td>
</tr>
<tr>
<td>Pre</td>
<td>114</td>
<td>3.8</td>
<td>0.886683</td>
<td>0.7862066</td>
<td>p=0.3</td>
</tr>
<tr>
<td>6. Post</td>
<td>115</td>
<td>3.83</td>
<td>0.874281</td>
<td>0.7643675</td>
<td>T=0.171238</td>
</tr>
<tr>
<td>Pre</td>
<td>85</td>
<td>2.8</td>
<td>1.116748</td>
<td>1.247126</td>
<td>p=0.3</td>
</tr>
<tr>
<td>7. Post</td>
<td>94</td>
<td>3.1</td>
<td>0.973204</td>
<td>0.9471268</td>
<td>T=1.013021</td>
</tr>
<tr>
<td>Pre</td>
<td>109</td>
<td>3.6</td>
<td>0.889918</td>
<td>0.7919543</td>
<td>p=0.2</td>
</tr>
<tr>
<td>8. Post</td>
<td>117</td>
<td>3.9</td>
<td>0.803012</td>
<td>0.6448279</td>
<td>T=1.278203</td>
</tr>
<tr>
<td>Pre</td>
<td>115</td>
<td>3.8</td>
<td>0.874281</td>
<td>0.7643675</td>
<td>p=0.4</td>
</tr>
<tr>
<td>9. Post</td>
<td>110</td>
<td>3.6</td>
<td>0.844182</td>
<td>0.7126434</td>
<td>T=0.926277</td>
</tr>
<tr>
<td>Pre</td>
<td>119</td>
<td>3.9</td>
<td>0.889918</td>
<td>0.7919543</td>
<td>p=1.0</td>
</tr>
<tr>
<td>10. Post</td>
<td>119</td>
<td>3.9</td>
<td>0.668675</td>
<td>0.4471269</td>
<td>T=0.708329</td>
</tr>
<tr>
<td>Pre</td>
<td>121</td>
<td>4.0</td>
<td>1.245221</td>
<td>1.550575</td>
<td>p=0.5</td>
</tr>
<tr>
<td>11. Post</td>
<td>126</td>
<td>4.2</td>
<td>0.805156</td>
<td>0.6482754</td>
<td>T=0.708329</td>
</tr>
<tr>
<td>Pre</td>
<td>121</td>
<td>4.0</td>
<td>1.023892</td>
<td>1.550575</td>
<td>p=0.5</td>
</tr>
<tr>
<td>12. Post</td>
<td>128</td>
<td>4.2</td>
<td>0.739679</td>
<td>0.6482754</td>
<td>T=0.708329</td>
</tr>
<tr>
<td>Pre</td>
<td>105</td>
<td>3.5</td>
<td>0.861034</td>
<td>0.7413794</td>
<td>p=0.3</td>
</tr>
<tr>
<td>13. Post</td>
<td>98</td>
<td>3.2</td>
<td>0.868345</td>
<td>0.7540231</td>
<td>T=1.157283</td>
</tr>
<tr>
<td>Pre</td>
<td>116</td>
<td>3.86</td>
<td>0.776079</td>
<td>0.6022993</td>
<td>p=0.8</td>
</tr>
<tr>
<td>14. Post</td>
<td>115</td>
<td>3.83</td>
<td>0.698932</td>
<td>0.4885054</td>
<td>T=0.214721</td>
</tr>
<tr>
<td>Pre</td>
<td>93</td>
<td>3.2</td>
<td>1.095445</td>
<td>1.2</td>
<td>p=0.2</td>
</tr>
<tr>
<td>15. Post</td>
<td>107</td>
<td>3.5</td>
<td>1.040005</td>
<td>1.08161</td>
<td>T=1.221605</td>
</tr>
<tr>
<td>Pre</td>
<td>85</td>
<td>2.93</td>
<td>1.080656</td>
<td>1.167818</td>
<td>p=0.9</td>
</tr>
<tr>
<td>16. Post</td>
<td>89</td>
<td>2.96</td>
<td>0.964306</td>
<td>0.9298852</td>
<td>T=0.127719</td>
</tr>
<tr>
<td>Pre</td>
<td>112</td>
<td>3.7</td>
<td>0.868345</td>
<td>0.7540231</td>
<td>p=0.4</td>
</tr>
<tr>
<td>17. Post</td>
<td>114</td>
<td>3.9</td>
<td>0.661764</td>
<td>0.4379317</td>
<td>T=0.817437</td>
</tr>
<tr>
<td>Pre</td>
<td>116</td>
<td>3.86</td>
<td>0.860366</td>
<td>0.7402301</td>
<td>p=0.5</td>
</tr>
<tr>
<td>18. Post</td>
<td>114</td>
<td>3.76</td>
<td>0.678911</td>
<td>0.4609196</td>
<td>T=0.619080</td>
</tr>
<tr>
<td>Pre</td>
<td>110</td>
<td>3.6</td>
<td>0.855006</td>
<td>0.731035</td>
<td>p=0.9</td>
</tr>
<tr>
<td>19. Post</td>
<td>107</td>
<td>3.56</td>
<td>0.817200</td>
<td>0.6678162</td>
<td>T=0.189332</td>
</tr>
<tr>
<td>Pre</td>
<td>113</td>
<td>3.7</td>
<td>0.773854</td>
<td>0.5988508</td>
<td>p=0.1</td>
</tr>
<tr>
<td>20. Post</td>
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p<0.05, df=29
### TABLE NINE

**Results of T-test Analysis**

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p<0.05, df=29
# PROGRAM C

**TABLE TEN**

Results of T-test Analysis

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<th>VARIANCE</th>
<th>T-TEST</th>
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p<0.05, df29
It is of interest that, although the subjects were seen to be similar demographically, during pretesting and posttesting the statements on the questionnaire were not similarly answered by the three groups. While only two questions were significantly different between pre- and posttesting, statements which indicate greater uncertainty (score of 3) were answered differently in some instances by each group. Areas concerning computer use about which the students felt strong agreement or disagreement were also different for Programs A, B, and C. Table 11 displays statistics for a sample of these questionnaire answers from the three programs. It should be mentionned that with multiple t-tests use, one item in twenty will be significant by chance alone when p<.05.

The sample of questions here reflects areas that are of particular concern in the use of computers by nurses. The concern of communication is reflected in question 2, time in question 5, better patient care in question 8, personal feelings in question 11, paperwork and charting in question 14, and ethics and legalities in question 20.

To elucidate, the answers to question 2 in the posttesting column showed that both Program A and B students showed a
strong disagreement with the statement concerning hospital department communication whereas Program C students would appear to have "guessed" since there is not a high percentage in any one column. This reflects lack of knowledge.

In examining the statistics from question five, it is apparent that the students from Program A reflected slightly more positive attitudes after the course than before, whereas Program B students apparently felt that the time they spent following the CAI packages was not as beneficial as they had anticipated and were more uncertain after use. This may reflect the studies that show that student nurses desire more feedback than computer programs presently deliver (Day & Payne, 1984, 1987; Ludwig, 1987). Program C students again were uncertain due to lack of knowledge and answered in all columns.

Answers to question 8 concerning better patient care as a result of computer use revealed that Program A and Program B students are strongly committed to computer use, whereas Program C students, while apparently in agreement, reflect a less positive opinion and tend to be more uncertain. Their posttest answers reflect more uncertainty, possibly
because they had not considered this statement prior to the introduction of the first survey. This may reflect the Hawthorne effect.
### TABLE 11
#### COMPARISON OF ANSWERS TO SPECIFIC QUESTIONS

**QUESTION #2**
Computers cause a decrease in communication between hospital departments.

<table>
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<th>College C</th>
<th>SA %</th>
<th>A %</th>
<th>U %</th>
<th>D %</th>
<th>SD %</th>
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<td>6 20.0</td>
<td>7 23.3</td>
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<tr>
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<td>10 33.3</td>
<td>9 30.0</td>
<td>7 23.3</td>
<td>3 10.0</td>
</tr>
</tbody>
</table>

| College B | | |
|-----------|---|---|---|---|---|
| Control - Pre | 4 13.3 | 6 20.0 | 8 60.0 | 2 6.6 |
| Control - Post | 14 46.6 | 15 50.0 | 1 3.3 |

| College A | | |
|-----------|---|---|---|---|---|
| Treatment Group - Pre | 4 13.3 | 3 10.0 | 15 50.0 | 9 30.0 |
| Treatment Group - Post | 1 3.3 | 1 3.3 | 3 10.0 | 18 60.0 | 3 26.6 |

**Question 5**
The time spent using a computer is out of proportion to the benefits.

<table>
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<th>A %</th>
<th>U %</th>
<th>D %</th>
<th>SD %</th>
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<td>6 20.0</td>
<td>13 43.3</td>
<td>8 26.6</td>
<td>2 6.6</td>
</tr>
</tbody>
</table>

| College B | | |
|-----------|---|---|---|---|---|
| Control - Pre | 14 46.6 | 15 50.0 | 1 3.3 |
| Control - Post | 1 3.3 | 20 66.6 | 7 23.3 | 2 6.6 |

| College A | | |
|-----------|---|---|---|---|---|
| Treatment Group - Pre | 3 10.0 | 13 43.3 | 10 33.3 | 5 16.6 |
| Treatment Group - Post | 6 10.0 | 8 26.6 | 12 40.0 | 5 16.6 |
**Question 8**

The use of a computer should result in better patient care.

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<td>Control - Pre</td>
<td>1</td>
<td>3.3</td>
<td>12</td>
<td>40.0</td>
<td>10</td>
</tr>
<tr>
<td>Control - Post</td>
<td>1</td>
<td>3.3</td>
<td>19</td>
<td>22.3</td>
<td>15</td>
</tr>
</tbody>
</table>

**College B**

| Control - Pre | 2 | 6.6 | 12 | 40.0 | 7 | 22.3 | 3 | 25.6 | 1 | 3.3 |
| Control - Post | 18 | 60.0 | 6 | 20.0 | 6 | 20.0 |

**College A**

| Treatment Group - Pre | 5 | 16.6 | 12 | 40.0 | 10 | 33.3 | 4 | 13.3 |
| Treatment Group - Post | 4 | 13.3 | 18 | 50.0 | 7 | 23.3 | 2 | 6.6 |

**Question 11**

If I had my way, nurses would not ever have to use computers.

<table>
<thead>
<tr>
<th>College C</th>
<th>SA</th>
<th>A</th>
<th>U</th>
<th>D</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control - Pre</td>
<td>3</td>
<td>10.0</td>
<td>6</td>
<td>20.0</td>
<td>13</td>
</tr>
<tr>
<td>Control - Post</td>
<td>2</td>
<td>6.6</td>
<td>3</td>
<td>10.0</td>
<td>6</td>
</tr>
</tbody>
</table>

**College B**

| Control - Pre | 3 | 10.0 | 2 | 6.6 | 21 | 70.0 | 4 | 13.3 |
| Control - Post | 2 | 6.6 | 5 | 20.0 | 14 | 46.6 | 7 | 23.3 |

**College A**

| Treatment Group - Pre | 1 | 3.3 | 5 | 16.6 | 1 | 3.3 | 8 | 26.6 | 1 | 50.0 |
| Treatment Group - Post | 2 | 6.6 | 1 | 3.3 | 16 | 53.3 | 11 | 36.6 |
**Question 14**

Paperwork for nurses has been greatly reduced by the use of computers.

<table>
<thead>
<tr>
<th>College C</th>
<th>SA %</th>
<th>A %</th>
<th>U %</th>
<th>D %</th>
<th>SD %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control - Pre</td>
<td>3 10.0</td>
<td>14 46.6</td>
<td>11 36.6</td>
<td>2 6.6</td>
<td></td>
</tr>
<tr>
<td>Control - Post</td>
<td>1 3.3</td>
<td>13 43.3</td>
<td>14 46.6</td>
<td>2 6.6</td>
<td></td>
</tr>
</tbody>
</table>

**College B**

| Control - Pre | 3 10.0 | 12 40.0 | 11 36.6 | 4 13.3 |
| Control - Post | 2 6.6 | 17 56.6 | 11 36.6 |

**College A**

| Treatment Group - Pre | 6 20.0 | 15 50.0 | 8 26.6 | 1 3.3 |
| Treatment Group - Post | 4 13.3 | 18 60.0 | 7 60.0 | 12 3.3 |

**Question 20**

Because of computers, nurses will face more lawsuits.

<table>
<thead>
<tr>
<th>College C</th>
<th>SA %</th>
<th>A %</th>
<th>U %</th>
<th>D %</th>
<th>SD %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control - Pre</td>
<td>2 6.6</td>
<td>14 46.6</td>
<td>12 40.0</td>
<td>2 6.6</td>
<td></td>
</tr>
<tr>
<td>Control - Post</td>
<td>1 3.3</td>
<td>2 6.6</td>
<td>16 53.3</td>
<td>8 26.6</td>
<td>3 10.0</td>
</tr>
</tbody>
</table>

**College B**

| Control - Pre | 1 3.3 | 12 40.0 | 14 46.6 | 3 10.0 |
| Control - Post | 3 10.0 | 12 40.0 | 11 36.6 | 4 13.3 |

**College A**

| Treatment Group - Pre | 1 3.3 | 11 36.6 | 15 50.0 | 4 13.3 |
| Treatment Group - Post | 2 6.6 | 14 46.6 | 12 40.0 | 3 10.0 |
The statement in question 11 about nurses' use of computers indicates that Program C students are aware that nurses may have to use computers. Program B students were less committed to them after their CAI programs and more uncertain. Six Program A students expressed the strongest dissent to using computers even though they would be taking a course within a month. These students may reflect the anxiety and fear of unknown documented in the literature (LaBranche, 1986). After the course, only two students were still not convinced that nurses should be using computers, and the remaining four students had joined the majority in stating that nurses would have to use the computer. Several students in College C were very strongly opposed to the idea of computer use by nurses in the post survey. The non-committed students in the nursing programs need to be identified in order to provide remedial assistance on order to assist the students to be more employable (Daria & Moran, 1985).

Regarding question 14, most students in all programs felt that paperwork would be reduced. This most likely reflected media knowledge concerning computers in general rather than particular nursing information.
Lawsuits mentioned in question 20 were not seen by the students as being increased by computer use. A large number of students are uncertain in this area, even the Program A students who have discussions in class regarding the technology. More dissemination of information may be indicated in this area.

Different programs, then, reveal different levels of understanding in the student nurses as to what problems the use of computers may unravel. Their level of understanding may reflect the curriculum.

Results
The major finding of this study is that there is a significant difference between the subjects in Program A and the subjects in Program C on attitudes toward the use of computers in nursing (p<0.05, df 58, t=3.6) Hypothesis #1 is not supported.

A second result is that there is a significant difference between the subjects enrolled in Program B and those enrolled in Program C (p<0.05, df 58, t=2.4). The second hypothesis is not supported.
A third finding is that there is no significant difference between the subjects enrolled in Program B and those enrolled in Program A ($p>0.05$, df 58, $t=1.5$). The third hypothesis is supported.

Two of the three null hypotheses were rejected (Figure 12). The presence of a computer program in the nursing curriculum does result in a statistical difference in second year student nurses' attitudes toward the use of computers in the nursing role.

**FIGURE 12**

**Hypothesis 1**
There will be no significant difference on scores of a perceptions of computer use questionnaire between second year diploma nursing students who have taken a computer literacy course and those who have not taken a course.

**Results**
Rejected ($p<0.05$, df 58, $t=3.6$)

**Hypothesis 2**
There will be no significant difference on scores of a perceptions of computer use questionnaire between second year diploma nursing students who have varying amounts of exposure to CAI and those who have had no experience.

**Results**
Rejected ($p<0.05$, df 58, $t=2.4$)
Hypothesis 3
There will be no significant difference on scores of a perceptions of computer use questionnaire between second year nursing students who have taken a one semester computer literacy course and those who have had varying amounts of experience in a CAI format.

Results
Supported (p>0.05, df 58, t=1.5)
CHAPTER FIVE

Summary and Implications

A review of current nursing literature indicated that many nurses were hesitant to begin using computers (Ronald, 1979; Happ, 1983; Ball, Snelbecker & Schecter, 1985). Staff nurses from diploma programs were required to use computers in employing agencies (Hassett, 1984). In Ontario, HIS were purchased. Community colleges which train student nurses have a mandate to assist students in their field of future employment. No school of nursing in Ontario had a computer component in their curriculum prior to 1986. Prior to using new technology, it is important to assess the attitudes of the potential users.

In December 1986 and April 1987, second year diploma nursing students who attended three community colleges in Ontario were surveyed using a pretest - posttest experimental design to determine attitudes toward computer use in the nursing role. The questionnaire used was judged reliable and valid by a panel of judges and tested in a
pilot study \( r = 0.89 \). From a total population of 315 second year nursing students, a random sampling of thirty students from each college was analyzed. One purpose of this study was to determine the attitudes of second year diploma student nurses toward the use of computers in the nursing role. This study has determined that the attitudes of these student nurses are positive, but not strongly positive toward computers in the nursing role. The posttest means of the three college groups were reported as College A 73.9, College B 70.6, and College C 63.8. Previously, Brodt & Stronge (1986) reported the means of diplome nurses at 72.92 which was less positive than the baccalaureate nurses with a mean of 74.29 but more positive than the LPN's at 63.9.

**FIGURE 6**

<table>
<thead>
<tr>
<th>MEAN SCORES POSTTEST</th>
</tr>
</thead>
<tbody>
<tr>
<td>COLLEGE A STUDENTS</td>
</tr>
<tr>
<td>COLLEGE B STUDENTS</td>
</tr>
<tr>
<td>COLLEGE C STUDENTS</td>
</tr>
</tbody>
</table>

**BRODT & STRONGE - (1986)**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>DIPLOMA NURSES</td>
<td>72.92</td>
</tr>
<tr>
<td>BACCALAUREATE NURSES</td>
<td>74.29</td>
</tr>
<tr>
<td>LICENSED PRACTICAL NURSES</td>
<td>63.9</td>
</tr>
</tbody>
</table>
A second purpose was to determine the extent to which CAI influenced attitudes. The program in place at College B did not alter to a significant degree (p>0.05) the posttest mean scores. Program B with the CAI options and simulations had the effect of increasing mean scores by 3.1 but this, while notable, was not statistically significant.

A compulsory computer literacy program which involved word processing did not influence attitudes quantitatively. Program A students altered their previously positive attitude mean score from 73.5 to 73.9. These students attended class, learned typing with some discussion of computers and were exposed to articles about computers in the library but did not change attitudes toward computers.

It would appear that neither Program A nor Program B can provide enough background knowledge about computers to facilitate, encourage or support the growth of significantly positive attitudes.

A fourth purpose was to determine the necessity for providing an educational computer course in the nursing curriculum. The mean attitude scores of the students attending College C became more negative over time from 65.6 to 63.8 although not significantly so (p>0.05). The student nurses from College C expressed more negative
attitudes overall than the other two colleges who had limited computer availability. The College C mean scores could be interpreted as indicating that nurse-educators must provide a computer course or at the least promote discussion about computers in the nursing role for these students. The students may be at a disadvantage when seeking employment at agencies with computerized facilities.

The fifth purpose was to provide further reliability and validity for the questionnaire. When used with this total sample population of 90, the questionnaire seems to be reliable for its stated purpose of assessing attitudes. Some adaptations were necessary from the original to facilitate understanding by second year Canadian student nurses. Inter-item correlations would have been an asset. Open ended comments on the questionnaire included statements such as "I wouldn't know, I've never used computers"; "I can't be expected to answer this question since I have no knowledge of computers at all"; "I only took one course in high school; I don't know what nurses do with them in hospitals". These statements from the posttest control group may indicate that the students became increasingly frustrated with the second survey and were thus more negative in their comments. The large
variance within and between the three groups might necessitate a further testing of the document. Its adaptability to second year student nurses may be limited.

Conclusions

Hypothesis one was rejected on the basis of a major finding of this study that student nurses who do not receive a computer component in their nursing curriculum become more negative over time toward the idea of computers in the nursing field. After a time span of four months, the posttest mean of students attending College C was 1.8 less than when first determined. The posttest results of Program C students when compared to Program A students indicated that while Program A students remained positive after the literacy experience, the Program C students became more negative. The Program C students had no reinforcement during the clinical component of their training regarding computers in the workplace. Of the three groups, students in Program A were the most positive in pretesting and remained so for posttesting. There was a significant difference (p < .05) between Program A and Program C students in pretesting and this difference increased by the time of posttesting. One of the objectives of a nursing program should be to develop
positive computer attitudes toward use of the computer in nursing. Based on the occurrence of the negativity of students receiving Program C, exposure to a computer course would seem to be warranted.

It should be noted that both periods of testing were approximately one week prior to semester final examinations for College C students. This may have resulted in a relatively negative feeling toward research in general and nursing research in particular. The students attending Colleges A and B would not be tested with final examinations for another two to three weeks.

Hypothesis two was rejected on the basis of data analysis using student's t-test and one way ANOVA results. Results indicated that experience with the CAI learning package had a positive effect on the attitudes of Program B second year diploma student nurses and their perceptions of computer use in the nursing role, although this was not significant (p>0.05). The mean of Program B students changed from 67.2 to 70.6 indicating more positive feeling toward computer use had occurred after the computer exposure. Program C students were significantly more negative at post testing than Program B students (p<0.05; df 58; t=2.4). There was no significant difference between the students receiving
Program B and those receiving Program C at pretesting 
(p>0.05, df·58; t=0.6). The positive attitudes can be 
attributed to the computer course.

When the results of the posttest statistical analysis were 
studied, the means of the scores of the CAI students 
receiving Program B were not significantly different from 
those students who were receiving the computer literacy 
course in Program A. Thus, the third hypothesis is 
accepted.

The students receiving Program A did not alter their 
relatively positive attitudes toward computer use in the 
scores of the post test results. Analysis of data in this 
study resulted in diploma students attaining a mean of 
73.53 initially with a non-significant rise to 73.96 after 
the course. When compared to the students at the other two 
Colleges, the students attending College A expressed the 
most positive attitudes toward the use of computers. This 
may have been a result of increased awareness of the need 
to learn computer functioning. During the academic school 
year, the hospitals in which some of the students were 
practising the patient care component of the curriculum 
were beginning to furnish the nursing stations with 
computers. Although no student had yet used one in that 
nursing context, it is possible that the students would be
exposed to the element of change and potential computer use during clinical experience. Any student who attended Open House prior to choosing College A would also have been aware of the existence of the computer laboratory and a required computer component as a part of nursing studies. Also, Program A students were seen to have had more general experience with computers prior to nursing school, although not more formal courses in high school than the other group at College C. This could be explained by the fact that the environs of College A are suburban and in close proximity to major technology seen in any large metropolis. Any or all of these factors may explain the positive attitude of the Program A students on the Pretest scores. The lack of a significantly more positive change in attitude toward computers in the nursing role after a four-month course, may point to a deficit in the curriculum. The Program A course itself does not have a strong nursing component. The emphasis is on typing and manipulating the keyboard. The intent of the program is to expand student awareness of technology, not necessarily just the nursing field. The lack of a more positive attitude toward computer use as indicated by mean scores may indicate that student nurses need objectives more strongly aligned with the perceived nursing role in order to develop more positive attitudes toward computers in the work place.
The change in standard deviation from 11.59 to 8.43 indicates a decrease in variance in response. Possibly, for some students, Program A was useful in assisting them to focus their feelings.

While it is the intent of this study to determine recommendations based on the findings of this study which relate to attitudes toward computers, it is important to recognize a bias inherent in this study which is that students who encounter computer experiences will become nurses who are more efficient and tractile about the technology. This is an area of further research.

**Implications for Hospitals and Employers**

This study shows that computer exposure at the student nurse level can result in a positive attitude toward the use of computers in the work place as evidenced by the posttest mean scores of the students attending College A and B. Administrators and educators need to dialogue and display encouragement and support for each others' objectives in order to prepare computer literate nurses. Nurse-educators can continue to study and document a course of action that will produce potential staff nurses with positive attitudes toward the use of hospital computers. In the future, administrators should not have to support
costly inservice training programs. With a positive computer attitude and a course at the educational level of the undergraduate, the new graduate may require only an overview of the peculiarities of the hospital's own HIS.

In order to facilitate patient care and minimize stress for the newly graduated staff nurse, administrators of employing agencies should suggest that more study of a type of program of benefit to the student as an employee should be discussed. This would enable the new graduate to concentrate on the new role as a patient advocate meeting designated patient needs, and not on technology. Thus, more time would be spent at the bedside this could be cost effective.

**Implications for Educational Curriculum**

When the raw score results of each item on the questionnaire were analyzed, there appeared a deficit in the curriculum regarding knowledge disseminated to student nurses. Tables eight and nine indicate that two questions are significant at the p<.05 level. As well, the means of several questions were less on posttest analysis, but not significantly so (p>0.05), and require further study. Of particular interest was question one in which those student nurses who had received Program A with word processing were
now of the opinion that most nurses wouldn't have to know how to use computers. Why did the students become less positive? Perhaps the typing component or intensity of the course led them to believe that this was too much to be expected of the average nurse. Students attending College B were encouraged by their exposure to CAI and were significantly more positive ($p<0.05$) when answering question ten. They did not feel that use of computers would result in a decrease in quality patient care. Information regarding background for questions 5, 13, and 20 needs to be disseminated since the results showed that the majority of students were uncertain about these items. These questions indicate that concerns regarding time necessary for training and ease of use need to be addressed. Also, more emphasis needs to be placed on the legal and ethical problems uncovered by computer use in a health care setting. Results of analysis of the raw score data from each question indicate a lack of knowledge in several areas. Overall, most questions were answered to reflect a more positive, but not significantly positive, posttest attitude.

The questionnaire is reliable for identifying which students are extremely negative in attitude. This could impact on nurse-educators to identify students in need of
remedial aid. Assistance could be given prior to or concurrent with exposure to computers in the educational or clinical setting. With assistance at the undergraduate level, the student can graduate as a more employable nurse.

Demographic data revealed that colleges have a wide continuum of ages to serve. College B in particular has a preponderance of students over 25. The needs of the adult learner have been studied by many authors (Knowles, 1977; Darkenwald & Merriam, 1982). The same computer program may not meet the needs of all students (Day & Payne, 1984; Huckabay et al, 1979; Happ, 1983). While the older students receiving Program B obtained more positive scores on posttesting in this study, the younger students did not, as seen in Figure 9.

Figure 9

<table>
<thead>
<tr>
<th>College B Nurses Posttest</th>
<th>Age: Over 25</th>
<th>Age: 21-24</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>80 73 63</td>
<td>Total</td>
</tr>
<tr>
<td>Scores</td>
<td>78 77 70</td>
<td>Scores</td>
</tr>
<tr>
<td>of 14</td>
<td>70 75 62</td>
<td>of 19</td>
</tr>
<tr>
<td>Respondents</td>
<td>72 66</td>
<td>Respondents</td>
</tr>
</tbody>
</table>
More research needs to be done on the type of computer program best suited to the individual needs and learning styles of the students. Day & Payne (1987) indicated that first year university students required faculty interaction when using CMI. This study showed that the more mature students profited from CAI in a self-directed modality. Less emphasis on technology and self direction and more emphasis on the nursing role in a computer course may lead to a more positive attitude in the younger student.

College C scores indicated a negative attitude toward computer use even though 30% of the students indicated that they had previously taken a high school computer course. A background investigation of the type of high school computer courses offered is warranted. If students have developed a negative attitude toward computers in general prior to college admission, nurse-educators have to overcome that resistance by a new or different approach to computer use in the work place. It is important that nurse-educators be aware of and promote programs which determine needs of students prior to instruction.
Recommendations for Further Research

1. This study showed changes using a time element of four months. There is a need for investigators to examine the optimum time element when a change in attitudes is to be measured. This study may not have allowed sufficient time for computer exposure at the student nurse level to have a more significant result.

2. The testing of students should be more carefully monitored so that the stress of other current courses does not reflect on the measurement of the study at hand.

3. More research at the community college level in the schools of nursing and related community hospitals would be an asset. This researcher found a paucity of literature and studies published which reflected the needs of the learners in the college setting. Some students who were the subjects also exhibited somewhat suspicious attitudes as reflected in added comments on the questionnaire (see Appendix C). With increased exposure to research and research methods, college students, and in particular student nurses could appreciate that nursing theory could be advanced. Ultimately, research may enhance the credibility of nursing profession on a par with other health care professions.
4. A study employing an experimental design for an investigation of a course which includes all the ideas indicated by the questionnaire may result in a usable format for teaching computer use in the undergraduate curriculum.

5. An acceptable positive attitude toward computers in the workplace needs to be established so that sabotage as identified by Worthley (1982) does not occur. Then students who are identified as needing remedial help in order to attain a previously determined acceptable level of positive feeling toward computers should be studied. If we can determine why some students are negatively inclined toward the use of computers in the workplace, nurse educators can plan to help those students.

6. Follow-up studies of the students in the clinical setting in one year's time and again as graduates should be carried out. It is important to ascertain the effect of their undergraduate course. The hoped-for result would be positive nurse attitudes when these registrants enter the employment field. A longitudinal study of the graduates of computer courses is necessary to see if gains made are maintained.
7. Computer courses already in place need to be continuously evaluated to see if they meet the needs of the students and the needs of the market place for those students. Nurse-educators need to teach part or all of the undergraduate computer courses so that students are not only computer literate but also familiar with the nursing role regarding use of computers in the work place.

8. In this study, neither Program A nor Program B students attained mean scores similar to the baccalaureate nurses surveyed by Brodt & Stronge (1986). The mean score of the baccalaureate nurses was 74.29. Although studies show that baccalaureate nurses are generally more positive toward computer use in the nursing role, a computer course which meets the needs of the diploma student nurse could raise mean scores. A needs assessment of the diploma nurse regarding use of computers in the nursing role would be an area of further research.

9. The low rating scores attained by students from different colleges on several questions and the difference in variance and standard deviation between the colleges suggest that the difference in attitude may related more to the subjects of the study, rather
than to the programs. Further studies which correlate scores with more demographic information regarding the subjects may be useful. This study could be replicated among community college students who were of more similar demographic or cognitive background. Access to registrant's files would probably be necessary.

10. Further study of the model by Rogers (1983) could be implemented. A longitudinal study of student nurses as they proceed into the work place would assist in validating the effectiveness of the model when used with the innovation of computers in the nursing role.

11. A study of the attitudes of nurse-educators in the community colleges utilizing this questionnaire would provide further documentation of validity and reliability for the instrument. In addition, data regarding these teachers may indicate a need for further computer use orientation. Student nurse attitudes may reflect those of their educators and associates as has been previously suggested by Thiele & Baldwin (1985) and Lindseth (1986).

12. This study warrants a factorial analysis of each item as revised to ascertain inter-rater reliability for the Canadian setting.
Critique of Existing Computer Programs in Ontario Diploma Schools of Nursing

The literature pointed to a need for nurses to use computers. Hofmann (1984) pointed out that evidence continues to mount that the human factor will increasingly dominate as the cause of computer application failure. It is important for adopters of innovations to become positive in their attitude toward the innovation. Diploma student nurses will be using HIS, currently as students, soon as graduates. They are not being prepared to do so by the two programs currently in place in the community colleges under study.

"The administration of college programs reflects a broad range of program initiatives specifically directed to the vocational training and educational needs of students and representative of the regional needs of business and industry" (Guidelines for Governors, 1986, p.58). With that mandate, the nursing curriculum should reflect the needs of the environs with respect to student nurses' ability to use a computer. The definition provided by Sheafor, Crain & Dort (1986) for computer competency is achievable at the diploma level. At the very least, hospital administrators should expect that the negative staff attitude reported by Dowling (1980) should no longer be prevalent among the student nurses. To that end, change
must occur. In order to effect attitude change, course content that evokes feelings or beliefs must be in place and discussed. Word processing, as offered by College A, may be of use in business but is not of use in day-to-day hospital duties of staff nurses. While the ability to utilize a word processor is valuable for teachers, the average hospital nurse does not require this intensity since most typing is done by medical secretaries or clerks in other departments. Nurse-educators of College B expected that use of computers as an adjunct to classroom learning would teach students about computers. Use of the computer resulted in a positive change in attitude for some students, but it was not significant (p>0.05). The course needs to be made compulsory with assigned hours so that through constant use a more positive attitude may occur. It is recommended that nurse-educators develop new models for computer use and decrease reliance on computer designs used by other professions. There is a need to increase student awareness of the use of computers in the nursing role. The technology of computer functioning is of little importance. Students' interest in the nurses' use of computers was aroused by the questionnaire used in this study. This interest was evidenced by written voluntary responses on the questionnaire (Appendix C).
Computer Course Models

It is suggested that a computer course be established as a compulsory course for student nurses and be undertaken with hospital involved software. This would involve cooperation with the training personnel of a hospital but with the school of nursing staff teaching at the students' learning level. Both colleges studied assume that a working familiarity of computers in general will evoke a positive effect that will be maintained and that the affected nurse will be willing to use the hospital computer. Little that the student nurse is learning in either program prepares this future employee for on site evaluation of data output or data entry. Myers (1986) states that "computer terminals are being placed in nursing units and in a wide variety of departments for retrieval of information concerning patient demographics, doctor's orders, treatment regimes, medication profiles and laboratory results" (p.1). Students should have opportunity to perform these computer machinations in a supervised setting in order to decrease fear of "crashing" the entire HIS. Students who require additional help both affectively and in the cognitive domain would be identified. While validating the feelings of the hostile student responses to computers in the hospital, informed nurse-educators could attempt a reasoned approach toward the use of computers. Cognitive
learning can occur through student library research, dissemination of information by informed personnel, audio-visual aids, field trips and on-the-site observation. Affective attitude change may occur after exposure of this nature, under the direction of nurse-educators.

A second model of interest to colleges currently employing CAI would be to adapt or purchase software which necessitates the student practising patient care plans, patient documentation, floor stock supply ordering and use of simulated hospital records. The hospital simulation should be used along with other CAI programs which are purchased for information giving and decision making. Again, nurse-led discussions concerning ethical and legal potential problems should be part of the program.

A third model could be used by a college which cannot afford CAI. A one semester, sixteen-hour course with the student doing most of the learning before and after class is possible if the student has awareness of other computers on campus. The students would research assignments specifically intended to provoke debate or discussion of potential problems such as access to patient information, medication errors, password problems, computer security.
Skiba (1986) has stated that hands-on experience is critical. Opportunity to use these other computers for an intense short period must be included. One software program with hospital data might be sufficient if the computers are linked. With technical assistance during a one or two day excursion to the computer lab, a nurse-educator could provide guidance for the students even if unsure herself of the technicalities of the computers.

The ideal course would be no course at all but the integration of computer applications throughout the curriculum. This could result in a nurse who has skills that can be transferred to any environment (Skiba, 1986).
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APPENDIX A

COMPUTER SURVEY
Instructions: It should not take longer than 10 minutes to complete the questionnaire. Do not omit any item. Read each statement carefully then select one of the five responses. Give your first reaction and response to the statement.

SA = Strongly Agree  A = Agree  U = Uncertain  D = Disagree  SD = Strongly Disagree

1. Only a few nurses will need to learn how to use computers.  
   SA A U D SD

2. Computers cause a decrease in communication between hospital departments.  
   SA A U D SD

3. Computers will allow the nurse more time for the professional tasks for which he/she is trained.  
   SA A U D SD

4. Computers are probably more useful to professions other than nursing.  
   SA A U D SD

5. The time spent using a computer is out of proportion to the benefits.  
   SA A U D SD

   SA A U D SD

7. Only one person at a time can use a computer terminal and therefore, staff efficiency is inhibited.  
   SA A U D SD

8. The use of a computer should result in better patient care.  
   SA A U D SD

9. Computers contain too much personal data to be used in an area as open as a nursing station.  
   SA A U D SD

10. Computers cause nurses to give less time to quality patient care.  
    SA A U D SD

11. If I had my way, nurses would not ever have to use computers.  
    SA A U D SD

12. Computers should only be used in the financial department.  
    SA A U D SD

13. Computers make nurses' jobs easier.  
    SA A U D SD

14. Paperwork for nurses has been greatly reduced by the use of computers.  
    SA A U D SD

15. It takes as much time to maintain patient records by computer as it does by hand.  
    SA A U D SD
16. A computerized record of nursing notes is usually more accurate than a hand written record.

17. Computers save steps and allow the nursing staff to become more efficient.

18. Using computers in hospitals is likely to put a lot of nurses out of work.

19. Computers will enable nurses to spend more time with patients.

20. Because of computers, nurses will face more lawsuits.

What other comments do you have (If any) regarding the application of computers in nursing?
DEMOGRAPHIC DATA

Age:  
   a) 17-20  
   b) 21-24  
   c) 25 or over  

Sex:  
   a) male  
   b) female  

Have you ever worked with computers?  YES  NO  
Number of years you have worked with computers  . If months, number of months  .  

Have you used the computer for computer-assisted instructions (CAI)?  YES  NO  

Did you take a computer course in high school?  YES  NO  

If a computer literacy course (not computer programming) were offered as an elective, would you sign up for it?  YES  NO  

Thank you for taking the time to complete this questionnaire.
APPENDIX B

PERMISSION FROM AUTHOR
Nurses' Attitudes Toward Computerization
Questionnaire
Copyright to Dr. James H. Stronge, 1985

Instructions: It should not take longer than 10 minutes to complete the questionnaire. Do not omit any item. Read each statement carefully then select one of the five responses. Give your first reaction and response to the statement. Circle only one answer for each statement.

SA=Strongly Agree A=Agree U=Uncertain D=Disagree SD=Strongly Disagree

Positive Statements + 3, 8, 13, 14, 17, 19
Negative Statements - 1, 2, 4, 5, 6, 7, 9, 10, 11, 12, 15, 16, 18, 20

1. A computer increases costs by increasing the nurses's workload. (Benefit to Institution)
   SA A U D SD

2. Computers cause a decrease in communication between hospital departments. (Benefit to Institution)
   SA A U D SD

3. Computers will allow the nurse more time for the professional tasks for which she is trained. (Patient Care)
   SA A U D SD

4. Part of the increase in costs of health care is because of computers. (Benefit to Institution)
   SA A U D SD

5. The time spent using a computer is out of proportion to the benefits. (Superior Capabilities of Computers)
   SA A U D SD

6. Computers represent a violation of patient privacy. (Legal)
   SA A U D SD

7. Only one person at a time can use a computer terminal and therefore, staff efficiency is inhibited. (Superior Capabilities)
   SA A U D SD

8. Computerization of nursing data offers nurses a remarkable opportunity to improve patient care. (Patient Care)
   SA A U D SD

9. Computers contain too much personal data to be used in an area as open as a nursing station. (Legal)
   SA A U D SD

10. Computers cause nurses to give less time to quality patient care. (Patient Care)
    SA A U D SD

11. If I had my way, nurses would not ever have to use computers. (Superior Capabilities)
    SA A U D SD

12. Computers should only be used in the financial department. (Superior Capabilities)
    SA A U D SD

13. Computers make nurse's jobs easier. (Superior Capabilities)
    SA A U D SD

14. Paperwork for nurses has been greatly reduced by the use of computers. (Superior Capabilities)
    SA A U D SD
15. Orientation for new employees takes longer because of computers and, therefore, unnecessary work delays occur. (Patient Care)  

16. Nursing data does not lend itself to computers. (Benefit to Institution)  

17. Computers save steps and allow the nursing staff to become more efficient. (Patient Care)  

18. The more computers in an institution, the less number of jobs for employees. (Threat to employment)  

19. Increased computer usage will allow nurses more time to give patient care. (Patient Care)  

20. Because of computers, nurses will face more lawsuits. (Legal)  

Additional Comments:  

DEMOCRAHIC DATA:  

Age: ________  

Sex: Male ________ Female ________  

Years worked as a nurse? ________  

Highest degree obtained in nursing:  
- LPN ________  
- RN-Associate Degree ________  
- RN-Diploma ________  
- RN-Baccalaureate ________  
- RN-Masters ________  

Date of most recent degree: ________  

Have you had experience working with computers? Yes ________ No ________  

Number of years you have worked with computers? ________  

Years worked at this hospital? ________  

Job Title? ________  

Thank you for taking the time to complete this questionnaire.
APPENDIX C

STUDENTS' WRITTEN COMMENTS ON QUESTIONNAIRE
Students' Comments on the Questionnaire

Pretesting comments

Benefits Cited Regarding Computers

1.1 Computers should be good to decrease law suits as you usually have some regime to follow. (A)

1.2 We should have more time for nursing care. (A)

1.3 Computers are being applied to other fields and working great. Computers should be of interest to people in all professions. (B)

1.4 Computers will decrease errors due to poor hand writing - then again doctors won't know how to type. Since I haven't worked with computers yet, it is difficult to assess. (C)

1.5 I feel that computers can bring a lot of benefits if they are used properly. It will take 3 times longer than normal until people get use (sic) to using computers but there is no sense (sic) fighting it. (H)

1.6 All patient history is at your fingertips without having to flip a file etc. when time is essential. (A)

1.7 I feel that computers would greatly enhance nursing and enable nursing to have much more accurate records. (B)
I feel that they will save time and provide information concerning the patient at a glance. I personally am looking forward to using computers (saw a computer once used in a New Brunswick Hospital two years ago and it saved valuable time in getting my Grandmother's name). (B)

Computers are coming in so except (sic) them and learn to use them. (C)

I haven't been involved with a computerized hospital but I see a lot of good qualities that a computer can offer this profession (sic). (C)

Computers would be beneficial for checking medications. (C)

**POSTTESTING COMMENTS**

**Benefits Cited Regarding Computers**

Hopefully there will be formal training to decrease people's anxiety about computers. It will keep records compact. Computers do breakdown and dependency produces chaos in these situations. I worked an a blood letter in a hospital with computers. No writing, verbal orders to contend with. (B)
1.2 I have not been required to use a computer in a clinical setting, however, I believe that they could be highly beneficial in terms of saving time and accuracy in patient information. (A)

1.3 They are a great idea. They will cut down errors and are much more accessible. (C)

1.4 Computers is (sic) the future. (C)

PRETESTING COMMENTS

Lack of Experience with Computers

2.1 I think I'd like the idea, but I don't know a lot about computers related to the nursing career. (A)

2.2 I don't have any experience with computers in a health care facility. (B)

2.3 My knowledge of computers is nil. (B)

2.4 I'm not really sure about the use of computers. (C)

2.5 I personally have never worked in a health care facility where computers are being used. (C)
2.6 Our hospital doesn't have a computer. We have never discussed it in class and I haven't had much experience with computer. (C)

2.7 Some questions are hard to answer having never dealt with computers on the hospital floor. (B)

2.8 My experience with the use of computers at this point is nil so my answers are based on assumptions. (C)

2.9 I don't know that much about computers. (C)

POSTTESTING COMMENTS

Lack of Experience

2.1 I can't be expected to answer this question (sic) since I have no knowledge of computers at all. (C)

2.2 Because we don't have computers on the floor, I'm uncertain about their value on the hospital floors. (C)

2.3 I only took one course in high school. I don't know what nurses do with them in hospitals. (C)

2.4 I know absolutely nothing about computers and hospitals. (C)

2.5 I feel that computers should and most likely will be used in the future, however, I've never seen them used in the hospital and don't understand how they are used. (B)

2.6 I haven't worked on a floor with computer terminals yet so a lot of these answers are uncertain. (A)
2.7 I have no experience with the computer being used in the hospital setting so really I am unfamiliar with its benefits. (C)

2.8 Courses involving computers should be incorporated in the schools. (C)

2.9 I have never been in a hospital that has a computer system. (C)

2.10 We student nurses have hardly had any exposure to computers so really this is an inappropriate questionnarie. (C)

PRETESTING COMMENTS

Negative Feelings Expressed about Computers

3.1 A floor would have to have a lot of terminals to ensure that information is recorded in an acceptable length of time. (C)

3.2 I hope that if computers are brought into the nursing profession that it would put more emphasis on time allowed for better patient care. (C)

3.3 I have no idea in what capacity nurses would be used in the hospital setting. Besides replacing some paperwork, the computer would seem to be an expensive addition to hospital budgets. (B)
3.4 Being that we have not had any direct contact with computers in nursing, it is hard to make a judgement. I worry about computer breakdown or malfunction hindering immediate access to patient files (chart). (B)

3.5 The use of computers would make charting more efficient and probably more detailed than normal charting. The only problem I see is that it would be extremely easy for others to see what is usually confidential information. Something needs to be done to ensure privacy. (B)

3.6 I think that computers will decrease the nurse workload but will not increase the quality of care to our patients. (C)

3.7 I don't know how we are supposed to know if computers will be beneficial. (C)

3.8 It doesn't seem possible that a person's entire chart can be put on a computer. (B)

POSTTESTING COMMENTS

Negative Feelings Expressed About Computers

3.1 If computers ever make their appearance in nursing care, I hope they would never be put in the nursing station. (C)

3.2 I hate computers. (C)
3.3 I can only imagine computers in the financial office.

(B)

3.4 I find these questions totally irrelevant as I have no idea on computers and nursing. (C)

3.5 Why aren't we learning how to use them in hospitals instead of all this garbage? (A)

3.6 If only one computer is available and you have all the nurses wanting to enter notes it would be frustrating because of all the waiting involved. On the other hand, I think, obtaining the patient's chart would be readily available (sic). (A)