

Running head: FACTORS INFLUENCING INFORMATION RETRIEVAL

Factors Influencing Successful Use of Information Retrieval

By Nurse Practitioner Students

By

Linda Rose R. N., B. S. N.

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Approved:

[Redacted]

M. Katherine Crabtree, RNCS, DNSc., Associate Professor

[Redacted]

William R. Hersh, MD, Associate Professor

[Redacted]

Katherine A. Caton, RN, Ph.D., Assistant Professor

[Redacted]

Beverly Hoeffler, RN, DNSc., FAAN, Associate Dean of Academic Affairs

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Abstract

Title: Factors Influencing Successful Use of Information Retrieval Systems by Nurse Practitioner Students

Study Type: Descriptive

Author: Linda Rose, RN, BSN

Approved:

{Katherine Crabtree, DNSc}

Background: Nursing researchers are not only responsible for conducting research but also for communicating their research findings to clinicians for the benefit of their patients. Timely dissemination and implementation of research findings is absolutely critical for improved patient care. The first step in research utilization is the retrieval of published research findings in order to provide the best possible health care for their patients. However, for more than twenty years, the nursing literature has documented a persistent gap between the conduct of nursing research and the dissemination and utilization of these findings in clinical settings.

There is a 10 to 15 year interval between the discovery of innovative research findings and implementation of research into nursing practice. An opportunity to potentially close this gap is to increase access to nursing research through more efficient and user friendly computerized Information Retrieval (IR) systems. Despite advances in computer technology and attempts to bring greater awareness and attention to research utilization, the gap between research and the utilization of research still persists. Few research utilization activities are taking place in clinical practice today.

Research in nursing literature regarding IR systems, and methods to improve the first step in research utilization, are almost non-existent. Furthermore, there are virtually no IR studies targeting Nurse Practitioners (NPs). As primary care providers, NPs encounter a broad range of clinical problems. To help clinicians use scientifically-based knowledge and solve clinical problems, requires clinicians with adequate IR skills and efficient IR systems. This study makes a contribution by establishing baseline information that describe an important group of clinicians (NPs) who have, as yet, not been studied, but who have potential for greater use of IR to benefit patients in primary care. In addition, this study may be an impetus for investigation into methods that we can implement to improve the application of information technology and corresponding information retrieval systems usability by nurses and Nurse Practitioners.

Purpose: The primary purpose of this study was to identify the personal attributes of Nurse Practitioner (NP) students best associated with successful use of information retrieval systems. The study also served as a pilot for a larger study. The study applied Rogers' Diffusion of Innovation Theory as a theoretical framework.

Methods: Twenty-four second year NP students completed a demographics and attitudes questionnaire, three timed cognitive tests (logic, vocabulary, and spatial abilities), and three separate Medline searches to find the answer to three primary care questions.

Three sets of predictor variables: cognitive attributes, professional attributes, and attitudes toward computer and IR technology were tested for correlation with each other and the dependent variable, successful answering of the clinical question using an Information Retrieval system.

Results: Subjects improved their ability to answer clinical questions with the Information Retrieval system. None of the cognitive or professional attributes were associated with successful use of the system. One predictor variable, attitude toward current computer technology, was significantly correlated ($r = 0.43$, $p \leq .05$) with successful literature searching. Specifically, NP students responding that their practice would be easier without computers were less likely to be successful at information retrieval. An additional positive correlation ($r = .424$, $p \leq .05$) was found between question difficulty and successful searching. More difficult clinical questions were associated with successful searches.

Discussion: The computer and IR technology industries have made great strides in moving forward to redesign IR interfaces that impact patient care. However, we have not yet achieved a goal of an IR-user interface that ensures finding appropriate information if it is available in the database. Despite the fact that the subjects for this study were in graduate school and possessed significant positive attributes, they were unsuccessful in performing many of the IR searches.

Conclusions: This study suggests that user attitude toward computers and characteristics of the questions asked are contributing factors to search outcomes. Further research is needed to better understand the reasons for successful or unsuccessful use of information retrieval systems by all nurses. We can utilize the knowledge that we gain from this study and others like it, to investigate new approaches to research utilization.

One goal is to increase the use of IR systems by nursing professionals. To attain this goal, more innovative and extensive IR training must be done. We must better understand the IR user's needs to assist them to become successful IR searchers. Similarly, computer

interfaces that are user friendly and intuitive cannot be designed without a thorough understanding of the experiences and expectations that the user brings with them every time that they approach an IR system to perform a search.

Nursing leaders, administrators, and educators must adopt new and innovative ways to promote a more positive attitude toward computer and IR technology. As a profession, we must begin to bridge the gap between the discovery of new knowledge and the dissemination of that knowledge into nursing practice.

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Chapter I

Introduction

Nursing Researchers are not only responsible for conducting research but also for communicating their research findings to clinicians for the benefit of their patients. Publishing is the initial step in the dissemination of research. In turn, clinicians and Nurse Practitioners are responsible for accessing new scientific information for improving patient care. The first step is the retrieval of published research findings in order to provide the best possible health care for their patients (Funk, Tornquist, & Champagne, 1995). Timely dissemination and implementation of research findings is absolutely critical for improved patient care. However, for more than twenty years, the nursing literature has documented a persistent gap between the conduct of nursing research and the dissemination and utilization of these findings in clinical settings (Funk et al., 1995). Unfortunately, and in keeping with many other professions, the gap is intolerably large. There is a disturbing 10 to 15 year interval between the discovery of innovative research findings and implementation of research into nursing practice (Bostrom & Wise, 1994).

Efforts to improve utilization of nursing research have been initiated at all levels, including the utilization of new technology. For example, in late 1970s, nurse researchers and practitioners implemented the Conduct and Utilization of Research in Nursing (CURN) project (Horseley, Crane, & Bingle, 1978). Furthermore, in an attempt to bring this critical gap to the attention of the nursing community, the National Center for Nursing Research defined research utilization as a major challenge to the nursing profession (Hinshaw, 1988).

An opportunity to potentially close this gap is to increase access to nursing research through more efficient and user friendly computerized information retrieval systems. Despite advances in computer technology and attempts to bring greater awareness and attention to research utilization, the gap between research and the utilization of research still persists. Few research utilization activities are taking place in clinical practice today (Funk et al., 1995, White, Leske, & Percy, 1995).

As stated above, the initial step in research utilization is the process of locating earlier research (Beaudry, VandenBosch, & Anderson, 1996). However, even with advances in searching technology, retrieval of research literature proves difficult, if not impossible, for many nurse researchers and clinicians, for a multitude of reasons. Barriers to access of needed information are plentiful. Access to research literature involves both the ability to search and retrieve relevant literature, as well as the ability to understand content and its implications. Although nurses are trained in database searching techniques, the process of information retrieval (IR) can be complex and generally requires additional instruction (Cronenwett, 1995).

Technology has made research literature more accessible to clinicians in practice sites and homes. However, there is evidence of consistently low usage of information retrieval systems, despite current awareness of the research utilization gap. This evidence may indicate a need to investigate other approaches to increasing IR use. Other approaches could include: innovative training, better computer interfaces, more user friendly systems, as well as the presentation of information in forms other than the traditional journal research report.

Hersh (1995) describes the IR process as the interaction between the user, who has an information need, and the IR system (also referred to as the database as well as computer hardware and software). Research in nursing literature regarding IR, and methods to improve the first step in research utilization, are almost non-existent. Furthermore, there are virtually no studies targeting Nurse Practitioners. Nurse Practitioners are advance practice nurses prepared at the master's level to deliver primary care. As generalists, they provide care for a wide range of health care problems and need access to scientific evidence for clinical problem solving. IR is one aspect of maintaining current high quality practice that meets standards expected by nursing and medical professionals and the society.

Since there are no IR studies dealing specifically with NPs, this study is important to nursing. It will serve as a basis for further research and contribute to the body of scientific literature regarding barriers to information retrieval and research utilization for NPs in health care today. In addition, this study may be an impetus for investigation into methods to improve the application of information technology and corresponding information retrieval systems usability by nurses and Nurse Practitioners. Ultimately, it is imperative that nursing practice be shaped by empirical research data, that those research findings be the most current facts available to practitioners, and that the profession of nursing strive to make this ideal a reality.

Chapter II

Review of Literature

The Research Utilization Gap

Despite insights into the diffusion/dissemination of information pertaining to the research utilization process, use of research findings in nursing practice has remained insufficient over the past two decades (Funk et al., 1991). Stetler (1985) recognized nursing's lack of disseminating research results into practice and reported that there is little data regarding how nurses actually utilize research findings.

In a study done in 1975, investigating clinical nursing practice in determining oral temperatures, Ketefian concluded that “the practitioner either was totally unaware of the research literature relative to her practice, or if she was aware of it, was unable to relate to it or utilize it” (p. 91). In addition, Kirchhoff (1982) reported that only 24% to 35% of critical care nurses were aware of current research findings that affected the nursing care of their coronary patients. In 1987, Brett's study demonstrated that out of 279 practicing nurses, 70% used less than 6 of 14 well known nursing research-based practices. Coyle and Sokop replicated Brett's study in 1990 with nearly the same results. While studying information seeking-behavior of 46 cardiovascular nurses in three metropolitan hospitals, Cocoran-Perry & Graves (1990) reported that the nurse's most common supplemental information source came from their professional colleagues, such as other nurses or physicians. The sample was made up of 175 instances of nurses seeking supplemental information. Supplemental information is defined by these researchers as information needed, but not available from memory, and that could be obtained from a computer.

Bunyan & Lutz (1991) not only had similar results in their analysis, but found that the majority of nurses studied did not access library resources readily available to them.

Barriers to Research Utilization

Research utilization is recognized as a vital responsibility of the nursing profession. The serious gap between discovery of an innovation and diffusion of research into practice is well documented throughout nursing literature. These documented studies have determined the existence of barriers that inhibit transformation of clinical findings to clinical practice. Examples from nursing literature demonstrate that barriers to research utilization are numerous. They include: (a) the method by which research is communicated, (b) accessibility to research findings, (c) quality and relevance of research, as well as (d) integrity of research conducted and qualifications of investigators. Time and workplace limitations may also be contributing factors to barriers of research utilization. (Funk et al., 1991).

One of the first studies addressing research utilization barriers in health care professionals, completed by Miller and Messenger (1978), revealed that the most frequently identified barrier was the ability to actually obtain research findings in a particular area of nursing interest. Obtaining research findings is defined as: utilization of information retrieval resources and acquisition of written materials. They also found that 42% of 215 nurses surveyed reported a "lack of institutional support" as an important barrier to research utilization.

Later, Funk et al. (1991) surveyed nurses at numerous institutions in the United States using the Barrier scale instrument. This instrument determines nurse's perceptions of potential obstacles for utilization and implementation of research findings in clinical

practice settings. The study demonstrated that approximately 74% of nurses evaluated stated that a lack of awareness of current research was a great or moderate barrier.

Information Retrieval

Information retrieval (IR) is the act of retrieving information from a computer, or more specifically, the retrieval of information from textual databases (Hersh, 1996b). In the health care domain, timely dissemination of new knowledge is dependent upon IR systems and the interactions that users have with these systems. The field of information retrieval (IR) is broad, and an explanation of all the aspects of this growing field is beyond the scope of this paper. However, it is important to understand that health care professionals must rely on IR systems in order to access and utilize the ever-growing body of scientific knowledge. Therefore, successful research utilization by NPs is dependent upon how well they are able to use IR systems in order to access that information.

Evaluation of IR systems is essential in order to understand how well the systems are performing as well as how well health care providers are using them. The evaluation of IR systems includes many components such as: the user or the searcher (may or may not be the same), the search, the questions, the type of IR system, and the outcome. However, for the purposes of this study, only qualities of the user and of the search were investigated.

In the past, the most widely used evaluation measures of outcome for IR systems have been the relevance-based measures of recall and precision (Figure 1). These measures quantify the number of relevant documents found during a search. Recall is the number of documents retrieved and relevant divided by the number of relevant documents in the

entire database. Precision is the number of documents retrieved and relevant divided by the number of documents retrieved (Hersh, 1996b).

Recall	=	$\frac{\text{Number of documents retrieved and relevant}}{\text{Number of relevant documents in entire database}}$	=	Fraction of relevant documents
Precision	=	$\frac{\text{Number of documents retrieved and relevant}}{\text{Number of documents retrieved}}$	=	Fraction of retrieved documents that are relevant

Figure 1. Relevance Based Measures: Recall and Precision

Unfortunately there are many problems with the above approach to IR evaluation. These problems include: (a) difficulty determining how many relevant documents are in a database, (b) redundancy and contradiction in medical literature, (c) different user interfaces may influence outcomes, (d) recall and precision may be inversely related and therefore not easily interpreted, (e) judgment of relevancy itself is subjective, and (f) measurement of a “significant difference” is unknown (Hersh, 1994, 1996b). Most of the above problems are related to the fact that relevance-based measures are outdated since they were established in early stages of IR system’s development. Older methods of batch searching no longer apply to today’s sophisticated user interactive queries (Hersh, 1996b). While investigating factors affecting on-line bibliographic retrieval, Fidel and Soergel (1983) state that “...we should strive to discover outcome measures that relate directly to the requirements arising out of problem situations of specific users.” (p. 169).

In an attempt to address problems related to relevance-based evaluation of IR systems, researchers have begun to develop alternative research approaches. One of the first studies beyond recall and precision evaluated other factors that correlate with a successful search of an IR system (Saracevic, Kantor, Chamis, & Trivison, 1988; Saracevic & Kantor, 1988; 1988). In this study, 36 different intermediaries or "outside searchers" and 3 project searchers performed an actual IR system search. Five general elements of IR were investigated including: the searcher, the question, the user, the search and the items retrieved. Forty professional information seekers (19 faculty from information and industrial research, 15 information science graduate students, 6 persons from industry) submitted one question each and then were video taped as they described their information problem to a reference librarian. Next, the nine intermediaries (5 outside searchers and 4 staff searchers) searched on 5 or 6 of the questions each. The IR system used was DIALOG, a vendor for many databases. An appropriate database for each question was chosen by the project team and only one database was used for each question. The search yield was limited to 150 items per question, which were then given to the user (the one with the information problem) to evaluate as to relevance. Statistical analysis was done using both regression and biomedical research technique called logarithmic cross ratio (t-value). After reviewing many factors, researchers found that, in general, each of the five above chosen elements had a significant relationship with the outcome of the retrieval process.

The task-oriented approach to evaluation of IR systems is different from the above method in that the user is given a pre-defined task. Two similar studies examined this approach. First, in a 1994, study Hersh et al. gave 13 medical students a ten-question test

related to the medical domain. After students finished answering the question without any references, they were asked to designate five questions, from the original ten, with which they had the least certainty regarding their answers. Then each student used one of two different types of IR systems to search for correct answers to those questions (see results below).

In another study, Hersh and Pentecost (1996) used the task-oriented method of IR evaluation while comparing two different IR systems. Answers to 12 questions were known to exist in the literature. The questions were grouped into therapeutic or diagnostic categories. While still IR evaluation, the approach was previously used to assess textbooks, an encyclopedia and a factual database. This was the first attempt to use the task-oriented approach to IR system evaluation with a large bibliographic database. Both the Hersh et al. (1994) and the Hersh and Pentecost (1996) studies demonstrated that a task oriented approach to the evaluation of IR systems using pre-defined questions is a viable solution to problems of earlier methods.

From a review of the published IR literature, there are essentially no studies relating to the utilization of IR systems by NPs. This IR research was a pilot project served as a basis for a larger study that will reach out into the community to investigate NPs as IR system users and will measure the effectiveness of their IR searches.

Conceptual Framework

Since timely dissemination and implementation of research findings is absolutely critical for improved patient care, Rogers' (1983) Diffusion of Innovation Theory provides the theoretical framework for this study. Diffusion is "the process by which an innovation is communicated through certain channels over time among members of a

social system” (Rogers, 1983, p. 11). The four main elements of the diffusion process are the innovation, communication channels, time, and social system. Much of the prominent literature regarding barriers to research utilization apply the social theory of diffusion of innovation in order to organize solutions to the problem (Funk et al. 1991; 1995a; 1995b; Coyle & Sokop, 1990). In a comprehensive review article, Johnson (1990), noting her views regarding the diffusion of innovation, writes: “An important feature of a discipline is that those who generate its knowledge openly share their work, principally through the act of publication” (p. 130). IR is in itself an innovation subject to the stages of diffusion Rogers describes. Given the lack of emphasis in the schools of nursing on IR skills, we can expect students and graduates to have low IR skills.

Purpose of the study

Few studies demonstrate an understanding of the user’s information needs regarding information retrieval for the purposes of dissemination of research. In his book Information Retrieval: A Health Care Perspective, Hersh (1996b) contends that studies regarding information retrieval in health care are limited. In health care settings, where information access may play a vital role for improved health care, practically no studies examined methods by which health care professionals access critical information or whether this information is accessed at all.

The NP’s scope of practice continues to focus on primary care. Although, this is not a new role for NPs in today’s current health care environment, NPs, practicing primary care, are serving a prominent role in modern health care. Because of this critical role as primary care providers, retrieval of pertinent information is essential for keeping current

in the latest scientific knowledge applicable to patient care. However, there are virtually no research studies involving NPs and IR in medical literature or nursing literature.

The purpose of this study was to investigate the relationship between successful completion of information retrieval with the following selected NP student attributes:

- (a) Cognitive attributes: logical reasoning, verbal comprehension, and spatial visualization
- (b) Professional attributes: years of nursing experience, breadth of clinical experience
- (c) Computer and IR attitudes and experience: attitudes and experience concerning current information retrieval technology and computer technology.

This study was designed as a pilot study for another IR research project. The later study, conducted by a pioneer in IR research (William Hersh, MD), will focus on development of a task-oriented approach to evaluation of information retrieval systems used by physicians and Nurse Practitioners.

Chapter III

Methodology

This predictive study examined whether a relationship exists between selected Nurse Practitioner (NP) students' attributes and successful information retrieval (IR). Successful IR is defined as the retrieval of accurate and relevant information appropriate to the question posed or information sought. A sample of 24 NP students each performed 3 consecutive literature searches using an IR system to find the correct answer to 3 predetermined primary care clinical questions. Before the searches, each subject completed the study consent form, the study questionnaire, and 3 cognitive tests (Appendix A, B, and C). In addition, after reading the clinical question but before the search, they were asked to guess the answer and their give the certainty of their guess.

The specific question addressed in this study was: Which of the following of Nurse Practitioner student's attributes best predicted successful IR searches?

1. Cognitive attributes: logical reasoning abilities, verbal comprehension and spatial visualization were operationalized using standardized tests.
2. Professional attributes: years of nursing experience, breadth of clinical experience were obtained by self-report.
3. Computer and IR attitudes and experience: attitudes and experience concerning current information retrieval technology and computer technology were likewise elicited by self-report.

Sample and Setting Description

The study was conducted at the Oregon Health Sciences University's (OHSU), Biomedical Information Communication Center (BICC) and medical libraries. This

setting provided participants needed access to the on-line IR system (Medline). Also, the BICC administration was familiar with IR research, since previous IR experiments had been performed in this setting with their assistance and cooperation.

A convenience sample was selected from a population of approximately 80 senior NP students from OHSU and U of P. NP students in the specialty areas of Adult, Family, Geriatrics, Women's Health Care and Nurse Midwifery were included in this study because of their knowledge in primary health care. Pediatric and Mental Health NP students were excluded because of their limited exposure to primary care.

It was anticipated that approximately half of the sample population would participate in the study. However, after six months and a follow-up letter, only twenty-four NP students volunteered. The length and complexity of the study along with the student's extremely full schedules were probably the main contributors to the small sample size.

Instruments

Three methods were used to collect information about selected attributes of NP students: (a) a seventeen item questionnaire designed by the investigator to assess attitudes toward and experience with computers and IR technology, (b) a series of three cognitive tests, and (c) an IR test to assess their ability to find the correct answers to three difficult primary care question, using only the OVID Medline system (Ovid Technologies, New York, NY).

Cognitive attributes. Spatial, verbal, and logic abilities were measured using test instruments selected from the Kit of Factor-Referenced Cognitive Tests (Ekstrom, French, & Harmon, 1976). These are published instruments used to assess cognitive attributes (Appendix C). The Educational Testing Services (ETS) provided validity

assessments for the instruments (individual reliability results reported below). ETS granted permission to use the three cognitive testing instruments and a licensing agreement was purchased allowing for reproduction of the tests (Appendix D).

Logical reasoning is “the ability to reason from premise to conclusion, or evaluate the correctness of a conclusion,” or deductive reasoning (Ekstrom et al., 1976). Within the realm of information retrieval, logical reasoning is associated with understanding the correct usage for combining Boolean operators to facilitate searching (Allen, 1992). In his 1992 study of the cognitive differences in end user searching of a CD-ROM index, Allen reported that logical reasoning as well as verbal comprehension abilities influenced search tactics. This cognitive ability is tested by the Nonsense Syllogisms Test (RL-1). Participants are given 15 syllogisms with nonsensical content so that they cannot discern the answer from past learning. A syllogism is a formal argument with a major and minor premise and a conclusion (Merriam-Webster, 10th ed.). Participants were instructed that the first and second statement in each problem is correct. Then they decided if the conclusion is good reasoning or poor reasoning considering the logic, or lack of, from the first two statements. Participants had 4 minutes to complete the test. Recorded reliability estimate for the Nonsense Syllogisms Test (RL-1) is .64 (Ekstrom et al., 1976). One hundred and eighty-nine high school males were the sample for this Nonsense Syllogisms reliability estimate.

Verbal comprehension is “the ability to understand the English language.” (Ekstrom et al., 1976). Verbal comprehension is central to IR. The lexical (meaning) component of language seems to be associated with long-term memory (Ekstrom et al., 1976). The ability to understand the search terms in order to expand the search and comprehend the

content of the retrieved material is a necessary part of successful use of IR systems (Allen, 1992). This cognitive ability was tested by administering the Vocabulary Test I (V-1) which consists of 18 words with a set of four possible synonyms. Study participants were instructed to select the synonyms that they perceive to be the closest to the meaning of the stem word and they had 4 minutes to complete the test. Reported reliability estimates for the Vocabulary Test I (V-1) is .94 and .70 (Ekstrom et al., 1976). The samples for these Vocabulary Test reliability estimates were 85 Army enlistees and 294 sixth graders, respectively.

Within the domain of cognitive abilities, measurement of spatial visualization is operationalized by conceptual evaluation of spatial abilities. Spatial visualization is the ability to manipulate objects in one's "mind's eye" in order to create other objects (Ekstrom et al., 1976). While completing research in the relationship of nurses' cognitive characteristics to their IR speed and accuracy, Stagger and Mills (1994) reported that spatial visualization is a significant predictor for nurses' overall performance IR speeds. In a study done to determine predictor characteristics for successful learning on computers, spatial visualization was one of the best predictors of the time taken to locate text in a retrieval system (Gomez, Egan, & Bowers, 1986). In another study, researchers found that subjects with low spatial ability took twice as long to complete a computer task as the subjects with high spatial abilities (Vicente, Hayes, & Williges, 1987). To test spatial ability, subjects completed a paper-folding test. Part 1 of the 3 minute Paper-folding (VZ-2) test required subjects to visually distinguish correct forms of folded and unfolded paper models. Participants had 3 minutes to do 10 items. Scores range from 0-10 with 0 indicating low spatial visualization abilities (Stagger & Mills, 1994). Reported

reliability estimates for the Paper-folding (VZ-2) tests are .84 and .84 (Ekstrom et al., 1976). The samples for these Paper-folding reliability estimates were 46-college students and 82 Army enlistees.

Professional attributes. Data for professional attributes were collected from the study questionnaire (Appendix B). Professional attributes measured were years of nursing experience, breadth of clinical experience, and NP specialty. Even though formal education in IR is suggested to be important in the search process, less is known about formal education in other areas such as nursing (Fidel & Soergel, 1983).

The NP student reported their years of experience as a continuous variable. To measure the subjects' breadth of clinical experience, they reported all the different clinical areas they had worked as a nurse. There were fourteen choices (i.e. Med/Sug, Telemetry, Critical Care etc.); in addition, they could write-in other areas. The areas were summed for a total number of clinical areas worked.

The subjects reported their area of clinical NP specialty. Those areas were Adult NP, Family NP, Geriatric NP, Neonatal NP, Women's Health Care NP, Certified Nurse Midwife, and other. In addition to the above professional attributes, the subjects reported basic demographic data. These included date of birth, gender, and both basic and highest educational level (Associate Degree, Diploma, BSN, Generic MN).

Computer and IR attitudes and experience. Fidel & Soergel (1983) suggest that attitudes regarding on-line searching are a significant factor in searching behavior. The user's perception of the utility or value of computers and on-line systems, interest and enthusiasm toward the technologies and a sense of professionalism are the user attitudes

studied in relation to information retrieval and computer technologies. Computer and IR attitudes were measured by the subjects self-reporting the following:

- (a) Would they be willing to pay for an IR newsletter (pay, subscribe if free, not interested)
- (b) Do they feel it is their professional obligation to complete on-line searches for answers to questions about patient care (yes-no)
- (c) Is on-line searching the best method for answering questions about patient care (yes- no)
- (d) Do they feel that as a professional, their practice would be easier or harder without computers (harder-easier)
- (e) Do they enjoy using a computer (yes-no)

Hersh and Hickam (1993) measured user computer and IR experience in a study to compare two methods of indexing and retrieval by medical students and found that these variables were not good predictors of successful use of systems. However, it is important that research studies be confirmed to build more reliable scientific evidence.

Previous information retrieval experience was ranked according to the number of self-reported on-line searches completed by the study subject during the past year (0, 1-2, 3-5, 6-10, 11 or more). Previous computer experience was operationalized by the weekly or more frequent use of a personal computer and productivity software (e.g. word processing, spreadsheet, database) (yes-no). The study subjects also reported the hours per week they used a personal computer (continuous variable). Again, data for the above attributes were collected from the study questionnaire (Appendix B).

Successful Information Retrieval. The single outcome variable was measured by totaling the number of correct answers (0-3) subjects found after completing all three of the literature searches using the IR system (Medline).

The search questions were randomly selected from the Medical Knowledge Self-Assessment Program (MKSAP, American College of Physicians, Philadelphia, PA). The MKSAP collection contains expanded abstracts from medical journals and is designed to keep medical clinicians apprised of the newest technologies or medical advances in their area of practice. Questions specific to different areas of practice (Oncology, pediatrics, geriatrics etc.) follow each section. A Nurse Practitioner and medical faculty member reviewed the set of questions. They then limited the set to only those that represented primary care type questions and those that they felt were appropriate for NP students. See Appendix E for an example of a typical question from MKSAP. After question criteria was determined, we were left with a set of eighteen primary care questions. For six subjects, the entire set of questions was used once.

Questions for the study were selected for a high degree of difficulty to minimize dependence between observations. By this method, successful use of the IR system is less likely to be due to the user's past knowledge of the subject (Hersh, 1996 a). An additional variable for question difficulty was measured by rating each question for difficulty on a scale of 1-5. The scores were then summed for a total difficulty score for each set of questions given to a subject (3-15 possible). The average difficulty score was 9.17. A Nurse Practitioner faculty member completed the question difficulty rating.

IR System Satisfaction. Participants' opinion regarding the usefulness of the IR system was collected using the " Information Retrieval Satisfaction Form" (Appendix F). This instrument utilized two different types of Likert scales to measure the subjects opinion about how helpful the system was in finding the answer and the relevance of the articles found.

Procedure

Permission to complete the study was given by OHSU's Institution Review Board. Since this study took place in an academic setting involving only the observation of educational curriculum and practices, the criteria for exemption from a full Institutional Review Board, Human Research Committee review applied (Appendix G). In addition, authorization was obtained to use OHSU's medical library and to approach both the U of P and OHSU NP students (Appendix H).

The process for study recruitment included a letter requesting NP student's participation in the research project (Appendix I). Potential subjects were also approached in a classroom presentation given by the researcher. All subjects signed consent forms to participate in the study; confidentiality and anonymity were assured (Appendix A). Confidentiality was maintained by coding the subject's identity on all data collection instruments. Only the investigator had access to subjects' names. Once data collection was completed, the list of names was destroyed.

Participants received a \$25 honorarium upon completion of their participation. The Principal Investigator for the subsequent larger study provided the total funds for this pilot study (\$640). While recruitment was taking place, a small pilot test was completed to assess the logistics of the using library facilities and the timing of the tests.

Data were collected either with one or two students at a time. Initially, for each subject, the researcher connected a video-capturing device to the computer (s). This device allowed videotaping of the IR search sessions. The computer screens from the complete search process were captured and saved on videotape as well as stored on a computer disk for possible later analysis as part of the larger study.

Prior to searching, participants completed the study questionnaire (Appendix B). Data on demographic, computer experience, professional and attitudinal variables were collected from the questionnaire.

Next, the subjects completed the three cognitive ability tests and were then given a packet containing three primary care clinical questions. After the participants read the questions but before performing the search, they were required to document their best guess at the answer and the certainty of their guess (See Appendix E). Then participants were asked to provide the answers to each clinical question by completing an on-line search, using only the Medline system database in the OHSU library. The searches were performed one at a time. During each search, subjects had the option of going to the periodical shelves and retrieving the relevant journal(s) that supported their answer or using the information from the on-line journal abstracts. They kept track of the articles they found relevant using an "Article Retrieval Form" (Appendix J). Subjects were provided with a form to document the question answer, their certainty of the answer, and the journal reference(s) that justified their answer (Appendix K). Finally, at the end of the search process, participants indicated how useful they thought the IR system was by answering the three IR satisfaction questions (Appendix F).

When the study procedure was finished, the subject was given a chance to debrief by asking questions about the process and discussing any concerns they might have regarding the study. The subjects were requested not to discuss the study with other students until after all data were collected. Data collection took approximately six months to complete. Since most participants had different questions, the opportunity for altering the outcome was reduced.

Data Analysis

The software package Statistica was used for data analysis. Frequencies, means, percentages, standard deviations, correlation and multiple linear regression were applied to analyze the collected data. Alpha was set at .05 ($\alpha = .05$) for all statistical analyses. Results from each search were collected at the time of the search and entered into a database. After the data collection was complete, the data were transferred to the statistical package for analysis.

Due to the small sample size ($n = 24$), multiple linear regressions were completed by testing each set of predictor variables separately to select the best predictor of successful searching. To conserve power, regression was used to build a model that predicted successful IR searching. After separate regressions were performed on each set of predictors, the best predictor was entered into the final regression. Utilizing this regression technique decreases the number of variables to be used in testing the final regression model. In addition, two the variables measuring IR attitudes were combined into a new variable to further reduce the independent variables.

Chapter IV

Results

Demographics

This chapter presents the results of the data obtained over a six month time period. Twenty-four NP students participated in the study; 24% (6) students from U of P and 76% (18) from OHSU. Subjects were between the ages of 27 and 49 with a mean age of 37.5 years, (SD= 6.1). Most of the subjects (96%) were Caucasian; while 4% (1) was of Eastern Indian decent. Only one participant was male (4%). Subjects' basic nursing education was: ADN 4% (1), Diploma 12 % (3), BSN 76% (18), and Generic MN (RN earned at Master's level) 8% (2). Twelve-percent (3) of the subjects had received a degree beyond their BSN.

Professional Attributes

Nurse Practitioner specialties represented were: ANP 42% (10), FNP 33% (8), WHCNP 17% (4), GNP 4% (1), and Nurse Midwife 4% (1). Both schools offering ANP programs accounted for the larger number of ANP participants. The mean years subjects had practiced nursing was 12.63 years (SD =6.7), ranging from 3 to 28 years. Each subject's breadth of nursing experience was measured by totaling the number of different nursing areas they had worked in during their careers. Results were: < 2 areas 20% (5), 2-3 areas 37% (9), 4-5 areas 25% (6), 6-7 areas 8% (2), 8-9 areas 4% (1), and 10-12 areas 4% (1). Most subjects had experience in several areas of nursing practice.

Computer and IR Experience

Participants who use a computer, spent a mean of 9.79 hours per week using the computer, (SD= 9.59). Unexpectedly, 20 % of the subjects reported they do not use productivity software (word processor, spreadsheet etc.). This finding implies that some NP students are using computers on a limited basis and that at least 20% of the students tested did not have a clear understanding of computer productivity software. These subjects may be disadvantaged by this inexperience with technology when they do seek IR sources to solve a question.

During the past year, 29% of the subjects (7) completed 11 or more literature searches, 33% (8) completed 6-10, 29% (7) completed 3-5, 4% (1) completed 1-2, and 4% (1) completed none. Reasons given for literature searches included: 75% (18) educational, 8% (2) patient care, and 17% (4) research. The low number of subjects reporting their reason for literature searches was patient care, is most likely is due to the fact that they were students at the time of testing.

Computer and IR Technology Attitudes

Attitudes towards computers and IR technology were assessed by a series of related questions. Not unexpectedly, when asked if the process of performing literature searches was the "best method for finding the correct answer to patient care questions", 54% (13) of the subject reported "yes" and 46% (11) "no." Of those who responded negatively to the above question, 36% (4) thought the best method was textbooks. Subjects preferring NP colleagues as the best method for finding patient care questions were 27% (3), physicians 0%, and the internet 9% (1). The 27% (3) remaining subjects suggested that there was not one 'best method' or that they would seek advice from a Ph.D., an expert in

the field, or a patient first. Since NP education highly encourages collaboration with colleagues (both physicians and NPs), the subjects' responses appear to indicate a lack of understanding about the question asked. This may be due to a poorly written question and the order of the answer choices. This finding suggests that the NP students tested do not fully accept the IR technology as the best method for finding the most current scientific knowledge. Their reluctance could be due to the time needed for IR searching, or that the answer forms are not easily applicable to clinical questions. If they do not value on-line searching how can they keep current or be aware that more current scientific knowledge may exist for patient care? Usually tools must be valued before they are put into practice.

The subjects were asked if they would pay for an IR newsletter. Only 8% percent (2) noted "yes" they would pay, 79% (19) would subscribe if free, and 13% (3) were not interested. Seventy-nine percent (19) of the subjects noted that they felt it was their professional obligation to use on-line searching in order to keep current on changes in patient care and 21% (5) did not. When asked if their practice would be more difficult without computers, 92% (22) recorded "yes" and 8% (2) "no". Eighty-seven percent (21) of the participants reported they enjoy computers and 13% (3) did not.

Only 8% of the subjects for this study did on-line searching specifically for patient care. Similarly, only 8% reported they would pay for a subscription to an IR newsletter. These low percentages seem to indicate that many of the subjects tested do not value on-line searching as an important tool for finding answers to clinical questions. Is this because of experience with unsuccessful searches and difficulty using a complex IR

system? Is it that NP students as well as practitioners find it difficult to stay abreast of the intricacies of the computer and IR technology as it is continually changing?

Characteristics of Search

Time to complete the entire study varied with each subject and ranged between one and one-half to three and one-half hours. Time to complete the three search questions ranged from 59 minutes to 2 hours and 40 minutes (Figure 2). The mean time for seventy-two searches (3 searches x 24 subjects) was 35.1 minutes, (5.1= SD). Several times throughout the study, subjects expressed their frustration with the amount of time and effort it took to complete the searches.

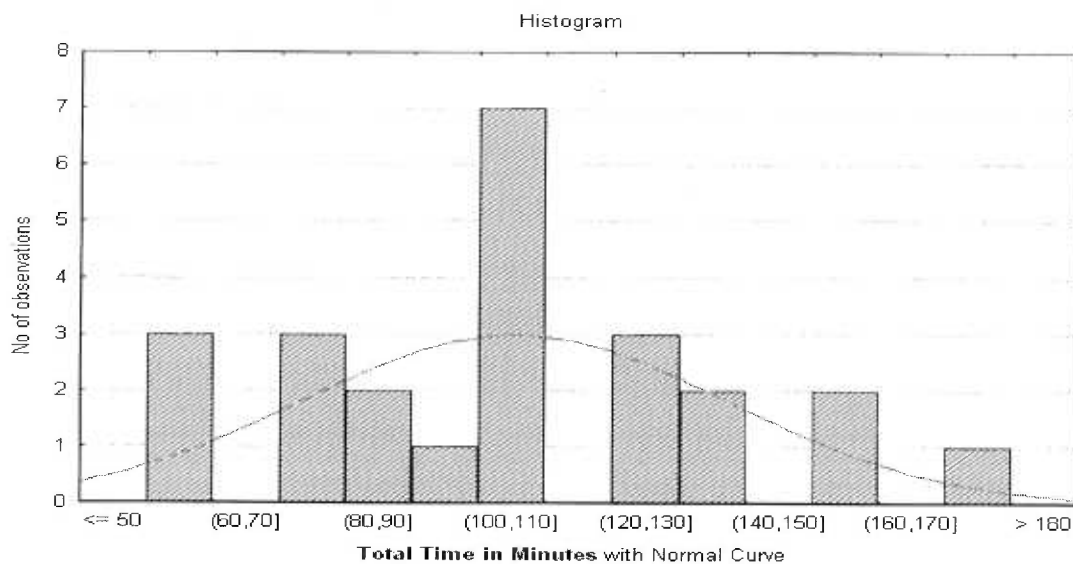


Figure 2. Histogram of Total Search Time for NP Students

Before each of the three searches, subjects were asked to guess the answer to their clinical question. For the seventy-two IR searches, the subjects' pre-search guesses were correct for 25 questions. After searching, they answered 42 of the questions correctly; an increase of 68% in the number of correct answers. The mean for IR searches correct per subject was 1.75 (SD=0.89) (Figure 3). These results suggest that the subjects were able

to use the IR system to substantially improve their correct answers over their initial guess. This may be a function of the IR system, or user skills or some combination of both.

A note of interest, two subjects had a decrease in the total number of correct answers when compared to the number of correct guesses. One explanation for this finding is that their low confidence in their pretest suggests that they might have easily changed to the wrong answers. After each search, subjects were asked if they thought the IR system (Medline and the library) was helpful. Subjects reported they strongly agreed for 18% (13) of the searches, moderately agreed for 33% (24), were neutral for 8% (6), moderately disagreed for 24% (17), and strongly disagreed for 17% (12) of the searches.

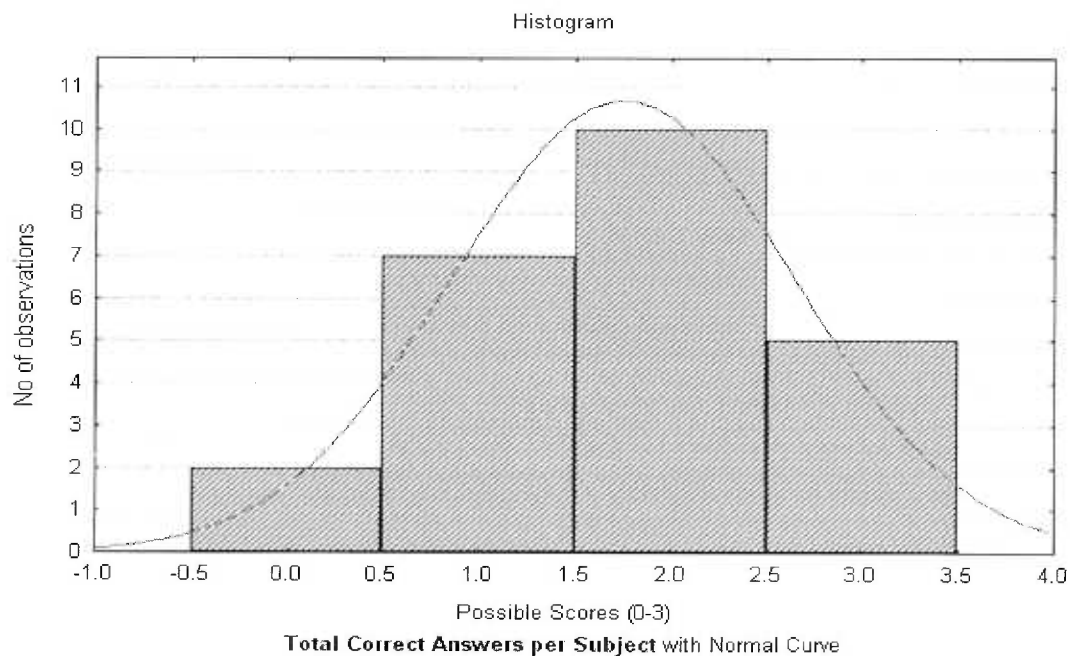


Figure 3. Histogram of Total Correct Answers for NP Students

There was also an increase of 90% between the number correct for all the searches on the first questions (10) compared to the same number correct for the third questions (19). This may indicate a significant "learning effect" as the NP students learned to better use the IR system between the first and last question.

Subjects were asked two questions regarding relevancy of the evidence found. The first question was, what was the proportion of relevant articles found in the IR system on the topic. Subjects reported that "all" articles found were relevant for 6% (4) of the searches, most were relevant for 21% (15), some were relevant for 65% (47), and no articles were relevant for 8% (6) of the searches. The second question asked of the articles retrieved, what proportion was relevant. Subjects noted that for 18% (13) of the searches "all" articles retrieved were relevant, most for 17% (12), some for 51% (37), and none for 14% (10) of the searches.

For most of the IR searches, 94% (68), the subjects provided evidence for their answers. Of those searches, 57% were correct. Several times, subjects reported that some of the journal articles were not available. This is a consistent problem when using hard copy journals provided by libraries. For the 6% (4) of the searches that did not have evidence, 75 % of answers given were correct. This finding suggests that the subjects already knew the answer. It was observed whether the subjects actually attempted to retrieve the article from the journal shelves or relied on the abstract. For 76% (55) of the searches, there was an attempt to obtain the journal article from the shelves and for 24% (17) there was not. Of those searches where the subject went to the shelves to retrieve the article, 55% (30) of the search answers were correct and 45% (25) were incorrect. Conversely, of those searches where the subject did not go to the shelves to retrieve the article, 70% (12) of the search answers were correct and 29% (5) were incorrect. Subjects were more likely to go to the shelves to retrieve articles if they thought the answer they got was correct so they must have known (thought) the answer was correct.

For IR searches, the mean number of articles retrieved per subject was 6.08 (SD = 2.64). The mean number of articles presented for evidence per search was 2 (SD= 1.1). Surprisingly, the Phi coefficient correlating the two dichotomous variables, evidence provided (yes-no) and correct answer (yes-no), was 0 .082, ($p < .05$); indicating that the magnitude of relationship between the variables is negligible. Perhaps some of the subjects retrieved the journal articles for confirmation only.

Cognitive Tests

Table 1 presents the means and standard deviations (SD) of the three cognitive tests reported for the subjects of this study and of those reported for the original subjects during reliability testing. The mean Logical Reasoning scores were similar for both samples. While NP students probably possess good logic skills, the GRE (Graduate Record Exam) scores for logical reasoning for these subjects were not used as criteria for graduate school admission. The standard deviation for the Logical Reasoning Test was larger for the NP students, indicating slightly more variability for the sample.

Table 1. Comparison of Sample Means, SD on Cognitive Tests

	Sample		Scores		
	<i>N</i>	<i>Type</i>	<i>Range</i>	<i>M</i>	<i>SD</i>
Logical Reasoning	189	High school males	0-30	15.2	3.00
	24	NP Students		15.8	4.50
Vocabulary	85	Army enlistees	0-36	23.2	----
	294	6 th Graders		8.8	5.60
	24	NP Students		31.4	3.45
Spatial Visualization	46	College students	0-20	13.8	----
	82	Army enlistees		10.4	4.5
	24	NP Students		12.2	3.09

For the Vocabulary Test, there was a higher mean score for NP students than that of other subjects, reflecting the current graduate school requirements for NP students that participated in this study. One would expect that this study's subjects would have much higher mean scores than that of the 6th grader's reported for test development. Similarly, Army enlistees are not expected to have the vocabulary qualifications of graduate students.

Comparing the mean scores for the Spatial Visualization Test, the NP student sample is similar to that of the other sample means. Again, the NP students are not screened for spatial visualization attributes because this trait is not viewed an essential skill for graduate nursing school.

Histograms for the raw cognitive test scores are presented in Figures 4, 5 and 6. The overlaid curve represents a normal curve for the frequency distribution. Any lack of variation in this sample is probably due to small sample size. The distribution for Logical Reasoning scores displays the most variability between the cognitive tests (Figure 4). The possible scores for this test range from 0 to 30.

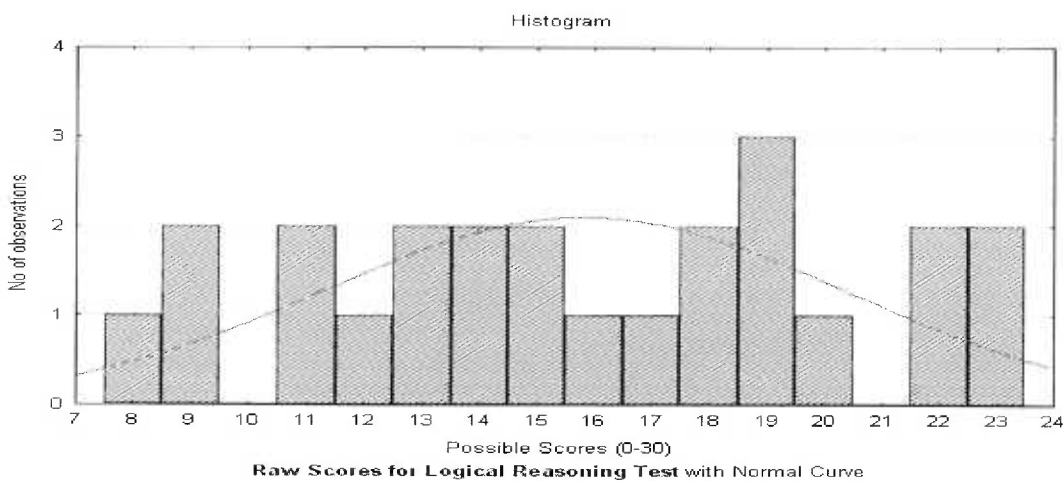


Figure 4. Histogram of NP Students' Raw Scores for Logical Reasoning Test

Scores on the Vocabulary Test are negatively skewed reflecting the higher performance of this sample (Figure 5). Possible raw scores for vocabulary ranged from 0 to 36.

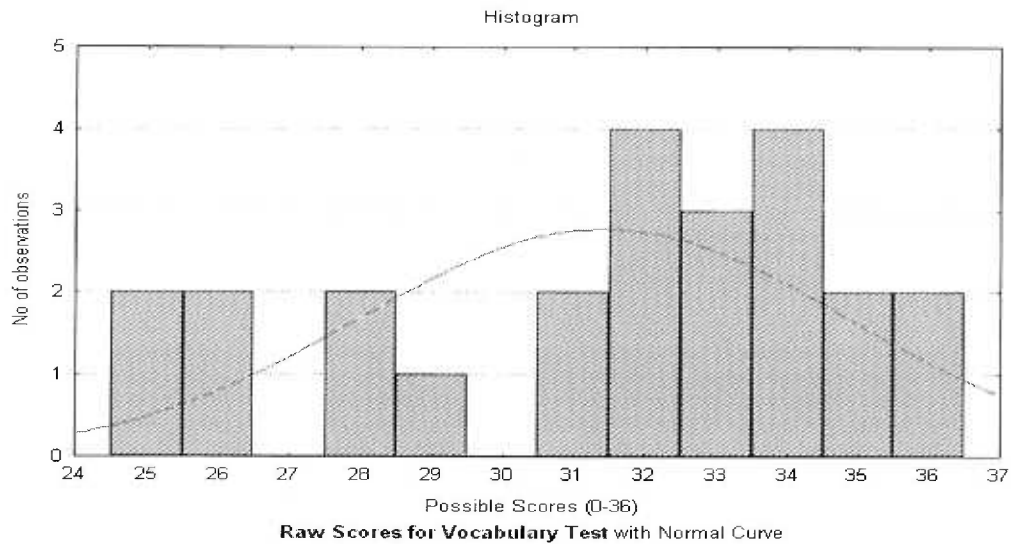
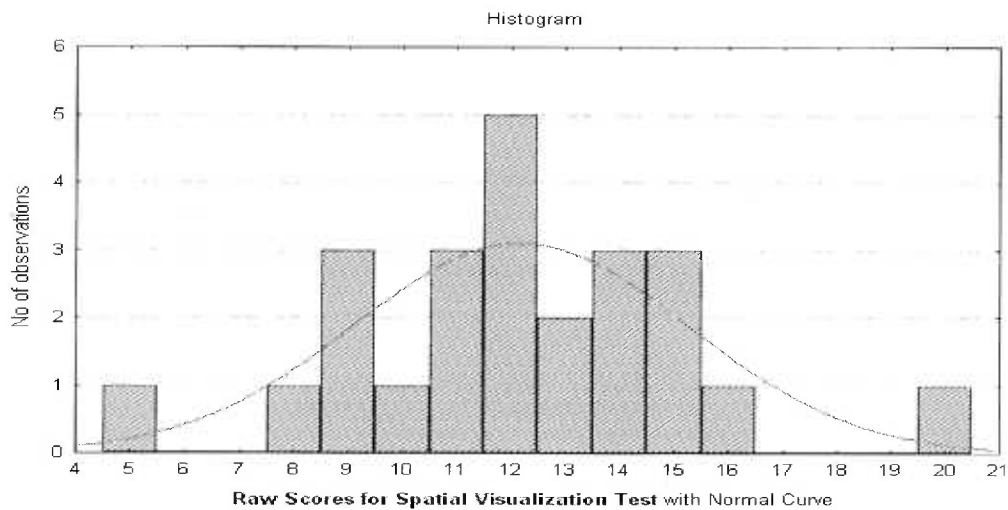


Figure 5. Histogram of NP Students' Raw Scores for Vocabulary Test

The distribution of Spatial Visualization scores approaches a normal curve. (Figure 6). Scores possible for the spatial test range from 0 to 20. To adjust for scoring differences and make comparison possible, z scores were calculated for the cognitive



tests. These scores were then used for correlation testing.

Figure 6 Histogram of the NP Student's Raw Scores for Spatial Visualization Test

Correlations

Three sets of predictor variables: a) cognitive attributes, b) professional attributes and c) attitudes toward computer and IR technology, were examined. The predictor variables within each set were tested for correlation with each other and the dependent variable (Table2).

Table 2. Description of Predictor Variables

<i>Cognitive Attributes</i> (scores possible)	Mean	SD
Logical Reasoning (0-30)	15.8	4.50
Vocabulary (0-36)	31.4	3.45
Spatial Visualization (0-20)	12.20	3.09
<i>Professional Attributes</i>	Mean	SD
Breadth of Nursing Experience	4.50	2.59
Years of Nursing Experience	12.63	6.7
<i>Technology Attitudes</i>	Mean	SD
IR Newsletter Subscription (1-3)	2.04	0.46
IR Attitude (2-4)	2.67	0.76
Computer Attitude (0-1)	0.92	0.28

There is no association among the sets of cognitive predictor variables (Tables 3). Of course, cognitive abilities differ among people. Perhaps people who have strong vocabulary skills may lack some degree of logic and spatial skills. Similarly, persons with strong logic skills may not possess the same level of spatial skills. Since the cognitive

tests selected for this study were intended to test different intellectual skill domains, it could be anticipated that there would not be an interrelationship among these variables.

Table 3. Correlations among Cognitive Attributes and Successful IR Searches using z Scores ($n = 24, p \leq .05, one\ tailed$)

Variables	Vocabulary	Spatial	# Answers Correct
Logic	$r = .212$ $p = .922$	$r = .283$ $p = .180$	$r = -.234$ $p = .271$
Vocabulary	----	$r = .344$ $p = .100$	$r = .035$ $p = .871$
Spatial	----	----	$r = .252$ $p = .236$

There was also no association between the cognitive tests and the search outcome or dependent variable. This finding does not substantiate previous research in the IR area that indicates logic, vocabulary and spatial skills correlate with a user's overall performance and IR speeds. None of the cognitive tests were significantly correlated with the total time to complete the searches either. It is unclear why the cognitive variables in this study did not correlate with the search outcome. Perhaps the answer is related to small sample size, the study design or question type compared to previous studies. The selected set of cognitive tests did not serve the intended purpose since they did not predict successful search outcomes within this population. This could be an area for further study.

Selected professional attributes were not significantly correlated with each other or with the dependent variable (Table 4). This finding would indicate that NP students with many years of experience do not necessarily work in several different areas of nursing.

The subjects of this study may reflect the general population, in that some people stay in one area of work for several years while others move to different areas frequently. This finding would also indicate that personal knowledge gained from breadth and depth of nursing experience did not assist the NP students to obtain the correct answer to the questions. Perhaps the questions were too difficult so personal knowledge did not help.

Table 4. Correlations among Professional Attributes of NP Students and Successful IR Searches ($n = 24, p \leq .05$ one tailed)

Variables	Breadth Nursing Experience	# Answers Correct
Years Nursing Experience	$r = .142$ $p = .509$	$r = .208$ $p = .330$
Breadth Nursing Experience		$r = .244$ $p = .251$

Correspondingly, neither the NP student's breadth of nursing experience nor their years in nursing were related to successful search outcomes. Although some areas of nursing require a higher level of computer and IR skills, most do not require the level of skills required to solve a complex clinical question utilizing only an IR system. This suggests the need for additional computer and IR training in schools of nursing, since the subjects were current graduate students.

From the third set of predictor variables, only the subjects' attitude toward computer technology was significantly correlated with successful search outcomes (Table 5). Specifically, NP students responding that their practice would be harder **without** computers were **more likely** to be successful at information retrieval (Figure 7). This finding seems to communicate a negative attitude toward computers in practice. Perhaps

the experience of this sample, dealing with the complexities of computer technology, is a part of the reason for unsuccessful IR searches.

Table 5. Correlations among NP Students' Attitudes toward Computers and Successful IR Searches ($n = 24, p \leq .05$ one tailed)

Variables	Information Retrieval Attitude	Computer Technology Attitude	Total Answers Correct
Newsletter	$r = .164$ $p = .444$	$r = .028$ $p = .898$	$r = .183$ $p = .393$
Information Retrieval Attitude		$r = .270$ $p = .203$	$r = 0.00$ $p = 1.00$
Computer Technology Attitude			$r = .429$ $p = .036$

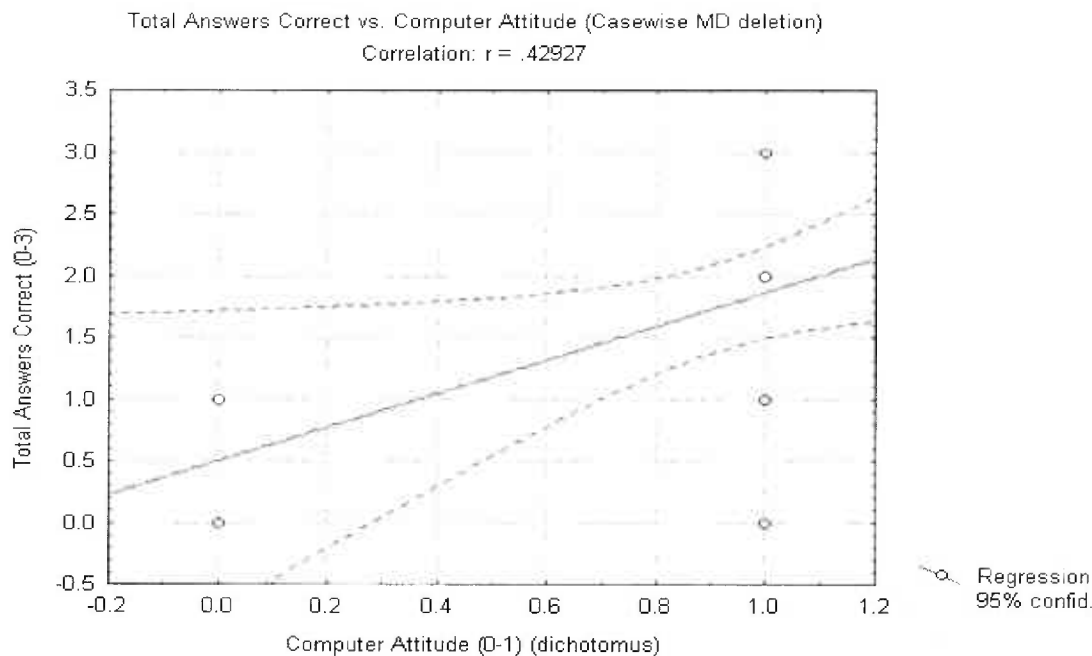


Figure 7 Total Answers Correct per NP Student Plotted against Computer Attitude (0-1)

There was a significant correlation between total question difficulty rating (3-15) per set of questions and successful searches per subject ($r = .4239$, $n = 24$, $p < .05$, one tailed). The correlation is positive; meaning that the more difficult the question set, the more successful subjects were at IR searching (Figure 8).

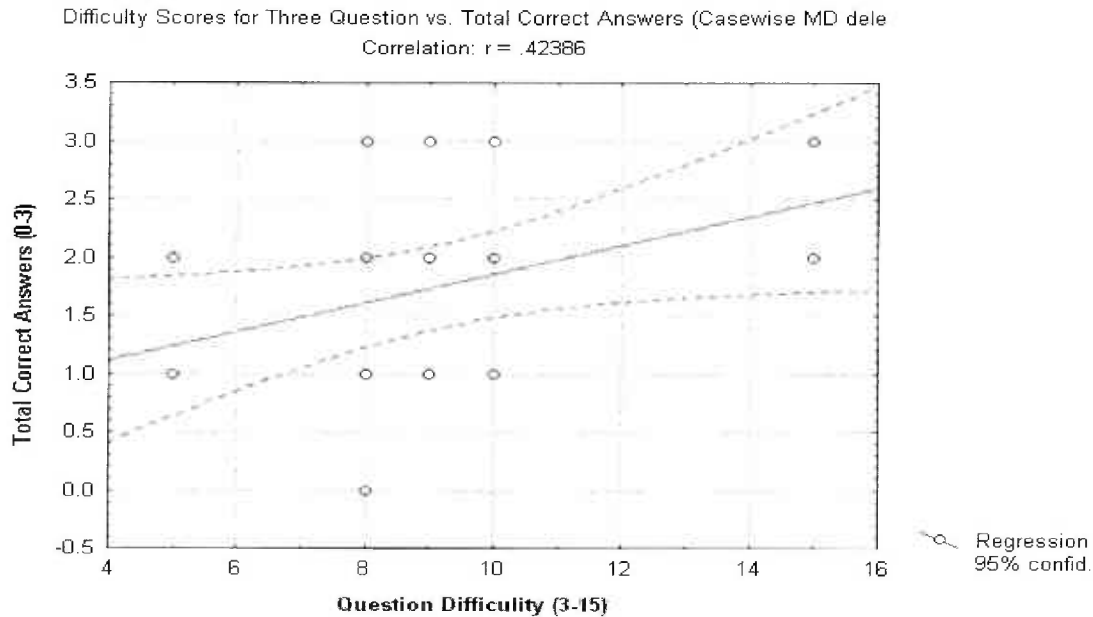


Figure 8. Total Answers Correct per NP Student Plotted against Question Difficulty

This result may be due to the function of one rater or due to differences in clinical background and experience between the rater (a NP faculty) and the subjects. Another suggestion is that this result may be a function of the IR system. That is, it might be less complex to search on difficult questions because the answer is easier to find in the IR system than the less complex questions. Are "difficult" questions extremely confined? Are "easy" questions broad and therefore more difficult to locate in the literature?

Regression

It was planned to select the one independent variable most highly correlated with the outcome variable from each set of predictors to test in the final regression model (Figure 9). However, only one predictor variable, computer attitude, was significantly correlated with the outcome variable. A single multiple linear regression was completed on the set of technology attitude variables and the dependent variable search outcome. None of the variables entered into the regression model ($R^2 = .282$, $p = .08$). Although the predictor variable, computer attitude, was moderately correlated with search outcome, we were unable to improve the predictive value for the set of independent variables using multiple linear regression. This finding suggests that none of the predictor variables explained the variability in the search outcome. Despite a somewhat negative attitude toward computer technology among some students, the students were able to perform IR searches successfully.

Predictor Variables

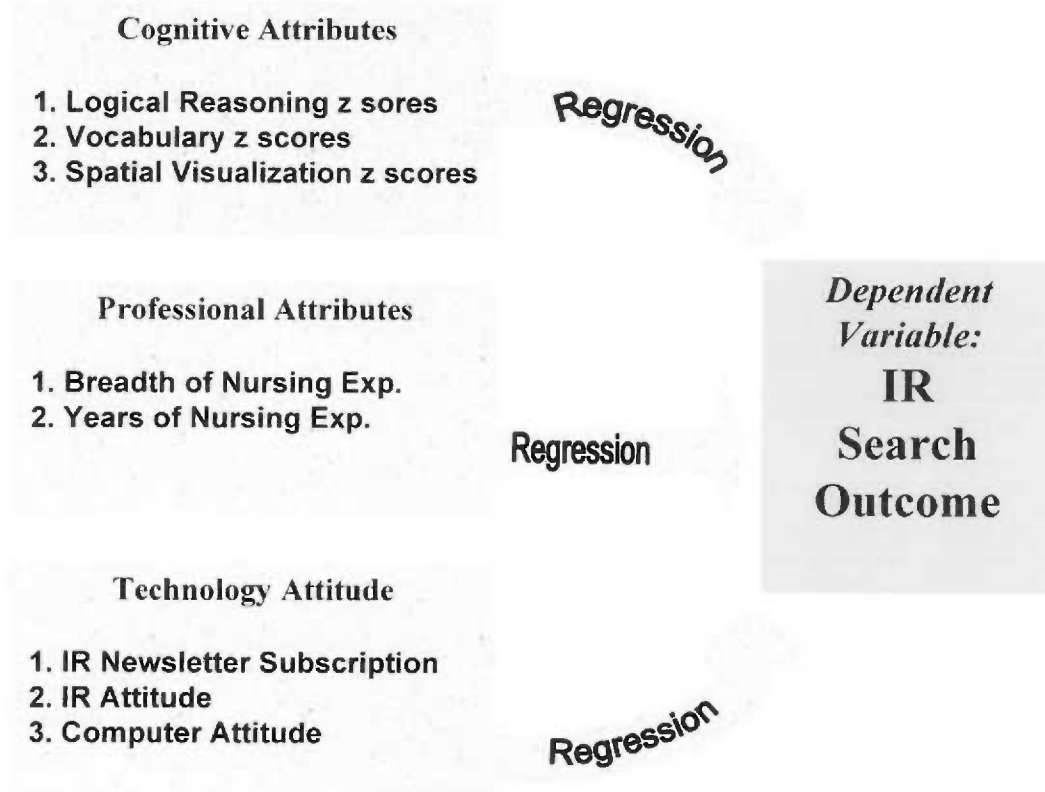


Figure 9. Plan for Selecting Best Predictors for Final Regression Model

Chapter V

Discussion

The primary purpose of this study was to investigate the relationship between selected NP student attributes and the successful completion of information retrieval (literature searches). Data analysis indicated that a positive attitude toward computer technology was moderately related to successful IR searching, supporting previous research that attitudes regarding on-line searching are a significant factor in searching behavior. Additionally, many study subjects reported they would seek the advice of a colleague or consult a textbook to resolve their patient care questions instead of attempting to locate the most current scientific literature on the topic; another 21% reported that it was not their professional obligation to do so. These findings confirm earlier research that nurses, in general, are not utilizing research in their practice. Although selected cognitive tests were not predictors of successful IR searching, an unexpected result revealed that the mean scores for two of the tests were similar to those of subjects with less educational background than that of graduate students. This leads to further questions about skills required for successful information retrieval.

First, a positive attitude toward computer technology could be promoted in schools of nursing. Baccalaureate and graduate-nursing programs could enhance their curricula to include more in-depth computer training and the integration of computer technology into all classes. A specific way to accomplish this might be to utilize more computer-based training (CBT) at the baccalaureate level. Also graduate-nursing schools might encourage research, either specifically or including computer technology as it relates to research utilization. Currently, faculty are requiring assignments be completed on the

computer. However, they could adopt curricular changes that foster computer skills and IR skills. Instructors could emphasize the importance of research utilization as the first choice for finding answers to many patient care questions and teach students the importance of continuing research-based practice when they are out of school. This might be a new course in evidence-based practice to relate research to practice.

In the community health care system, hospitals and other health care providers could allow more time and provide more incentives for clinicians to learn computer skills and apply this technology towards research utilization. These incentives could include positive performance evaluations and salary increases. To facilitate easier access to nursing and health care research, leaders in these fields might form a coalition to promote and fund the further development and use of full-text on-line professional nursing journals. Time could be set aside for nurses to share their ideas and accomplishments in research utilization with the final goal of positive patient outcomes. Nurses and their employers could become directly involved with the research and development of more "user friendly" computer technology and information retrieval systems.

To promote research utilization as a professional obligation, the nursing profession could collectively build a model that follows the medical standards for evidence-based practice like those for the Agency for Health Care Policy and Research (AHCPR). The proposal would go beyond the Annual Review of Nursing Research. In this model, reports on state-of-the-art scientific information on nursing care and new health care technologies are published in print and on the internet to assist nursing professionals in making critical patient care decisions using the best scientific knowledge available. Professional nurse researchers, located in health care centers across the nation might be

assigned to specific nursing and health care topics in their area of expertise. Periodically, they would review all of the relevant scientific literature on these topics, compiling this information into easily retrievable reports. These reports would become standards for nursing practice. Using this research utilization model, guidelines for nursing practice could be developed and updated very quickly, compared to today's standards.

The cognitive tests selected did not serve to predict how well NP students would perform IR searching and this study did not support the finding of other research in this area. The three cognitive tests (logic, vocabulary and spatial) were selected for use in this study based on the current literature for cognitive attributes, as they relate to computer and IR users. The results may be because research in this area is very limited and it is even less prevalent for nursing studies. It is difficult to determine if more useful instruments and cognitive tests could be developed that would better predict successful IR searches for NP students because the current research in this area is so limited.

As stated above, the NP students' mean scores for two of the cognitive tests, Logical Reasoning and Spatial Visualization were similar to those of less educated subjects. Only the NP students' mean vocabulary scores were higher compared to those of Army enlistees and high school males. These findings are consistent with the fact that most graduate-nursing schools do not screen for logic or spatial skills as part of their admission requirements. Is it possible that nursing school administrators are aware of the value of language proficiency as a necessary skill for graduate education, but lack convincing evidence that spatial and logic skills are a necessary to successfully complete information retrieval.

Another purpose of this study was to serve as a pilot for a larger IR research project developing a task-oriented approach for IR system evaluation. A significantly positive correlation suggests that the more difficult the clinical question, the more successful subjects performed IR searching. Also, there was a notable improvement in the subjects' IR searching outcome between their first search and their third.

The positive correlation ($r = .424, p = \leq .05$) between the difficulty of the clinical question and the success of the IR search was an unexpected finding, having many implications for the larger IR study. This result may be due to the function of one rater, or due to difference in clinical backgrounds and experience between the rater (a faculty NP) and the subjects. Another suggestion is that the results may be a function of the IR system. That is, it might be less complex to search on difficult questions because the answer is easier to find in the IR system.

Finally, another finding relevant to the larger IR study is that there was an overall improvement (90%) in the NP students' efficiency of searching between the first and third search. This could be due to a learning effect, but was confounded by the fact that the questions were kept in the same order and were not rotated to lessen the order effect of the questions. The larger study will adjust for these issues by requesting that subjects report their basic computer and IR skills on a checklist before they start searching. If needed, the subjects will be instructed in any deficient skill areas. Also, the questions for the larger study will be rotated to lessen any effect they might have on the search outcome.

Limitations

There are some important limitations of this study. Sample size was small, especially compared to the number of variables. This translates into a problem with statistical power and therefore limits the study's generalizability to the population being investigated.

Calculated power for the study was .28 ($n=24$, $\alpha < .05$, and moderate effect size). A sample size of 72 would be needed to increase power to .91. It is unknown whether a larger sample size, would have resulted in correlations that may have been significant enough to build and test a regression model. Recruiting NP students for this research was difficult because of their busy schedules and the length of the testing. The subsequent study will combat this problem by splitting the testing session into two or three separate sessions. This tactic should lessen the impact of the research on the subjects and increase sample size.

Another limitation affecting internal validity was that, initially, the subject's basic computer and IR skills were not assessed. During the research process, the investigator noticed that a few of the NP students were not using the IR system to maximum efficiency. The results may reflect the fact all the students did not meet baseline proficiency on computer and IR skills initially. It is suggested that an essential computer and IR skills list be created for the larger study to validate the subject's basic computer and IR skills and then, if needed, provide a training session. A second internal validity problem was that the questions in each set of questions were kept in the same order throughout the study. Therefore, the percentage of improvement (90%) in the number of correct answers between the first and third search may be the result of a "learning effect" or

due to the difficulty of the questions themselves. Another possible explanation may be the match between question content and subjects' experience and knowledge base.

An external validity problem was that the convenience sample was composed of volunteers from the available NP student population. Therefore, students with some amount of confidence in their abilities with computers and IR systems or those wanting to learn more about computers were probably the only study participants. Unfortunately, the available population was small (N=80) and random selection was not possible.

Except for the cognitive tests, reliability of the instruments was difficult to assess. Every opportunity was taken to ensure that the measurements of professional attributes and computer and IR attitudes were consistent with the literature. However, these specific instruments were created for this study and will need further evaluation. Future use of these new instruments may further contribute to evaluation of their reliability.

Implications for Practice

It is an expectation that the results from this study will substantially contribute to the larger IR study that is developing a task-oriented approach to evaluation of information retrieval systems. Some changes in the larger study design have already occurred as a direct result of our findings from this pilot. Question design, question order and the validity of the cognitive tests will be changed to deal with issues raised by this research pilot. The continued research will ultimately focus on the IR practices of community Nurse Practitioners and physicians. It is expected that the larger study will advance the understanding of research utilization, and ultimately lead to better patient care. Perhaps at the same time, the participants of this study may have gained a greater awareness of the

existing gap in research utilization and how closely that gap is related to frequent and successful use of IR systems by NPs.

Since there are no IR studies dealing specifically with NPs, this study is important to nursing. It will serve as a basis for further research and contribute to the body of scientific literature regarding barriers to information retrieval and research utilization for NPs in health care today. This study makes a contribution by establishing baseline information that describe an important group of clinicians (NPs) who have, as yet, not been studied, but who have potential for greater use of IR to benefit patients in primary care. In addition, this study may be an impetus for investigation into methods to improve the application of information technology and corresponding information retrieval systems usability by nurses and Nurse Practitioners.

The computer and IR technology industries have made great strides in moving forward to redesign IR interfaces that impact patient care. However, we have not yet achieved a goal of an IR-user interface that ensures finding appropriate information if it is available in the database. Despite the fact that the subjects for this study were in graduate school and possessed significant positive attributes, they were unsuccessful in performing many of the IR searches. This study suggests that attitudes toward computers are a contributing factor to search outcomes. Further research is needed that will begin to assist us in understanding the reasons for successful or unsuccessful use of IR systems by all nurses. We must utilize the knowledge that we gain from this study and others like it, to investigate new approaches to research utilization. Our goal is to increase the use of IR systems by nursing professionals. More innovative and extensive IR training must be done. We must better understand the IR user's needs to make them successful searchers.

Similarly, computer interfaces that are user friendly and intuitive cannot be designed without a thorough understanding of the experiences and expectations that the user brings with them every time that they approach an IR system to perform a search.

Nursing leaders, administrators, and educators must adopt new and innovative ways to promote a more positive attitude toward computer and IR technology. This could be accomplished through enhancement of their curricula that increase nursing students' proficiency and add to their successful experiences with computer and IR systems. Students and practicing nurses should be expected to provide patient care based on state-of-the-art scientific research.

The first step in research utilization is information retrieval. Although computer and information retrieval technologies have greatly advanced over the past few decades, nursing has not fully utilized these sciences in order to improve research utilization. The gap between the discovery of new research findings and the application of those findings in nursing practice is well documented throughout the nursing literature. Yet the discrepancy persists, although over the last twenty years there have been many efforts by the nursing profession to lessen the gap. Why are we so inadequate at putting our science into practice in a timely manner? Why have these efforts been unsuccessful?

Discovery of new nursing knowledge based on strong scientific principles and the application of that knowledge into clinical practice is and should be the foundation of improved patient care. It is not enough to just perform research, if new discoveries take years to be applied to practice. We must conduct studies to better understand the barriers to research utilization and overcome them. We cannot stop short of our goal for better research utilization in the practice of nursing. As a profession, we must begin to bridge

the gap between the discovery of new knowledge and the dissemination of that knowledge into nursing practice.

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APPENDIX A

Consent Form

Oregon Health Sciences University**Consent Form**

Title: Factors Influencing Successful Use of Information Retrieval Systems by Nurse Practitioner Students

Principal Investigator: Linda Rose RN, BSN, 494-3801
Dr. Katherine Crabtree, ANP, 494-3828 (Advisor)

Purpose: As a professional nurse, you are aware that the timely dissemination and implementation of research findings is absolutely critical for improved patient care. However, for more than twenty years, the nursing literature has documented a persistent gap between the conduct of nursing research and the dissemination and utilization of these findings in the clinical setting. Unfortunately, and in keeping with many other professions, the gap is intolerably large. There is a disturbing 10 to 15 year interval between the discovery of innovative research findings and the implementation of research into nursing practice.

The first step in the research utilization is the process of locating earlier research. Retrieval of research literature proves difficult if not impossible for many nurse researchers and clinicians for a multitude of reasons which includes access to the needed information. The Information Retrieval (IR) process is the interaction between the user, who has an information need, and the IR system otherwise referred to as the database as well as the computer hardware and software. Research in the nursing literature regarding IR and methods to improve the first

step in research utilization is almost non-existent and there are virtually no studies targeting Nurse Practitioners.

You have been invited to participate in this research study because of your knowledge in primary health care as a nurse practitioner student. The purpose of this research study is to investigate the relationship between the successful completion of information retrieval with the following selected NP student attributes: (a) selected cognitive abilities (spatial visualization, verbal comprehension, and logical reasoning), (b) previous computer and information retrieval experience, (c) attitudes concerning current information retrieval technology, (e) attitudes concerning current computer technology. This information may aid future efforts to increase IR by NPs and improve the quality of patient care. Participation in this study will take approximately 2 hours.

Procedures:

As a participant of the study you will be asked to:

- (1) complete a questionnaire regarding your (a) previous computer / information retrieval experience, (b) attitudes concerning current information retrieval technology and current computer technology, (c) and selected professional attributes such as years of nursing experience. (15-30 min.).
- (2) complete 3 simple cognitive tests for spatial and perceptual abilities. (30 min.).

(3) perform a computerized literature search in the OHSU library in order to answer 3 specific clinical questions. (60 min.) (Includes brief training session before the search and time to answer any questions you might have afterwards)

Additional data will be collected regarding the time spent to search, terms used and the contents of each computer screen for further analysis as part of a future larger IR study.

Risks & Discomforts:

The study questionnaire, cognitive tests and on-line search will take time to complete. If at anytime you feel uncomfortable answering the questions or performing the tests, you may discontinue participation in the study. There is a brief period planned at the end of the process to discuss your results and answer and problems or questions you might have about the study. If you do not complete the tasks, there will not be any penalties or repercussions from any representative of Oregon Health Sciences University.

Benefits:

Since there are no information retrieval studies dealing specifically with Nurse Practitioners, this proposed study is important to nursing. Although you may not personally benefit from this study, your participation will serve as a basis for further research and contribute to the body of scientific literature regarding barriers to information retrieval and research utilization for Nurse Practitioners in health care today.

In addition, this study may be an impetus for more investigation into methods we can implement to improve use of computer technology by Nurse Practitioners and the nursing profession as a whole. It is imperative that we practice knowledge-based nursing, shaped by empirical research data.

You will receive a \$25 honorarium for your participation in the research study.

Confidentiality: Confidentiality will be assured. Neither your name nor your identity will be used for any publication or publicity purposes. However, since the information retrieval process will be video taped, anonymity cannot be guaranteed. Test results will be assigned an identification number and only the investigator will have access to the names of the subjects. Videotapes will be erased immediately after the data analysis process is complete.

Costs: There is no cost to you for your participation in the study.

Liability: The Oregon Health sciences University, as an agency of the state, is covered by the State Liability Fund. If you suffer any injury from this research project, compensation would be available to you only if you establish that the injury occurred through the fault of the University, its officers, or employees. If you have further questions, please call the Medical Services Director at (503) 494-8014.

Participation: You are free to ask any questions concerning any aspect of the research study that you may have at any time. You should contact Linda Rose, RN at 494-3801.

If you have any question regarding your rights as a research subject, you may contact the Oregon Health Sciences University Institutional Review Boards at (503) 494-7887.

You may refuse to participate, or you may withdraw from this study at any time without affecting your relationship with or treatment at the Oregon Health Sciences University.

Your signature below indicates that you have read the foregoing and agree to participate in this study. You will receive a copy of this consent form.

Signature of Subject

Date

Signature of Witness

Date

Signature of Principal Investigator

Date

APPENDIX B

Study Questionnaire

Information Retrieval Research Questionnaire

I. DEMOGRAPHIC INFORMATION

What is your Date of Birth? _____

Gender

1 Male 2 Female

What is your ethnic origin?

Black Hispanic White Asian/Pacific Islander Native American
 1 2 3 4 5

Other _____
 6

II. EDUCATIONAL BACKGROUND AND CERTIFICATION

What was your basic (first) RN nursing education?

Associate Degree Diploma BSN Generic MN (RN earned at master's level)
 1 2 3 4

Which of the following best describes your highest level of nursing education / training?

Associate Degree Diploma BSN Generic MN (RN earned at master's level)
 1 2 3 4

III. PREVIOUS COMPUTER EXPERIENCE

How many hours per week do you use a computer? _____

Do you use productivity software at least once a week? (word processor, spreadsheet, presentation, etc.)?

Yes No
 1 2

Comments: _____

IV. PREVIOUS INFORMATION RETRIEVAL EXPERIENCE

How many literature searches for a specific topic have you completed in the past year?

- 0 1-2 3-5 6-10 11 or more
1 2 3 4 5

What is your main reason for performing searches?

- Education Patient Care Research
1 2 3

Comments: _____

V. ATTITUDES CONCERNING INFORMATION RETRIEVAL TECHNOLOGY

In general, do you think literature searching is the best method for finding correct answers to your patient care questions?

- Yes No
1 2

Comments: _____

If you answered NO to the above question, what do you think is the best method ?

- Text Books Colleagues Physicians Internet Other _____
1 2 3 4 5

Comments: _____

If there were a newsletter available that explained about information retrieval systems, how to use them, and any innovations in the field would you:

- Pay money to subscribe Subscribe if free Not be interested-why not? _____
1 2 3

Comments: _____

Do you feel you have a professional obligation to use on-line searching in order to keep current on changes in patient care?

- Yes No
1 2

Comments: _____

VI. ATTITUDES CONCERNING CURRENT COMPUTER TECHNOLOGY

Do you feel that as a professional, your practice would be easier or harder without computers ?

- Harder Easier
1 2

Comments: _____

Do you enjoy using a computer ?

- No Yes
1 2

Comments: _____

VII. YEARS NURSING OF NURSING EXPERIENCE

How many years have you been practicing as a nurse? _____

VIII. BREADTH OF CLINICAL EXPERIENCE

How many different areas have you worked as a nurse. Select all that pertain.

- Med/Surg Telemetry Critical Care Pediatrics OR/Recovery Neonatal
1 2 3 4 5 6

- Management/Admin Occupational Health Case Management Out Patient Clinic
7 8 9 10

- Public Health Mental Health Nursing home Emergency Care
11 12 13 14

- Other _____
15

IX. NURSING SPECIALTY

Indicate your clinical NP specialty by education

- Adult NP Family NP Geriatric NP Neonatal NP Women's Health Care NP
1 2 3 4 5

- Certified Nurse Midwife Other _____
6 7

APPENDIX C

Cognitive Testing Instruments

MANUAL FOR
KIT OF FACTOR-REFERENCED
COGNITIVE TESTS

1976

The tests described in this manual are distributed for research use only. They should not be used for counseling or other operational purposes.

Ruth B. Ekstrom
John W. French
Harry H. Harman
with Diran Dermen

Office of Naval Research Contract N00014-71-C-0117
Project Designation NR 150 329

Harry H. Harman, Principal Investigator

Educational Testing Service
Princeton, New Jersey

August 1976

INTRODUCTION

The purpose of this Kit of 72 factor-referenced cognitive tests for 23 factors is to provide research workers with a means of identifying certain aptitude factors in factor-analytic studies. It is intended that use of these tests will facilitate interpretation and the confident comparison of one factor study with another. Except for the replication of studies within a given laboratory, it has usually been necessary to cross-identify the factors in two studies by means of psychological interpretation alone, often without any tests common to the two studies. However, in many kinds of investigations the process of identification of comparable factors across studies can be made more objective by including marker tests for factors that are expected to appear or for factors that a researcher wants to isolate from other domains of interest.

There are several techniques for objectively comparing a factor found in one analysis with that found in another (Harman, 1976). However, all methods of this kind require either a set of tests or a group of subjects that are common to the two studies. Use of tests such as those in this Kit should provide researchers with sets of common tests, and at the same time, provide linkages to the findings in many different laboratories.

While use of these tests should help clarify factorial descriptions, it must be recognized that over-dependence on them might be counter-productive. It is not our intent to inhibit an investigator who might be led by inspiration or hunch to use alternate measures that could produce creative results. However, in such cases it might still be useful to include factor-referenced measures to help clarify the contribution of such newly-created measures. Thus, these tests, and others like them, have been found useful in generating theories of intellect by researchers like the following: Guilford (1967) and his students in developing a "structure of intellect" model; Royce (1973) in the development of a conceptual framework for a multi-factor theory of individuality; and Carroll's (1974) new structure of intellect approach.

such as Hunt, Lunneborg, and their co-workers (1973, 1975) and by the Harrises (1973).

On the basis of the research findings, together with a thorough review of the 1963 Kit, a set of 72 marker tests are now recommended for 23 cognitive factors. These are listed in Table 1. This list differs somewhat from that presented in the 1963 edition. New factors now considered to be established are Verbal Closure, Figural Fluency, Flexibility of Use, Integrative Processes, and Visual Memory. Four previous factors have been dropped both because other research had failed to confirm them and because recent efforts by ETS to develop markers for them were not successful and seemed to cast some doubt on their existence as separate factors. These are Semantic Originality, Semantic Redefinition, Sensitivity to Problems, and Semantic Spontaneous Flexibility. Parts of these factors are now thought to be represented by the Expressional Fluency and Flexibility of Use factors. An additional factor, Concept Attainment, has been reported in the literature. However, an attempt to replicate this factor has failed (see TR 8), and hence there are no recommendations of marker tests for it. Two other factors, Length Estimation and Mechanical Knowledge, were dropped because they seem to refer to achieved skills rather than to what are normally called aptitudes. Also to be noted are two factor name changes: Syllogistic Reasoning to Logical Reasoning; and Figural Adaptive Flexibility to Figural Flexibility. These reflect some change in the conceived nature of these factors.

Preparation of the two earlier editions of the Kit, as well as the initiation of the present study, was preceded by a conference of persons interested in multiple factor analysis. Thus, an effort has been made to truly represent the past research of many factor analysts. In the first Kit, broad representativeness in the sense of accurate factor marking was assured by including (with author and publisher permission) the actual tests that were found to generate specified factors. In the second Kit, many of these original markers were replaced by new tests adapted by

After the foregoing information about the factor is presented in each section, the following descriptions of the cognitive tests are given:

- The name of the test. Where the test is similar to a test discussed in the literature, the author of the original test is credited; usually the name is changed slightly to make it clear that they are not the same test while calling attention to their similarity. Rev. following the name of a test means that this is a test from the 1963 edition of the Kit which has been substantially revised for this new edition; these revisions include changes in test directions, item order, and/or item content. Not every revised test, however, bears the Rev. notation. Table 3 indicates the status of all new and revised tests.
- An alpha number designation for each test, which includes the symbol for the factor and a number. The numerical order of tests for each factor has no significance.
- Length of test in terms of number of items and time limit. All tests except the Memory Span tests are presented in two parts. This enables the researcher to compute reliabilities like those reported in Table 2. While administration of both parts is recommended for most situations, the user may sometimes want to shorten testing time by using only one part at the sacrifice of some reliability.
- Grade levels for which the test is suitable.

Following these brief descriptions of the tests, the actual cover pages of the test booklets are reproduced. These contain the test-administration directions and sample practice items. Finally, given at the end of each section are the scoring instructions and keys for the tests referenced to that factor. A number of the tests can be adapted to machine scoring. In order to save time and expense, it would seem reasonable for any large-scale study to use answer sheets that fit the kind of scoring machinery available to the researcher. However, for a few highly speeded measures, the answers should probably be made directly in the booklet, because the time for the subject to mark an answer sheet would materially affect the score and alter the factorial composition of the test. For those tests that call for open-ended responses, the answer spaces are provided directly in the test booklet.

A reference list of the works cited in support of the established factors is given at the end of the Manual.

Factor & Tests	Mean	S.D.	Rel.	Mean	S.D.	Rel.	Mean	S.D.	Rel.	Sample
RC										
1 Arithmetic Aptitude	(4.6	3.6	data on Part I only)	16.0	5.8	.83	4.0	3.8	.57	294 6th graders
2 Mathematics Aptitude	(4.8	3.1	data on Part I only)	13.4	5.0	.80	12.0	4.3	.64	119 9th grade males
3 Necessary Arithmetic Operations				14.0	---	---	14.0	---	.81	83 Army enlistees
RL										
1 Nonsense Sylogisms	(6.4	2.1	data on Part I only)	17.0	3.6	.57	15.2	3.9	(.64)	189 h.s. males
2 Diagramming Relationships	12.1	5.2	.79	16.8	3.6	.46				
3 Inference Test				12.0	3.9	.76	16.1	2.7	.57	145 college males
4 Deciphering Languages	8.8	3.0	.69	11.5	3.8	.78	11.8	4.1	.76	189 h.s. males
S										
1 Card Rotations	(44.0	24.6	data on Part I only)	(test revised, data on earlier version)	.86		(test revised, data on earlier version)	.80		46 college students
2 Cube Comparisons	Test revised since validation study -- data on earlier version			23.5	6.6	.77	22.7	9.4	.84	99 college females
				21.5	6.6	.77	10.9	---	.47	46 college students
										99 college females
SS										
1 Maze Tracing Speed	22.4	6.3	.91	30.3	8.3	.94				46 college students
2 Choosing A Path	20.7	6.0	.89	15.5	7.0	.77				46 college students
3 Map Planning	19.6	6.0	.80	25.0	6.1	.79				46 college students
	19.0	5.8	.75							

Factor & Tests	Mean	S.D.	Rel.	Mean	S.D.	Rel.	Mean	S.D.	Rel.	Sample
V										
1 Vocabulary I	23.2	---								85 Army enlistees
2 Vocabulary II	8.8	5.6	.70							294 6th graders
3 Extended Range Vocabulary	6.6	4.9	.68							294 6th graders
4 Advanced Vocabulary I	15.5	5.5	.84	19.7	6.6	.84				119 9th graders
5 Advanced Vocabulary II	16.8	---	.89	20.7	6.2	.81				82 Army enlistees
	16.6	5.6	.76							119 9th grade males
	13.3	---	.56							83 Army enlistees
	13.8	5.2	.79							181 college students
	10.8	6.4	.83							181 college students
VZ										
1 Form Board	124.8	38.3	.81							46 college students
2 Paper Folding	13.8	4.5	.84	11.5	3.7	.75				46 college students
3 Surface Development	10.4	---	.84	10.4	3.7	.77				82 Army enlistees
	43.6	15.1	.90							46 college students
	37.8	---	.92							86 Army enlistees
XF										
1 Toothpicks										
2 Planning Patterns	12.7	9.3	.49							
3 Storage Test	1.3	1.7	.67	2.0	2.6 (Part I only)					
XU										
1 Making Groups	10.9	3.8	.60							
2 Different Uses	13.7	6.2	.76							
3 Combining Objects	19.4	7.1	.80							
4 Substitute Uses	14.4	4.0	.81							

RL REASONING, LOGICAL

Factor

*The ability to reason from premise to conclusion,
or to evaluate the correctness of a conclusion*

This factor was originally called "Deduction" by Thurstone. In the 1963 edition of this Kit, it was called "Syllogistic Reasoning." Guilford and Cattell have sometimes called this factor "Logical Evaluation."

Guilford has pointed out that what is called for in syllogistic reasoning tasks is not deduction but the ability to evaluate the correctness of the answers presented. This factor can be confounded with verbal reasoning when the level of reading comprehension required is not minimized.

The complexity of this factor has been pointed out by Carroll (1974) who describes it as involving both the retrieval of meanings and of algorithms from long-term memory and then performing serial operations on the materials retrieved. He feels that individual differences on this factor can be related not only to the content and temporal aspects of these operations, but also to the attention which the subject gives to details of the stimulus materials.

Identification: Cattell, UI-T4; Guilford, EMR or EMI; Thurstone, D.

References: 3, 13, 20, 22, 48, 49, 55, 65, 79, 85, 103, 111, 128, 139, 173, 193, and 205.

TestsNonsense Syllogisms Test -- RL-1

Suggested by Thurstone's False Premises. The subjects are presented with formal syllogisms using nonsensical content so that they cannot be solved by reference to past learning. Some of the stated conclusions follow correctly from the premises and some do not. The task is to indicate whether or not the conclusion is logically correct.

Length of each part: 15 items, 4 minutes

Suitable for grades 11-16

Diagramming Relationships -- RL-2

The subject is asked to select one of five diagrams which best illustrates the interrelationship among sets of three objects.

Length of each part: 15 items, 4 minutes

Suitable for grades 9-16

Inference Test -- RL-3

A test suggested by a similarly named test by Guilford. The task is to select one of 5 conclusions that can be drawn from each given statement.

Length of each part: 10 items, 6 minutes

Suitable for grades 11-16

Deciphering Languages -- RL-4

The subject is asked to use reasoning to determine the English translation of artificial languages.

Length of each part: 12 items, 8 minutes

Suitable for grades 11-16

Name _____

NONSENSE SYLLOGISMS TEST - RL-1

This is a test of your ability to tell whether the conclusion drawn from certain statements is correct or incorrect. Although all of the statements are really nonsense, you are to assume that the first two statements in each problem are correct. The conclusion drawn from them may or may not show good reasoning. You are to think only about the reasoning.

If the conclusion drawn from the statements shows good reasoning, put an X on the letter G. If the conclusion drawn from the statements shows poor reasoning, put an X on the letter P.

Now try the practice problems given below. The first two syllogisms have been correctly marked.

- | | | |
|--|---|---|
| 1) All trees are fish. All fish are horses
Therefore all trees are horses. | X | P |
| 2) All trees are fish. All fish are horses.
Therefore all horses are trees. | G | X |
| 3) Some swimming pools are mountains. All mountains
like cats. Therefore all swimming pools like cats. | G | P |
| 4) All swimming pools are mountains. All mountains
like cats. Therefore all swimming pools like cats. | G | P |
| 5) All elephants can fly. All giants are elephants.
Therefore all giants can fly. | G | P |
| 6) Some carrots are sports cars. Some sports cars
play the piano. Therefore some carrots play
the piano. | G | P |
| 7) No two flowers look exactly the same. Roses and
tulips look exactly the same. Therefore roses
and tulips are not two flowers. | G | P |

The answers to the other five problems are as follows: 3 is P; 4 is G; 5 is G; 6 is P; 7 is G.

Your score on this test will be the number marked correctly minus the number marked incorrectly. Therefore, it will not be to your advantage to guess unless you have some idea whether the reasoning is good or bad.

You will have 4 minutes for each of the two parts of this test. Each part has 1 page. When you have finished Part 1, STOP. Please do not go on to Part 2 until you are asked to do so.

DO NOT TURN THIS PAGE UNTIL ASKED TO DO SO.

Part 1 (4 minutes)

Mark the G if the conclusion shows good reasoning. Mark the P if it is poor reasoning.

- | | | |
|---|---|---|
| 1. All birds have purple tails. All cats are birds.
Therefore all cats have purple tails. | G | P |
| 2. No singer is a pogo stick. All pogo sticks are movie stars.
Therefore no singer is a movie star. | G | P |
| 3. All cars have sails. Some swimming pools are cars.
Therefore some swimming pools have sails. | G | P |
| 4. No chipmunks are clowns. Some mushrooms are chipmunks.
Therefore some mushrooms are not clowns. | G | P |
| 5. No skunks have green toes. All skunks are pigs.
Therefore no pig has green toes. | G | P |
| 6. All horses have wings. No turtle has wings.
Therefore no turtle is a horse. | G | P |
| 7. No hummingbirds fly. Some tractors fly.
Therefore some tractors are not hummingbirds. | G | P |
| 8. All apes are houseflies. Some houseflies are not snails.
Therefore some apes are not snails. | G | P |
| 9. Some dogs like to sing. All dogs are snowdrifts.
Therefore some snowdrifts like to sing. | G | P |
| 10. All doctors are sea horses. Some doctors are tornadoes.
Therefore some tornadoes are sea horses. | G | P |
| 11. Some people who like Alice do not like Robert. Everyone who
likes Sue likes Alice. Therefore some people who like Robert
do not like Sue. | G | P |
| 12. All trains are coal mines. Nothing above 5,000 feet is a train.
Therefore no coal mine is above 5,000 feet. | G | P |
| 13. Some men are purple. Everything which is purple is a horse.
Therefore some horses are men. | G | P |
| 14. Some dogs are seals. Some seals bark.
Therefore some dogs bark. | G | P |
| 15. All elephants are pink. This animal is pink
Therefore this animal is an elephant. | G | P |

DO NOT GO ON TO THE NEXT PAGE UNTIL ASKED TO DO SO.

STOP.

Part 2 (4 minutes)

Mark the G if the conclusion shows good reasoning. Mark the P if it is poor reasoning.

- | | | | |
|-----|--|---|---|
| 16. | No one with a pink nose can be president. All men have pink noses. Therefore no man can be president. | G | P |
| 17. | All alligators are art collectors. Some art collectors live in caves. Therefore some alligators live in caves. | G | P |
| 18. | No cats are electrified. All ghosts are electrified. Therefore no ghost is a cat. | G | P |
| 19. | All birds are snakes. No bird is left-handed. Therefore nothing that is left-handed is a snake. | G | P |
| 20. | All lions are lavender. Some cowards are not lavender. Therefore some cowards are not lions. | G | P |
| 21. | All ice skates are totem poles. No totem pole snores. Therefore nothing that snores is an ice skate. | G | P |
| 22. | Some birds are pink. All hurricanes are pink. Therefore some birds are hurricanes. | G | P |
| 23. | All monkeys are pineapples. All pineapples have wings and all birds have a tail and wings. Therefore all monkeys have a tail. | G | P |
| 24. | No onions are parsnips. Some parsnips are tangerines. Therefore some tangerines are not onions. | G | P |
| 25. | Some kettles are giraffes. All zebras are kettles. Therefore some giraffes are zebras. | G | P |
| 26. | All dogs are ink bottles. Some ink bottles are squirrels. Therefore some squirrels are dogs. | G | P |
| 27. | Some people in our town are not famous. Everyone in our town is rich. Therefore some rich people are not famous. | G | P |
| 28. | No one who has green hair is a teenager. Some people who have green hair drink milk. Therefore some people who drink milk are not teenagers. | G | P |
| 29. | Los Angeles has fewer people than Detroit. Detroit has more people than East Overshoe. Therefore East Overshoe has more people than Los Angeles. | G | P |
| 30. | Some soldiers who were in the Civil War used green peaches for gunpowder. This soldier uses green peaches for gunpowder. Therefore he must have been in the Civil War. | G | P |

DO NOT GO BACK TO PART 1, AND

DO NOT GO ON TO ANY OTHER TEST UNTIL ASKED TO DO SO.

STOP.

Scoring KeysNonsense Syllogisms -- RL-1

<u>Part 1</u>		<u>Part 2</u>	
1. G	9. G	16. G	24. G
2. P	10. G	17. P	25. P
3. G	11. P	18. G	26. P
4. G	12. P	19. P	27. G
5. P	13. G	20. G	28. G
6. G	14. P	21. G	29. P
7. G	15. P	22. P	30. P
8. P		23. P	

Diagramming Relationships -- RL-2

<u>Part 1</u>		<u>Part 2</u>	
1. A	9. E	16. C	24. E
2. E	10. A	17. E	25. C
3. C	11. D	18. B	26. B
4. B	12. B	19. A	27. A
5. D	13. B	20. A	28. E
6. C	14. E	21. D	29. C
7. D	15. C	22. D	30. D
8. A		23. B	

V VERBAL COMPREHENSION

Factor*The ability to understand the English language*

Factors similar to the verbal factor for the English language have been found in studies of native speech in other languages and in bilingual or multilingual populations. There may be separate verbal comprehension factors for each language (Guthrie, 1963). This factor contrasts with the ideational fluency and word fluency factors which are not specific to a given language.

Some research has suggested that verbal comprehension is a subfactor of a broader factor involving reading comprehension, verbal analogies, matching proverbs, grammar and syntax. Others have suggested a broader factor that seems to be closer to verbal reasoning or verbal relations.

Two studies (Haag and David, 1969; Messick and French, 1975) have suggested a verbal factor related to "availability and flexibility in the use of multiple meaning of words."

According to Carroll (1974) verbal comprehension is almost exclusively dependent on the contents of the lexicosemantic long-term memory store. He suggests that a set of verbal comprehension tests more diversified than multiple-choice vocabulary tests based on synonyms might call on other aspects of the lexicosemantic store.

Identification: Cattell, UI-T13; Guilford, CMU; Thurstone, V.

References: This factor has been found in more than 125 studies.

TestsVocabulary I -- V-1

Adapted from a test by J. B. Carroll. This is a 4-choice synonym test.

Length of each part: 18 items, 4 minutes

Suitable for grades 7-12

Vocabulary II -- V-2

Adapted from a Cooperative Vocabulary Test. This is a 5-choice synonym test. The format is intentionally different from that of V-1 to reduce common variance of an artifactual nature.

Length of each part: 18 items, 4 minutes

Suitable for grades 7-12

Extended Range Vocabulary Test -- V-3

Adapted from a Cooperative Vocabulary Test. This is a 5-choice synonym test having items ranging from very easy to very difficult.

Length of each part: 24 items, 6 minutes

Suitable for grades 7-16

Advanced Vocabulary Test I -- V-4

Adapted from a Cooperative Vocabulary Test. This is a 5-choice synonym test consisting mainly of difficult items.

Length of each part: 18 items, 4 minutes

Suitable for grades 11-16

Advanced Vocabulary Test II -- V-5

Adapted from a test by J. B. Carroll. This is a 4-choice synonym test consisting mainly of difficult items.

Length of each part: 18 items, 4 minutes

Suitable for grades 11-16

Cover Pages

VOCABULARY TEST I — V-1

This is a test of your knowledge of word meanings. Look at the sample below. One of the four numbered words has the same meaning or nearly the same meaning as the word at the left. Indicate your answer by writing, in the parentheses at the right, the number of the word that you select.

attempt 1-run 2-hate 3-try 4-stop ()

The answer to the item is number 3; you should have a "3" written in the parentheses.

Your score will be the number marked correctly minus a fraction of the number marked incorrectly. Therefore, it will not be to your advantage to guess unless you are able to eliminate one or more of the answer choices as wrong.

You will have 4 minutes for each of the two parts of this test. Each part has one page. When you have finished Part 1, STOP. Please do not go on to Part 2 until you are asked to do so.

DO NOT TURN THIS PAGE UNTIL ASKED TO DO SO.

Name _____

VOCABULARY TEST I — V-1

This is a test of your knowledge of word meanings. Look at the sample below. One of the four numbered words has the same meaning or nearly the same meaning as the word at the left. Indicate your answer by writing, in the parentheses at the right, the number of the word that you select.

attempt 1-run 2-hate 3-try 4-stop ()

The answer to the item is number 3; you should have a "3" written in the parentheses.

Your score will be the number marked correctly minus a fraction of the number marked incorrectly. Therefore, it will not be to your advantage to guess unless you are able to eliminate one or more of the answer choices as wrong.

You will have 4 minutes for each of the two parts of this test. Each part has one page. When you have finished Part 1, STOP. Please do not go on to Part 2 until you are asked to do so.

DO NOT TURN THIS PAGE UNTIL ASKED TO DO SO.

Part 2 (4 minutes)

19. chef 1-cheese 2-style 3-head cook 4-candle . . ()
20. milestone 1-marker 2-plant 3-soft music
4-grindstone ()
21. chowder 1-dog 2-chemical 3-pigment 4-stew ()
22. emancipator 1-theorist 2-liberator 3-prophet 4-spy . ()
23. consultative 1-monitory 2-conservative 3-advisory
4-narrative ()
24. emergence 1-laziness 2-identity 3-contrast
4-coming forth ()
25. sheepfold 1-blanket 2-warm coat 3-sheep
4-crooked stick ()
26. ignoramus 1-monster 2-gossip 3-dandy 4-dunce . . . ()
27. calamitous 1-clamorous 2-discontented 3-disastrous
4-uncouth ()
28. furlough 1-leave of absence 2-garden 3-foot soldier
4-timberland ()
29. incubate 1-inform 2-anticipate 3-burn 4-brood . . ()
30. incessantness 1-hopelessness 2-continuousness
3-inclination 4-rashness ()
31. blithesome 1-morbid 2-cheery 3-blessed
4-venturesome ()
32. devitalize 1-eat 2-deaden 3-soften 4-wave ()
33. exonerate 1-betray 2-transgress 3-exult
4-vindicate ()
34. decadence 1-decline 2-decision 3-color 4-joy . . . ()
35. ungainly 1-cheap 2-stupid 3-clumsy 4-hazardous . . ()
36. pestilential 1-malignant 2-preparing 3-boisterous
4-yearly ()

DO NOT GO BACK TO PART 1 AND DO NOT GO ON TO ANY
OTHER TEST UNTIL ASKED TO DO SO.

STOP.

Scoring KeysVocabulary Test I -- v-1

<u>Part 1</u>		<u>Part 2</u>	
1. 3	10. 1	19. 3	28. 1
2. 4	11. 4	20. 1	29. 4
3. 2	12. 4	21. 4	30. 2
4. 4	13. 2	22. 2	31. 2
5. 1	14. 2	23. 3	32. 2
6. 3	15. 3	24. 4	33. 4
7. 3	16. 2	25. 3	34. 1
8. 1	17. 4	26. 4	35. 3
9. 2	18. 1	27. 3	36. 1

Vocabulary Test II -- v-2

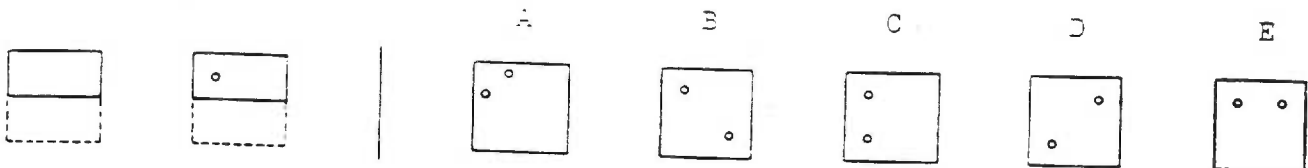
<u>Part 1</u>		<u>Part 2</u>	
1. 4	10. 3	19. 2	28. 3
2. 5	11. 3	20. 5	29. 5
3. 2	12. 2	21. 5	30. 5
4. 4	13. 4	22. 5	31. 2
5. 3	14. 3	23. 4	32. 2
6. 2	15. 3	24. 1	33. 5
7. 3	16. 4	25. 3	34. 2
8. 3	17. 1	26. 4	35. 4
9. 1	18. 1	27. 2	36. 1

Name _____

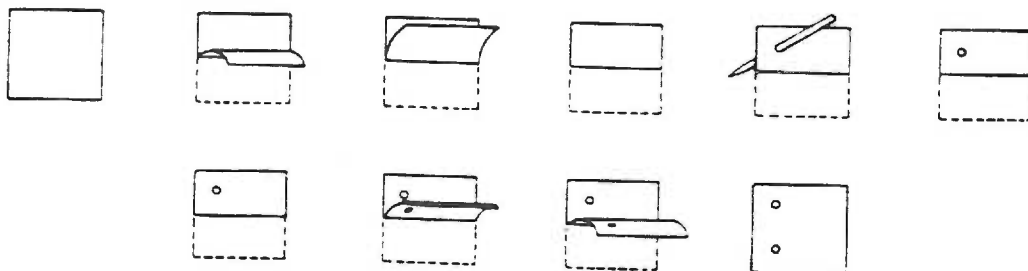
PAPER FOLDING TEST — VZ-2

In this test you are to imagine the folding and unfolding of pieces of paper. In each problem in the test there are some figures drawn at the left of a vertical line and there are others drawn at the right of the line. The figures at the left represent a square piece of paper being folded, and the last of these figures has one or two small circles drawn on it to show where the paper has been punched. Each hole is punched through all the thicknesses of paper at that point. One of the five figures at the right of the vertical line shows where the holes will be when the paper is completely unfolded. You are to decide which one of these figures is correct and draw an X through that figure.

Now try the sample problem below. (In this problem only one hole was punched in the folded paper.)



The correct answer to the sample problem above is C and so it should have been marked with an X. The figures below show how the paper was folded and why C is the correct answer.



In these problems all of the folds that are made are shown in the figures at the left of the line, and the paper is not turned or moved in any way except to make the folds shown in the figures. Remember, the answer is the figure that shows the positions of the holes when the paper is completely unfolded.

Your score on this test will be the number marked correctly minus a fraction of the number marked incorrectly. Therefore, it will not be to your advantage to guess unless you are able to eliminate one or more of the answer choices as wrong.

You will have 5 minutes for each of the two parts of this test. Each part has 1 page. When you have finished Part 1, STOP. Please do not go on to Part 2 until you are asked to do so.

DO NOT TURN THIS PAGE UNTIL ASKED TO DO SO.

Part 1 (3 minutes)

11

10

9

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7

6

5

4

3

2

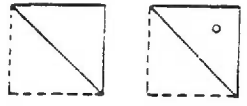
1


	A	B	C	D	E
11					
10					
9					
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7					
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5					
4					
3					
2					
1					


DO NOT GO ON TO THE NEXT PAGE UNTIL ASKED TO DO SO.

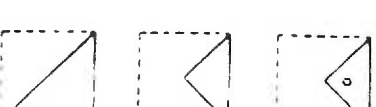
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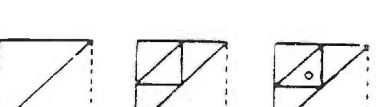
Part 2 (3 minutes)


11 


12 

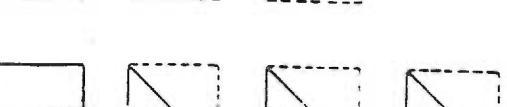
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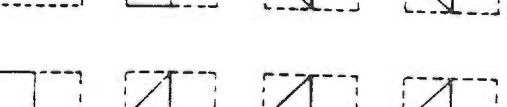
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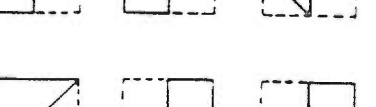
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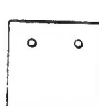





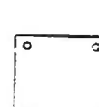

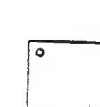






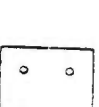







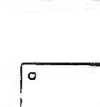
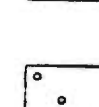






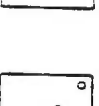


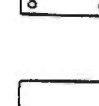
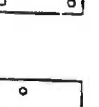
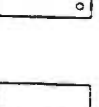
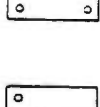
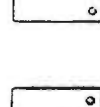
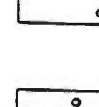
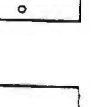

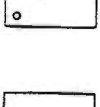
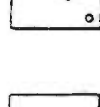
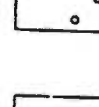
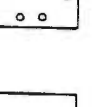

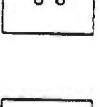
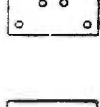
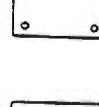
16 

17 

18 

19 

20 

	A	B	C	D	E
11					
12					
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DO NOT GO BACK TO PART 1, AND

DO NOT GO ON TO ANY OTHER TEST UNTIL ASKED TO DO SO.

STOP.

Paper Folding Test -- VZ-2

<u>Part 1</u>	<u>Part 2</u>
1. A	11. C
2. D	12. B
3. B	13. A
4. D	14. E
5. B	15. B
6. E	16. A
7. A	17. E
8. C	18. D
9. E	19. D
10. E	20. C

Surface Development Test -- VZ-3

<u>Part 1</u>	<u>Part 2</u>
<u>Page 2</u>	<u>Page 4</u>
1. B, A, A, E, B	7. C, B, E, A, B
2. E, D, A, F, A	8. A, D, H, C, B
3. A, B, A, B, E	9. D, B, A, F, G
<u>Page 3</u>	<u>Page 5</u>
4. A, C, G, H, A	10. F, C, D, G, E
5. F, E, C, D, B	11. C, H, B, D, F
6. A, A, D, C, E	12. C, G, D, F, H

APPENDIX D

Education Test Service Licensing Agreement

EDUCATIONAL TESTING SERVICE



PRINCETON, N.J. 08541

January 27, 1997

EDUCATIONAL TESTING SERVICE
PRINCETON, N.J. 08541

Linda Rose, RN, BSN
Oregon Health Sciences University
9220 SW Barbur #119-183
Portland, OR 97219

Dear Ms. Rose:

Enclosed are two copies of a Licensing Agreement permitting you to reproduce certain test(s) from the Kit of Factor-Referenced Cognitive Tests for use in your research study.

We will appreciate receiving any data resulting from your study. Please send such data directly to Dr. Ruth B. Ekstrom, Principal Research Scientist.

If these arrangements are satisfactory, please sign both copies of the Agreement and return one copy, along with your payment in the amount of \$50.00, to the following address:

Educational Testing Service
Rosedale Road
Princeton, New Jersey 08541
Attention: Lorraine Carmosino M/S 38-D

Sincerely,

A solid black rectangular box redacting the signature of Lorraine Carmosino.

Lorraine Carmosino
Administrative Assistant
Contracts and Proprietary
Rights

Enclosures

cc: R. Ekstrom
E. Mingo

LICENSING AGREEMENT

THIS AGREEMENT, entered into as of January 24, 1997, between Educational Testing Service (hereinafter called "ETS"), a nonstock, nonprofit corporation organized and existing under the Education Law of the State of New York, with offices at Princeton, New Jersey 08541, and

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Oregon Health Sciences University
9220 SW Barbur #119-183
Portland, OR 97219

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WITNESSETH:

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WHEREAS, Licensee wishes to produce editions of

Paper Folding Test (VZ-2)
Nonsense Syllogisms Test (RL-1)
Vocabulary Test I (V-1)

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APPENDIX E

Test Question Example

Question A2-16

DIRECTIONS: The following item consists of four or five lettered headings followed by a numbered word, phrase, or statement. For the following numbered word, phrase, or statement, select the one lettered heading that is most closely associated with it and circle it.

Students and faculty attend a college picnic where hot dogs, potato chips, salad, soda, and pre-packaged desserts are served. Four attendees have adverse reactions after eating the meal.

For the following case described below, select the food ingredient (A-E) that most likely caused the adverse reaction.

- (A) Monosodium glutamate
- (B) Yellow dye No. 5
- (C) Sulfites
- (D) Pyridoxine
- (E) Nitrites

16. Migraine headache in a 38-year-old man with a history of migraine.

- What is your best guess at the answer before you do the Medline search? _____

What is the certainty of your guess? *check one*

- Very certain Somewhat certain Slightly certain Completely uncertain
- 1** **2** **3** **4**

Stop: Complete the Medline search for this question before finishing the next page.

Question A2-16 Answer: _____

What is the certainty for your answer? *check one*

- Very certain Somewhat certain Slightly certain Completely uncertain
1 2 3 4

Please list all references you retrieved that provide evidence for your answer

Journal _____
Volume _____ Issue _____ Date _____ Page# _____
Article Title _____
Author(s) (first one or two) _____

Journal _____
Volume _____ Issue _____ Date _____ Page# _____
Article Title _____
Author(s) (first one or two) _____

Journal _____
Volume _____ Issue _____ Date _____ Page# _____
Article Title _____
Author(s) (first one or two) _____

Journal _____
Volume _____ Issue _____ Date _____ Page# _____
Article Title _____
Author(s) (first one or two) _____

APPENDIX F

Information Retrieval Satisfaction Form

Information Retrieval Satisfaction Form

Subject ID _____

Question Number _____

Please indicate your agreement with the following statement:

1. The system was helpful in finding the answer to this question.

Strongly agree	Moderately agree	Neutral	Moderately disagree	Strongly disagree
1	2	3	4	5

2. What proportion of relevant articles in MEDLINE do you believe you found on this topic?

All	Most	Some	None
1	2	3	4

3. Of the articles you retrieved, what proportion do you believe were relevant in answering the question?

All	Most	Some	None
1	2	3	4

Comments _____

APPENDIX G

Institutional Review Board Approval



**OREGON
HEALTH SCIENCES UNIVERSITY**

3181 S.W. Sam Jackson Park Road, Portland, OR 97201-3098
Mail Code L106, (503) 494-7887 Fax (503) 494-7787

Institutional Review Board/Committee on Human Research

DATE: January 30, 1997

TO: Linda Rose, RN, BSN

FROM: Institutional Review Board,
MacHall 2170, Ext. 4-7887

L106

RE:

This confirms receipt of the above mentioned research study proposal. It is our understanding that this study meets the criteria for exemption (Category #2) by the Committee on Human Research. Please see the following excerpt from the Code of Federal Regulations (45 CFR 46.101 b).

Research involving the use of educational tests, (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures or observation of public behavior, unless: (i) information obtained is recorded in such a manner that subjects can be identified, directly or through identifiers linked to the subjects; and any disclosure of the human subjects responses outside the research could reasonably place the subjects at risk of criminal or civil liability or be damaging to the subjects' financial standing, employability, or reputation

This study has been put into our exempt files, and you will receive no further communication from the Committee concerning this study. However, if the involvement of human subjects in this study changes, you must contact the Committee on Human Research to find out whether or not those changes should be reviewed. If possible please notify the Committee when this project has been completed.

Thank you for your cooperation.

APPENDIX H

Requests and Approvals from:

Oregon Health Sciences University

University of Portland

BICC Medical Library

Linda Rose, RN, BSN
Oregon Health Sciences
School of Nursing

January, 24, 1997

Sarah Porter
Director of Student Affairs
Oregon Health Sciences University

Dear Sarah Porter,

I am a Community Health Care Systems Masters' student at OHSU. In order to fulfill part of the course requirements, I am conducting a research study related to my area of interest which is Information Retrieval. Per our phone conversation, I am requesting your permission to invite the second year Nurse Practitioner students from OHSU to participate in my proposed research study. Certified Nurse Midwives and Mental Health Nurse Practitioner students will be excluded from the study because they may have limited knowledge in general practice areas.

As a professional nurse, you are aware that the timely dissemination and implementation of research findings is absolutely critical for improved patient care. However, for more than twenty years, the nursing literature has documented a persistent gap between the conduct of nursing research and the dissemination and utilization of these findings in the clinical setting. Unfortunately, and in keeping with many other professions, the gap is intolerably large. There is a disturbing 10 to 15 year interval between the discovery of innovative research findings and the implementation of research into nursing practice.

The first step in the research utilization is the process of locating earlier research. Retrieval of research literature proves difficult if not impossible for many nurse researchers and clinicians for a multitude of reasons which includes access to the needed information. Access to the literature involves both the ability to search and retrieve relevant literature as well as the ability to understand content and its implication. Although nurses are trained in database searching techniques, the process of information retrieval (IR) can be complex and generally requires additional instruction.

The IR process is the interaction between the user, who has an information need, and the IR system otherwise referred to as the database as well as the computer hardware and software. Research in the nursing literature regarding IR and methods to improve the first step in research utilization is almost non-existent and there are virtually no studies targeting Nurse Practitioners.

Since there are no IR studies dealing specifically with NPs, this proposed study is important to nursing. It will serve as a basis for further research and contribute to the body of scientific literature regarding barriers to information retrieval and research utilization for NPs in health care today. In addition, this study may be an impetus for more investigation into methods we can implement to improve use of computer technology by Nurse Practitioners and the nursing profession as a whole. It is imperative that we practice knowledge-based nursing, shaped by empirical research data. And that those research findings be the most current facts available to practitioners.

The purpose of this research study is to investigate the relationship between the successful, as a measure of accuracy, completion of information retrieval with the following selected NP student attributes: (a) selected cognitive abilities (spatial visualization, verbal comprehension, and logical reasoning), (b) previous computer and information retrieval experience, (c) attitudes concerning current information retrieval technology, (e) attitudes concerning current computer technology. This information may aid future efforts to increase IR by NPs and improve the quality of patient care.

Your NP students (**ANP, FNP, GNP, WHCNP or NMIDWIFE**) have been selected to participate in this research study because of their knowledge in primary health care as a nurse practitioner student. If they decide to participate, I will contact them to make an appointment for one session at the OHSU library. During this session, they will complete a questionnaire regarding selected demographics, computer experience, etc., and complete 3 simple tests that will measure selected cognitive abilities. In addition, they will be asked to do a literature search using Medline to answer 3 specific clinical questions. Additional data will be collected regarding length of searches, terms used and computers screens completed for use in a larger future IR study. The entire session will take approximately 2 hours and each student will be given an honorarium of \$25 for their participation in the research project.

Thank you for your consideration and your enthusiastic interest in this research project. Please complete the enclosed form giving permission for your students participation in this study and return it via fax # 503-696-2754. Also, please direct me to a contact person name and phone number who will be able to supply a list of NP students names and addresses so that they can be invited to participate in this study. If you have any questions regarding the research project feel free to contact me at (503) 366-1948 (home) or (360) 737-5364 (pager).

Sincerely,

LINDA ROSE, RN, BSN

Enclosures: 1

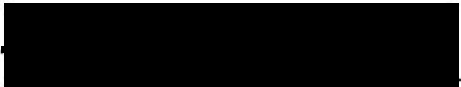
Fax To 696-2754

Consent for Nurse Practitioner Student Participation

Director of Student Affairs
As ~~Dean of Student Affairs~~ in the School of Nursing at ~~Oregon State University~~, I am granting you permission to solicit participation from the currently enrolled Nurse Practitioner students in your research project.

Oregon Health Sciences University

I understand that the purpose of this research study is to investigate the relationship between the successful, as a measure of accuracy, completion of information retrieval with the following selected NP student attributes: (a) selected cognitive abilities (spatial visualization, verbal comprehension, and logical reasoning), (b) previous computer and information retrieval experience, (c) attitudes concerning current information retrieval technology, (e) attitudes concerning current computer technology



Director
Sarah Orlor, ~~Dean~~ of Students Affairs
School of Nursing
Oregon Health University

Jan 29, 1996
Date



Linda Rose, RN, BSN
Oregon Health Sciences
School of Nursing

January, 24, 1997

Susan Mascato
Acting Director, School of Nursing
University of Portland
5000 M. Willamette Blvd.
Portland, OR 97203

Dear Dr. Moscato,

I am a Community Health Care Systems Masters' student at OHSU. In order to fulfill part of the course requirements, I am conducting a research study related to my area of interest which is Information Retrieval. Per our phone conversation, I am requesting your permission to invite the second and third year Nurse Practitioner students from U of P to participate in my proposed research study. Certified Nurse Midwives and Mental Health Nurse Practitioner students will be excluded from the study because they may have limited knowledge in general practice areas.

As a professional nurse, you are aware that the timely dissemination and implementation of research findings is absolutely critical for improved patient care. However, for more than twenty years, the nursing literature has documented a persistent gap between the conduct of nursing research and the dissemination and utilization of these findings in the clinical setting. Unfortunately, and in keeping with many other professions, the gap is intolerably large. There is a disturbing 10 to 15 year interval between the discovery of innovative research findings and the implementation of research into nursing practice.

The first step in the research utilization is the process of locating earlier research. Retrieval of research literature proves difficult if not impossible for many nurse researchers and clinicians for a multitude of reasons which includes access to the needed information. Access to the literature involves both the ability to search and retrieve relevant literature as well as the ability to understand content and its implication. Although nurses are trained in database searching techniques, the process of information retrieval (IR) can be complex and generally requires additional instruction.

The IR process is the interaction between the user, who has an information need, and the IR system otherwise referred to as the database as well as the computer hardware and software. Research in the nursing literature regarding IR and methods to improve the

first step in research utilization is almost non-existent and there are virtually no studies targeting Nurse Practitioners.

Since there are no IR studies dealing specifically with NPs, this proposed study is important to nursing. It will serve as a basis for further research and contribute to the body of scientific literature regarding barriers to information retrieval and research utilization for NPs in health care today. In addition, this study may be an impetus for more investigation into methods we can implement to improve use of computer technology by Nurse Practitioners and the nursing profession as a whole. It is imperative that we practice knowledge-based nursing, shaped by empirical research data. And that those research findings be the most current facts available to practitioners.

The purpose of this research study is to investigate the relationship between the successful, as a measure of accuracy, completion of information retrieval with the following selected NP student attributes: (a) selected cognitive abilities (spatial visualization, verbal comprehension, and logical reasoning), (b) previous computer and information retrieval experience, (c) attitudes concerning current information retrieval technology, (e) attitudes concerning current computer technology. This information may aid future efforts to increase IR by NPs and improve the quality of patient care.

Your NP students (**ANP, FNP, GNP, WHCNP or NMIDWIFE**) have been selected to participate in this research study because of their knowledge in primary health care as a nurse practitioner student. If they decide to participate, I will contact them to make an appointment for one session at the OHSU library. During this session, they will complete a questionnaire regarding selected demographics, computer experience, etc., and complete 3 simple tests that will measure selected cognitive abilities. In addition, they will be asked to do a literature search using Medline to answer 3 specific clinical questions. Additional data will be collected regarding length of searches, terms used and computers screens completed for use in a larger future IR study. The entire session will take approximately 2 hours and each student will be given an honorarium of \$25 for their participation in the research project.

Thank you for your consideration and your enthusiastic interest in this research project. Please complete the enclosed form giving permission for your students participation in this study and return it via fax # 503-696-2754. Also, please direct me to a contact person name and phone number who will be able to supply a list of NP students names and addresses so that they can be invited to participate in this study. If you have any questions regarding the research project feel free to contact me at (503) 366-1948 (home) or (360) 737-5364 (pager).

Sincerely,

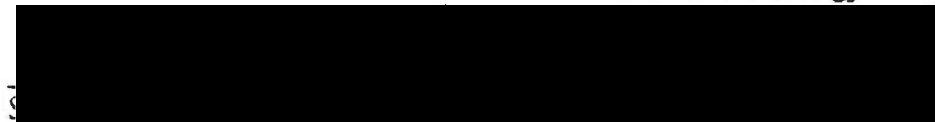
LINDA ROSE, RN, BSN

Enclosures: 1

Consent for Nurse Practitioner Student Participation

As Dean of the School of Nursing at the University of Portland, I am granting you permission to solicit participation from the currently enrolled Nurse Practitioner students in your research project.

I understand that the purpose of this research study is to investigate the relationship between the successful, as a measure of accuracy, completion of information retrieval with the following selected NP student attributes: (a) selected cognitive abilities (spatial visualization, verbal comprehension, and logical reasoning), (b) previous computer and information retrieval experience, (c) attitudes concerning current information retrieval technology, (e) attitudes concerning current computer technology



Mesero

Dean of the School of Nursing
University of Portland

Date 27 January 1997



Linda Rose, RN, BSN
Oregon Health Sciences
School of Nursing

January 24, 1997

Cynthia Cunningham
Biomedical Information Communication Center
Oregon Health Sciences University
3181 SW Sam Jackson Parkway
Portland, OR 97201

Dear Cynthia,

I am a Community Health Care Systems Masters' student at OHSU. In order to fulfill part of the course requirements, I am conducting a research study related to my area of interest which is Information Retrieval. Per our phone conversation, I am requesting your permission to utilize the BICC computer and information retrieval resources to complete the research study.

As a professional, you are aware that the timely dissemination and implementation of research findings is absolutely critical for improved patient care. However, for more than twenty years, the nursing literature has documented a persistent gap between the conduct of nursing research and the dissemination and utilization of these findings in the clinical setting. Unfortunately, and in keeping with many other professions, the gap is intolerably large. There is a disturbing 10 to 15 year interval between the discovery of innovative research findings and the implementation of research into nursing practice.

The first step in the research utilization is the process of locating earlier research. Retrieval of research literature proves difficult if not impossible for many nurse researchers and clinicians for a multitude of reasons which includes access to the needed information. Access to the literature involves both the ability to search and retrieve relevant literature as well as the ability to understand content and its implication. Although nurses are trained in database searching techniques, the process of information retrieval (IR) can be complex and generally requires additional instruction.

Since there are no IR studies dealing specifically with NPs, this proposed study is important to nursing. It will serve as a basis for further research and contribute to the body of scientific literature regarding barriers to information retrieval and research utilization for NPs in health care today. In addition, this study may be an impetus for more investigation into methods we can implement to improve use of computer technology by Nurse Practitioners and the nursing profession as a whole. It is imperative that we practice knowledge-based nursing, shaped by empirical research data. And that those research findings be the most current facts available to practitioners.

The purpose of this research study is to investigate the relationship between the successful, as a measure of accuracy, completion of information retrieval with the following selected NP student attributes: (a) selected cognitive abilities (spatial visualization, verbal

comprehension, and logical reasoning), (b) previous computer and information retrieval experience, (c) attitudes concerning current information retrieval technology, (e) attitudes concerning current computer technology.

NP students have been selected to participate in this research study because of their knowledge in primary health care as a nurse practitioner student. I will contact them to make an appointment for one session at the OHSU library. During the library session at the BICC, they will complete a questionnaire regarding selected demographics, computer experience, etc., and complete 4 simple tests that will measure selected cognitive abilities. In addition, they will be asked to do a literature search using Medline to answer 3 specific clinical questions. Additional data will be collected regarding length of searches, terms used and computers screens completed for use in a larger future IR study. The entire session will take approximately 2 hours and the students will be given an honorarium of \$25 for their participation in the research project.

Thank you for your consideration and your support in this research project. Please complete the enclosed form giving permission for the use of BICC resources in this study and return it via fax # 503-696-2754. If you have any questions regarding the research project feel free to contact me at (503) 366-1948 (home) or (360) 737-5364 (pager).

Sincerely,

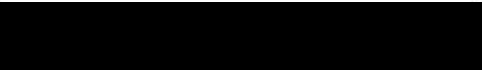
LINDA ROSE, RN, BSN

Enclosures: 1

Consent for Use of BICC Libraries for Research Project

As administrator of the Biomedical Information Communication Center at the Oregon Health Sciences University, I am granting you permission to use the library and information retrieval systems services to conduct your research project.

I understand that the purpose of this research study is to investigate the relationship between the successful, as a measure of accuracy, completion of information retrieval with the following selected NP student attributes: (a) selected cognitive abilities (spatial visualization, verbal comprehension, and logical reasoning), (b) previous computer and information retrieval experience, (c) attitudes concerning current information retrieval technology, (e) attitudes concerning current computer technology


Cynthia Cunningham, BICC Administrator
Oregon Health Sciences University

Date

1/27/97

Research
Findings

The Research Utilization Gap

Nursing
Practice

APPENDIX I

Recruitment Letters and Return Forms

Linda Rose, RN, BSN
Oregon Health Sciences University
School of Nursing

March 11, 1997

Nurse Practitioner Student
Oregon Health Sciences University
School of Nursing

Dear Nurse Practitioner Student (ANP, FNP, GNP, WHCNP or NMIDWIFE),

As a Nurse Practitioner student with advance practice role, you are aware that the timely dissemination and implementation of research findings is absolutely critical for improved patient care. However, for more than twenty years, the nursing literature has documented a persistent gap between the conduct of nursing research and the dissemination and utilization of these findings in the clinical setting. Unfortunately, and in keeping with many other professions, the gap is intolerably large. There is a disturbing 10 to 15 year interval between the discovery of innovative research findings and the implementation of research into nursing practice.

The first step in the research utilization is the process of locating earlier research. Retrieval of research literature proves difficult if not impossible for many nurse researchers and clinicians for a multitude of reasons which includes access to the needed information. Access to the literature involves both the ability to search and retrieve relevant literature as well as the ability to understand content and its implication. Although nurses are trained in database searching techniques, the process of information retrieval (IR) can be complex and generally requires additional instruction.

The IR process is the interaction between the user, who has an information need, and the IR system otherwise referred to as the database as well as the computer hardware and software. Research in the nursing literature regarding IR and methods to improve the first step in research utilization is almost non-existent and there are virtually no studies targeting Nurse Practitioners.

Since there are no IR studies dealing specifically with NPs, this proposed study is important to nursing. It will serve as a basis for further research and contribute to the body of scientific literature regarding barriers to information retrieval and research utilization for NPs in health care today. In addition, this study may be an impetus for more investigation into methods we can implement to improve use of computer technology by Nurse Practitioners and the nursing profession as a whole. It is imperative that we practice knowledge-based nursing, shaped by empirical research data. And that those research findings be the most current facts available to practitioners.

The purpose of this research study is to investigate the relationship between the successful, as a measure of accuracy, completion of information retrieval with the following selected NP student attributes: (a) selected cognitive abilities (spatial visualization, verbal comprehension, and logical reasoning), (b) previous computer and information retrieval

experience, (c) attitudes concerning current information retrieval technology, (e) attitudes concerning current computer technology.

If you are a NP student in the specialty area of **ANP, FNP, GNP, WHCNP or NMIDWIFE**, you have been selected to participate in this research study because of your knowledge in primary health care as a nurse practitioner student. If you decide to participate, I will contact you to make an appointment for one session at the OHSU library. During this session, you will complete a questionnaire regarding selected demographics, computer experience, etc., and complete 3 simple tests that will measure selected cognitive abilities. You will then be asked to complete a literature search using Medline to answer 3 specific clinical questions. Additional data will be collected regarding length of searches, terms used and computers screens completed for use in a larger future IR study. The entire session will take approximately 2 hours and you will be given an honorarium of \$25 for your participation in the research project.

Please complete the enclosed form and return in the stamped envelope. If you have any questions regarding the research project feel free to contact me at (503) 366-1948 (home) or (360) 737-5364 (pager).

Sincerely,

LINDA ROSE, RN, BSN

Linda Rose

Enclosures: 1

Yes, I would like to participant in your research project. I understand that I will receive a \$25 honorarium for my valuable contribution to your study.
Please contact me at:

Name

Phone

Best hours to contact me

My specialty is: ANP FNP GNP WHCNP NMidwife

No, I do not choose to participant in your research project at this time because:

____ Time Constraints

____ Concerns about privacy

____ Concerns about research procedure



APPENDIX J

Article Retrieval Form

Article Retrieval Form

Subject ID _____

Question Number _____

Use this form to write down articles you are considering using to answer the question. You may use abbreviations and truncate the title and/or author list. You must also circle one of the choices (bold) in each of the sentences that follow the reference. You may use as many pages as needed for any given question but **always use a new page to start a new question.**

Journal _____

Volume _____ Issue _____ Page# _____

Article Title _____

Author(s) (first one or two) _____

Circle one of the following for each sentence:

I **was able** / **was not able** / **did not attempt** to find this article in the stacks.

This article was **helpful** / **not helpful** in answering my question.

Which portion of the article did you read?

None **Title** **Abstract** **Skimmed text** **Carefully read entire article**

APPENDIX K
Question Answer Form

Question A2-16 Answer: _____

What is the certainty for your answer? *check one*

- Very certain Somewhat certain Slightly certain Completely uncertain
- 1** **2** **3** **4**

Please list all references you retrieved that provide evidence for your answer

Journal _____

Volume _____ Issue _____ Date _____ Page# _____

Article Title _____

Author(s) (first one or two) _____

Journal _____

Volume _____ Issue _____ Date _____ Page# _____

Article Title _____

Author(s) (first one or two) _____

Journal _____

Volume _____ Issue _____ Date _____ Page# _____

Article Title _____

Author(s) (first one or two) _____

Journal _____

Volume _____ Issue _____ Date _____ Page# _____

Article Title _____

Author(s) (first one or two) _____