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FACTORS ASSOCIATED WITH INFORMATION LITERACY COMPETENCIES OF THE
TRADITIONAL BACCALAUREATE NURSING STUDENT

by

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A dissertation submitted in partial fulfillment of the requirements
for the degree of Doctor of Philosophy
in the College of Nursing
at the University of Central Florida
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ABSTRACT

Nursing practice at all levels requires a nurse to use evidence-based nursing to improve the quality of patient care. Registered nurses need information literacy skills to practice evidence-based nursing, therefore, all nursing students need to be information literate upon graduation from nursing programs. There is no empirical research evidence on information literacy skills for students entering nursing programs in four-year colleges. Students seeking to attain a baccalaureate degree through a traditional nursing program, enter with differing demographic and educational factors that may affect their information literacy skills. Therefore, the purpose of this research was to examine information literacy skills of the entering traditional baccalaureate nursing student and to assess the relationship of demographic and educational factors utilizing a validated assessment tool, the Information Literacy Test (Madison Assessment, 2012).

The Information Literacy Test (ILT) was administered to 120 students in a traditional baccalaureate nursing program at a major metropolitan university during the first month of their academic program. The students in this sample were a homogenous aggregate of white, young females. Cronbach's alpha for the Information Literacy Test was minimally acceptable for reliability of the test. One hundred two of the 120 students in this study were identified as proficient in information literacy by achieving a 65% on the ILT with 18 students not being proficient. The ILT raw scores ranged from 31 to 55. The mean score for the ILT in this sample was 43.64. Two of the 120 students were at the Advanced Proficient level. Out of the four Association of Colleges and Research Libraries Competency Standards tested on the ILT, students had the most difficulty with Competency 2 on accessing needed information efficiently and effectively.

Demographic and educational factors were examined for prediction of information literacy skills in students entering their junior year in a traditional baccalaureate nursing program using Chi Square and regression analysis. The categorical variables of English as their primary language ($p < .001$), race ($p < .001$), and years since completing science prerequisites ($p = .036$) demonstrated a statistically significant relationship with the ILT using Chi Square analysis. A pre-analysis test indicated that the Test of Essential Academic Skills, which is an entrance test for nursing program admission, was positively correlated with the ILT ($p < .001$). An ANOVA of the TEAS and the bivariate ILT indicated that the means were significantly different ($p < .001$) between the Proficient and the Not Proficient students. A single regression analysis was significant in predicting a positive relationship with the ILT ($p < .001$) using the one continuous variable, the TEAS score, with the ILT raw score.

A logistic regression analysis was performed with two categorical variables, English as the primary language and years since completing science prerequisites, and one continuous variable, the TEAS score with the bivariate ILT raw score. All three variables were significant predictors of information literacy in the model. Student who did not have English as their primary language were 9 times as likely to be not be proficient on information literacy ($p = .010$). If a student who had science courses completed 3 or more years prior to entry in the nursing program, the student was 12 times as likely to not be proficient in information literacy ($p = .008$). For every 5 point increase in the TEAS, the ILT score increased by 4 points indicating that students with higher TEAS scores tend to be more proficient in information literacy ($p = .004$).

This page is dedicated to my husband, John J. Lafferty, MD, my two children and their families for being supportive through the years in my educational endeavors. My husband tells me that I am a perpetual student but as a nurse, we are challenged to continue our learning throughout our lives. I would also like to include on this dedication page my late father Stanley Godek, my mother, Cecilia Ziembra Godek, and my sister, Marianne Phillips for always being there for me. In addition, this page is dedicated to my friends, old and new, who continue to keep me inspired to continue my education through their thoughts and prayers.

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CHAPTER ONE: INTRODUCTION

Information literacy (IL) is a major requirement for baccalaureate nursing students to be successful in their education and in their professional career as a registered nurse (RN) (American Association of Colleges of Nursing [AACN], 2010). With its identification in 1989, information literacy is defined as a life-long learning process for all professionals to be effective users of information and to solve problems by finding, examining, and evaluating new information throughout their lifetime (American Library Association [ALA], 1989). The American Association of Colleges of Nursing (AACN) integrates IL in the *Essentials for Baccalaureate Education for Professional Nursing Practice*, known as the *Essentials* document, which guides accreditation of four-year nursing education programs (AACN, 2008). Information literacy is applied in the *Essentials* document, directly and indirectly, in setting standards for educating student nurses, thereby, stressing the importance of IL in nursing. The assimilation of IL into the nursing curriculum provides students with the basic knowledge to apply skills for evidence-based practice (EBP) that are required to improve the quality of care in complex nursing environments (AACN, 2008). Essential I states explicitly “The baccalaureate program prepares the graduate to: ... 3.) Use skills of inquiry, analysis, and information literacy to address practice issues” (AACN, 2008, p.12). The Baccalaureate *Essentials* document further asserts in Essential III on Scholarship for Evidence-Based Practice, in Essential IV on Information Management and Application of Patient-care, in Essential VII on Clinical Prevention and Population Health, and in Essential IX on Baccalaureate General Practice that IL is central to baccalaureate level skills in professional nursing practice (AACN, 2008).

Information literacy for college students is comprised of five Competency Standards as identified by the Association of Colleges and Research Libraries (ALA, 2000). The Association

of Colleges and Research Libraries (ACRL) is a subdivision of the American Library Association (ALA) whose purpose is to set the policies for higher education. Information literacy is central to all disciplines of study and all levels of education. Appendix A provides an alignment of the *Essentials* document with the five ACRL competencies. The development of IL competencies is the basis for the premise of life-long learning where learners are self-directed and assume control of their education (ALA, 2000). Furthermore, the ACRL has the endorsement of the American Association for Higher Education and the Council of Independent Colleges with reference to the five IL competencies (ALA, 2000).

The five specific Competency Standards are to:

1. Identify when information is needed;
2. Access the needed information;
3. Evaluate the information found;
4. Apply the information to accomplish a specific purpose;
5. Understand the economic, legal and social issues in using information in any context (ALA, 2000).

The competency standards have increasing levels of complexity.

At this time, no specific recommendations or standards exist for the measurement of the competencies. There are three validated, standardized assessments for testing IL skills: the Information Literacy Test (ILT) from James Madison University (Russell, 2009), the Standardized Assessment of Information Literacy Skills (SAILS) test from Kent State University (Project SAILS, 2010), and the iSkills Assessment from Educational Testing Services (ETS) (2013). The ILT and the SAILS test measure four of the five IL competencies omitting competency number 4, which is context dependent and not suitable for standard measurement in

a multiple-choice format (Russell, 2009; Projects SAILS, 2010). The ETS iSkills Assessment is a revised version of the earlier Information and Communication Technology Literacy (ICT) Core Level test that is a simulation-based test of IL skills. The ETS iSkills Assessment is based on all five ACRL competencies (Educational Testing Services, 2013).

Depending on their prior education, entering baccalaureate nursing students may demonstrate various levels of IL skills. Knowledge of the students' IL skills would allow nursing faculty to develop strategies to assist students in improving these skills. Research on IL in nursing education exists but a consistent definition of IL has not been used across studies. Published studies are predominantly limited to researcher developed, self-reported instruments with a focus on student attitudes, self-efficacy, confidence, and perception of IL skills. To date, nursing educational studies lack measurement of IL skills using a standardized, validated tool.

Purpose of the Study

The purpose of this study was to describe information literacy competencies in traditional nursing students admitted to a baccalaureate degree program at a major metropolitan university using a standardized test, the Information Literacy Test (Madison LLC, 2012), which has reported validity and reliability.

The research questions were:

1. What are the IL competency levels of students entering their junior year in a traditional baccalaureate nursing program?
2. Are demographic and educational factors predictive of information literacy level in students entering their junior year in a traditional baccalaureate nursing program?

Background of the Problem

Many reports from the Institute of Medicine (IOM), starting in 1999 on the quality of care in the United States (US), provide recommendations for health professionals that relate to the use of up-to-date guidelines in planning and providing care. Additional reports by the IOM that recommend altering the education of health care professionals to enhance healthcare have called for a change in curriculum for baccalaureate nursing education. In 2001, *Crossing the Quality Chasm* outlined skills that are required of health professionals to practice in the 21st century that are linked to IL (Institute of Medicine [IOM], 2001). Three recommendations in this report requires health care systems to: 1) use information technology for timely, consolidated information on patients, 2) create policies for improved patient care, and 3) prepare the healthcare workforce to engage in evidence-based practice (EBP) and form interdisciplinary teams for training (IOM, 2001a). A complementary report on educating the healthcare workforce, *Health Professions: A Bridge to Quality* (IOM, 2003), recommends that proficiency be maintained in two core area related to IL, namely evidence-based practice and informatics.

The latest report issued by the IOM, *The Future of Nursing: Leading Change, Advancing Health* (IOM, 2010), addresses the multiple educational pathways of nursing education for achieving RN licensure in the US and the need for nursing education to be more congruent across nursing programs. The AACN asserts that baccalaureate nursing programs enhance the professional nursing practice graduates with additional knowledge and coursework that makes a difference in the care provided, particularly with regard to EBP (AACN, 2011a).

Recommendations include increasing levels of baccalaureate prepared nurses to 80% in the workforce by 2020 from the current 50% of the nursing workforce (IOM, 2010, p.172).

Consequently, admissions in baccalaureate nursing programs have increased. In a more recent

survey, preliminary data from actual counts by AACN (2011b) demonstrated that the enrollment in all baccalaureate degree programs increased 3.9% for 2010-2011. Additionally, the hiring of baccalaureate nurses was preferred by 76.6% of employers (AACN, 2011b).

Students are admitted into baccalaureate programs with a range of previous educational experiences which include community/junior college, four year college, and some students may have a higher education degree in another discipline before entering nursing programs. Nursing pre-educational curricula that lead to baccalaureate preparation may not provide relevant competencies needed for the upper level courses in nursing (Cleary, McBride, McClure, & Reinhard, 2009). This is especially true for those who completed pre-requisites at a community college. Students that attend community colleges come from a wider variety of cultures, ethnic backgrounds, and socioeconomic status than the typical four year college student (Frye, 2009).

Barriers exist that may prevent these baccalaureate nursing students from being successful in their nursing programs. One barrier is the failure to prepare nursing students adequately with required competencies for transitioning into higher education (IOM, 2010, p. 190). With the upsurge of information and communication technology used in higher education programs in nursing, nurse educators need to capitalize on IL competencies that are possessed by incoming students. Students may use technology daily in a social context but be unfamiliar with sources of information and/or how to use information sources for professional nursing practice. One of the main benefits of the baccalaureate education for nurses is the increased ability to appraise research and to apply research evidence to improve nursing practice (AACN, 2011a). Improved nursing practice, based on relevant guidelines and research, can enhance quality and safety in the provision of care to patients.

Benefits of a Liberal Education in Baccalaureate Degree in Nursing Education

Although the associate degree programs have filled a niche for educating technical nurses since the 1950s, a shift in nursing education trends requires differentiated practice that is determined by education, experience, and competence (Matthias, 2010, p. 40). This change to evidence-based practice in nursing at the baccalaureate level of practice requires a liberal education. According to the AACN (2008), a liberal education is described as “providing the distinguishing cornerstone for the study and the practice of professional nursing” (p.11). The baccalaureate graduate has the ability to solve the complex problems in the present-day healthcare environment because their liberal education allows the integration of knowledge attained from the arts and sciences (AACN, 2008, p. 12). Additionally, liberal education provides the baccalaureate nursing student (BSN) with the time to engage in practice inquiry, analysis, critical thinking and communication during their education. The development of professional nursing values and standards, based on information literacy skills, is critical to socializing and to working with healthcare professionals having a bachelor’s and higher degrees (AACN, 2008).

Liberal education is the foundation of baccalaureate nursing education that fosters professional growth (AACN, 2008). The current push by external forces to increase the workforce with baccalaureate prepared nurses emphasizes the value of liberal education in the nursing curriculum. The requirement for scholarly inquiry positions a nurse with a baccalaureate degree to impact practice issues that are relevant in providing quality patient care (AACN, 2008). The BSN nurse applies knowledge learned in a nursing program through practice with written case studies and clinical assignments. The assignments are based on observed problems in their practice or clinical areas (AACN, 2008). Therefore, the baccalaureate registered nurse is prepared to master higher order analytic skills by applying the IL skills to identify problems in

nursing care, to search the literature, to review scientific evidence from the literature, and to evaluate practice changes for quality and safety in patient care. In addition, many educational papers and projects require identifying specific national safety and quality initiatives that apply to a clinical problem (Quality and Safety Education for Nurses [QSEN], 2012).

Though limited in number, a few studies demonstrated a relationship of a baccalaureate nursing education to better outcomes in patient care (Tourangeau, Giovannetti, Tu, & Wood, 2002; Aiken, Clarke, Cheung, Sloane, & Silber, 2003; Estabrooks, Midodzi, Cummings, Ricker, & Giovannetti, 2005). Ridley (2008) recommended in her state of the science review on patient safety indicators that the level of nursing education should be measured as a predictor of patient care quality. Using the level of education as one of the factors in nursing research studies may demonstrate added value for the baccalaureate prepared nurse to the healthcare system.

Significance of the Study

The complexity of health care requires nurses to acquire skills related to computer use and information technology, communication, and problem-solving for healthcare outcomes to be met (Corrall, 2007; Partnership for the 21st Century [P21stC], 2008). A highly skilled workforce using these skills can advance the economy by allowing the US to remain competitive in the global community (P21stC, 2008). Information literacy drives the use of knowledge-based resources that will ultimately improve the quality of nursing care through problem-solving and communication among health professionals for the betterment of society. Supporting this change is the Technology Informatics Guiding Education Reform (The TIGER Initiative) whose purpose is to support changes in nursing education by integrating basic computer skills, information literacy, and informatics skills in the baccalaureate curriculum (Dulong & Ball, 2008). The

TIGER Initiative (2012) is a consortium of nursing informatics professionals, nursing educators from AACN, and nursing administrators from the Association of Nurse Executives (AONE) that was formed to identify best practices in information/knowledge management and technology education for nurses.

Changes in nursing curricula should be responsive to a call for greater accountability from the public on institutions of higher learning (P21stC, 2008). Although information literacy competencies are the approved standard on IL by information and library professionals, in general, higher education continues to lag in incorporating the ACRL competencies (DaCosta, 2010). Examining IL and its relationship nursing education would inform nursing education administrators who plan to modify the traditional orientation programs in educating students for nursing practice (Sigma Theta Tau International Honor Society in Nursing [STTI], 2005; National League for Nursing [NLN], 2008b).

The science of nursing education needs empirical research to assess IL and its related factors in students entering nursing programs (Pravikoff, Tanner, & Pierce, 2005; Fetter, 2008; NLN, 2008b). Research on IL provide information on incoming nursing student needs by identifying those students at risk who have low IL skills. Knowledge of specific predictors of IL would enable faculty to direct resources to assist students to develop and to utilize their IL skills before graduation. Program effectiveness could also be measured and provide accountability for curriculum improvement outcomes for the accreditation standards that address information literacy skills (Commission on Collegiate Nursing Education [CCNE], 2009). The Commission on Collegiate Nursing Education is the official agency recognized by the U.S. Department of Education as the accrediting organization for baccalaureate and graduate nursing programs (CCNE, 2012).

Definitions

The Essentials: The *Essentials of Baccalaureate Education for Professional Nursing Practice* is an educational framework for the preparation of professional nurses. The *Essentials* document describe the expected outcomes of graduates of baccalaureate nursing programs and applies to all pre-licensure programs. The *Essentials* document includes the end-of-program outcomes that are expected of nursing students (AACN, 2008).

Information literacy: Information literacy is defined as the five specific competencies developed by the ACRL: to identify when information is needed; to access the needed information; to evaluate the information found; to apply the information to accomplish a specific purpose; and to understand the economic, legal and social issues in using information in any context (ALA, 2000).

Traditional baccalaureate nursing student: A traditional nursing student is a pre-licensure student who is preparing to become a registered nurse in a baccalaureate granting institution. For the purpose of this study, the student will have completed two years of liberal arts, sciences, specific prerequisite college courses prior to being admitted to the nursing phase of the degree program.

Overview

The dissertation followed the University of Central Florida's traditional quantitative dissertation format focusing on information literacy of junior students entering the traditional nursing program. Chapter Two presents synthesis of the relevant literature used to guide this study. Chapter Three provides the research design and methodology to accomplish the specific aims of this study, and its limitations. Chapter 4 presents the analysis of the data. Chapter 5

presents a discussion of the findings and will provide recommendations for nursing education and policy, and research based on the findings from this study. This study measured the IL skills in nursing students to determine baseline ranges, tendencies, and factors associated with information literacy that can be useful in planning educational experiences while reflecting the skills needed for nursing practice before graduation.

CHAPTER TWO: LITERATURE REVIEW

Information literacy (IL) is a foundation for evidence-based practice (American Association of Colleges of Nursing [AACN], 2008). A review of the current literature to identify the basis for IL measurement and its relationship to the education processes and outcomes of nursing students is required to know how students are performing in this skill. Low information literacy skills were cited frequently as a barrier impeding nurses' efforts to engage in evidence-based practice (EBP) (Brettle, Hulme, & Ormandy, 2007; Koehn & Lehman, 2008; Brown, Wickline, Ecoff, & Glaser, 2008). An earlier report indicated that only 40% of the nursing programs surveyed had a specific information literacy requirement (National League for Nursing [NLN], 2008a). Supporting the nursing educational perspective on information literacy skills as a requirement for evidence-based practice, the discipline of information and library science has the expectation that all college students to be information literate (American Library Association [ALA], 2000). Therefore, the purpose of this literature review is to review the current research on IL assessment in nursing education that is important for today's technological environment. Fifteen studies were suitable in meeting criteria for research on measuring IL in nursing education. Concluding the chapter will be a discussion on selected information and library science findings on IL. The Association of Colleges and Research Libraries (ACRL) Competency Standards is the framework guiding this research.

A database search was completed using EbscoHost database with CINAHL Plus Full Text, ERIC, Medline, Health and Psychosocial Instruments, Health Source - Nursing/Academic Edition, Academic Search Premier; LISTA and Library Literature Full-Text; and Dissertations & Thesis Abstracts from January, 1990 to March, 2012. The year, 1990, was selected as a beginning point ~~critical to use for the~~ this literature search because the formal definition by the American

Library Association (ALA) was developed and introduced in 1989. Terms that were used to search the databases included: information literacy, nursing education, nursing students, and studying and teaching. The initial search produced a total of 258 articles among the databases. Narrowing the search to include only data-based journal articles reduced the number of articles to 50 which also included the removal of duplicate articles. One dissertation was found on information literacy and nursing students. Reference sections of the articles were reviewed for pertinent research articles important to this study.

Further refinement of the search limited the search to the following: (a) the study addressed at least one of the five ACRL competencies; (b) the article had to be research-based ; (c) a full discussion of methodology was included; and (d) nursing students had to be included in the sample. A total of 15 articles were found to meet all inclusion criteria.

Results of the Literature Search

The five IL Competency Standards for higher education, as identified by the ACRL, guided this review of the 15 studies. The competencies provided a blueprint for teaching, testing, and evaluating information literacy standards (ALA, 2000). This review underscored both the highlights of the studies and some of the inadequacies found in past studies on assessing IL in nursing students and on utilizing the ACRL Competency Standards as a guide to studies on IL. Table 1 provides a summary of characteristics of the articles for the literature review that are based on the five ACRL competencies.

Table 1. Characteristics of Articles on Information Literacy in Nursing Education

Author/Year	Journal	Purpose	ACRL Competency Standard Measured	Quantitative Measurement Tool with Validity and Reliability
Carlock & Anderson, 2007	Nurse Educator	To assess the effectiveness of a baccalaureate nursing program on educating students to access literature.	II	Researcher developed: Performance Assessment and rubric on searching databases; no validity and reliability
Courey, Benson-Soros, Deemer, & Zeller, 2006	Nursing Education Perspectives	To educate associate degree students on IL skills, the role of nursing literature in EBP, and the importance of life-long learning in nursing.	II, III	Researcher developed: Self-reported Questionnaire; Cronbach's $\alpha = 0.798$ (Access Scale) Cronbach's $\alpha = 0.886$ (Attitude Scale)
Craig & Corral, 2007	Health Information & Libraries Journal	To investigate the effectiveness of an educational intervention to increase IL skills confidence to registered nurses in the United Kingdom.	II	Researcher developed: Pilot tested, Self-reported Questionnaire; no validity and reliability; triangulation to increase validity
Dee & Stanley, 2005	Journal of the Medical Library Association	To report on information resources used by clinical nurses and nursing students, the frequency and reasons for use, and library use.	II	Researcher developed: Self-reported Questionnaire; no validity and reliability
Fox, Richter, & White, 1996	Bulletin of the Medical Library Association	To identify student characteristics and to establish student confidence levels in using key library skills.	II, III	Researcher developed: Self-reported Survey; no validity and reliability
Franks &	Nursing	To establish student characteristics	II, III	Researcher developed: Self-

Author/Year	Journal	Purpose	ACRL Competency Standard Measured	Quantitative Measurement Tool with Validity and Reliability
McAlonan, 2006	Education in Practice	and indicate their level of confidence in using key library skills		reported Questionnaire; Content validity
Gannon-Leary, Walton, Cader, Derbyshire, & Smith, 2006	Library & Information Science Journal	To identify library sources used for a health needs analysis and ease of use in accessing databases.	II	Citation analysis; no validity and reliability
Grant & Brettle, 2006	Health Information & Libraries Journal	To develop and test a web-based tutorial on IL skill attainment.	I, II, III	Researcher developed: Pilot tested, modified skills assessment tool; no validity and reliability
Hersh, Crabtree, Hickman, Sacherak, Rose, & Friedman, 2000	Bulletin of the Medical Library Association	To assess the ability of senior medical students and nurse practitioner students in answering a clinical question by searching a library database correctly and to identify an associated characteristics of the students.	II	Researcher developed: Self-reported Questionnaire; no validity and reliability
Ku, Sheu, & Kuo, 2007	Journal of Nursing Research	To explore the effectiveness of an information literacy intervention in RN/BSN students	I, II, III, IV, V	Researcher developed: Pilot tested, Self-Reported Questionnaire; Content validity
Schutt & Hightower, 2009	Journal of Nursing Education	To assess library instruction on database search techniques in RN/BSN students.	II, III, V	Researcher developed: Self-reported Questionnaire; no validity and reliability
Smith-Strom & Norvedt, 2008	Journal of Nursing	To evaluate the effectiveness in teaching the appraisal of the nursing	I, II, III, V	Researcher developed: Pilot-tested, Self-reported

Author/Year	Journal	Purpose	ACRL Competency Standard Measured	Quantitative Measurement Tool with Validity and Reliability
	Education	literature to nursing students.		Questionnaire; Content validity
Tarrant, Dodgson, & Law, 2007	Nurse Education Today	To evaluate the effectiveness of a course module on information literacy in nursing students.	II, III, V	Researcher developed: Pilot tested, Self-reported Questionnaire; Cronbach's α = 0.97 (Information Literacy Scale) Cronbach's α = 0.95 (Writing Scale) Content validity index = 0.93
Verhey, 1999	Journal of Nursing Education	To describe the development and the evaluation of integrating information literacy into the undergraduate nursing curriculum.	II, III, V	Researcher developed: Pilot tested, Self-reported Questionnaire; Content validity index (CVI) = 1.0 (Faculty); CVI = 0.91 (Librarians); Correlation co-efficient for test-retest reliability = 0.78
Wallace, Shorten, & Crooks, 2000	Nurse Education Today	To determine the extent of student development of information literacy skills and changes in student confidence level in searching for information.	II	Researcher developed: Self-reported Questionnaire; no validity or reliability

Table 1 highlighted important aspects of the studies. Thirteen of the fifteen studies used questionnaires that were researcher developed for the study. Six of the fifteen studies mentioned that the questionnaires were pilot-tested which added substance to the validity of the studies. However, only two studies of the fifteen studies provided a detailed explanation of validity and reliability of the questionnaires. Fourteen studies were self-assessments by the students on attitudes, confidence, and skills in IL. Competency II, accessing the information, was the most frequent ACRL Competency Standard researched by all fifteen studies while Competency IV was minimally assessed in the studies reviewed.

Information Literacy by Competency

The information literacy framework of the five ACRL Competency Standards will guide this review in discussing the literature for the study chronologically. These ACRL Competency Standards identify specific indicators that provide faculty, librarians, and college administrators information on the attainment of IL skills (ALA, 2000). As college students progress through their programs of study, certain competency standards are given more emphasis with the expectation of higher IL achievement with increasing levels of education. Therefore, an assessment of these IL Competency Standards should identify areas of success and of needed improvement by faculty and librarians as students advance toward their intended degrees (ALA, 2000).

Determining Need for Information

The first Competency Standard focused on determining the nature and extent of the information need with costs and benefits of acquiring needed information and re-evaluation of the need (ALA, 2000). A few studies assigned a specific topic to the nursing students for to

determine their need for information and re-evaluating the extent of the information need but may have provided no further information on this first competency (Carlock & Anderson, 2007; Courey, Benson-Soros, Deemer, & Zeller, 2006; Fox, Richter, & White, 1996; Franks & McAlonan, 2006; Grant & Brettle, 2006; Hersh et al., 2000; Schutt & Hightower, 2009; Smith-Strom & Norvedt, 2008). Only three of these studies provided a brief discussion of students and their need for information for class assignments (Carlock & Anderson, 2007; Grant & Brettle, 2006; Smith-Strom & Norvedt, 2008).

Grant and Brettle (2006) provided a tutorial to 21 students to conduct a literature search for nursing, occupational, and physical therapy students working on a doctorate in their discipline. Tutorial sessions consisted of 12 weekly modules on EBP where student learned about information searching, research designs, and critical appraisal of articles. However, only 13 assessments of the students were usable for data analysis. In using pre/post mixed-mode design, Grant and Brettle (2006) found significant differences in the quantitative self-assessment of scores related to assignments ($p = 0.001$). Eleven of the 13 students demonstrated improvement on their IL scores which students attributed to the tutorial session. The self-reported questionnaire that was developed and pilot-tested by the authors previously, explored the views and effectiveness of a tutorial program on information skills of the students. An unpaired t-test comparing those requesting help on a search strategy for the assignment with those who did not seek help supported the hypothesis by Grant and Brettle (2006) that students seeking help had significantly higher assignment scores ($p = 0.034$). Additionally, five of the eleven students thought that their research skills improved remarkably, while four of the eleven students felt their information search skills improved ($p.83$). However, the authors concluded

that the students viewed their skill development on the self-assessment test more negatively on the post-tests than on the pre-tests perhaps due to higher expectations (Grant & Brettle, 2006).

In a prospective cohort quasi-experimental study design, Carlock and Anderson (2007) used a performance assessment to examine competency of 90 nursing students on database searching skills after providing a 30-minute lecture and hands-on instruction using the CINAHL database by a librarian. Additional progressive instruction, provided by librarians, took place throughout the program. Using a rubric for the assessment, two group scores were compared with one group (Group A) receiving the educational interventions (N = 60) and a control group (Group B) not receiving instruction (N= 30). The mean scores on the rubric for Group A increased from 60.6% to 88% while Group B's mean went from 45% to 47% (Carlock & Anderson, 2007). Sixty-three percent of the students in Group A received a perfect score on the rubric while none of the students in Group B received a perfect score. Group B was not required to complete the additional assignments so the authors assumed that this affected the outcome (Carlock & Anderson, 2007). This study demonstrates that progressive instruction of IL skills supports improvement in measuring IL competencies.

Smith-Strom and Nortvedt (2008) provided Norwegian nursing students (N = 48) specific scientific articles with different research designs, and a one-time lecture with an instruction manual to critically appraise an article. The students used the framework that stands for problem, intervention, comparison, and outcome (PICO) for evidence-based practice (EBP) to develop clinical questions from their nursing practice. Seventy-one percent of the students responded to the questionnaire developed by Smith-Strom and Norvedt (2008) with 31% of the students agreeing that knowledge of the research process was relevant to nursing practice. Only 18% of the students indicated that the PICO framework was helpful in guiding the development of

focused answerable questions while 71% of the students felt that learning critical appraisal of the article was effective (Smith-Strom & Nortvedt, 2008). Students indicated that the class helped with searching and finding the best evidence for their case assignments (p.374). This study was limited by a lack of uniform measurement of student IL skills.

Only six out of the 15 studies provided any practical information on the first competency, identifying the need for information (Craig & Corral, 2007; Dee & Stanley, 2005; Gannon-Leary et al., 2006; Ku, Shue, & Kuo, 2007; Wallace, Shorten, & Crookes, 2000; Tarrant, Dodgon, & Law, 2007; Verhey (1999). Many studies did not discuss the costs and the benefits to acquire needed information ~~on~~ to conduct the analysis which is a higher order thinking skill that may be utilized by the graduate or doctoral student (ALA, 2000). No specific framework was used to measure this competency and all of the studies used self-report by the students.

Accessing the Literature

The second Competency Standard is accessing needed information. This competency examines appropriateness of accessing a particular information system to retrieve information, effectiveness of search strategies, retrieval of information, re-defining the search strategies if needed, and information extraction with recording of the information (ALA, 2000). A number of studies (N = 13) utilized a quantitative and/or a mixed-method research design to assess nursing students on this competency. Self-reported questionnaires or surveys were developed and used to measure students' ability to accessing information. Database access and skills were self-assessed by students in nine studies (Courey et al., 2006; Craig & Corral 2007; Fox et al., 1996; Franks & McAlonan, 2006; Grant & Brettle, 2006; Ku et al, 2007.; Tarrant et al., 2007; Verhey, 1999, Wallace et al., 2000).

Confidence, and perceptions and attitudes in self-reported questionnaires were the focus of studies by Fox et al. (1996). This older study by Fox et al. (1996) demonstrated that an educational session on library searching at a university increased students' perceptions of their ability to search databases for a research proposal. Using the Pathways to Information Literacy program, this study based their development of this program on ACRL's Bibliographic Instruction Goals of that time (Fox et al., 1996). The study goals provided for an understanding the role of the library and their services; formulating a research question; locating information, and evaluating the information; applying appropriate search strategies; and practice of scholarly activities (Fox et al., 1996). A librarian worked with nursing faculty to provide four educational sessions early in the nursing curriculum to junior nursing students. Using a 4-point Likert scale on self-confidence and attitudes toward library use, 116 students showed a marked increase (76%) in confidence in using computer databases after completing the Pathways program (Fox et al., 1996). Students completed a survey after graduation on their current scholarly activities in applying information literacy skills (Fox et al.). In a comparison of nursing graduates, prior to the introduction of the Pathways program, the students receiving the pathways program reported higher scholarly activity after graduation at 45% than those who did not receive the Pathways program at 10% (Fox et al., 1996). Lastly, nursing students (N = 68) and college students from other disciplines (N = 208) completed an objective 28-item survey on information literacy skills, developed by the library faculty. Seventy percent of the nursing students correctly answered questions related databases searches on CD-ROMs compared to 49% of the college students from other disciplines (Fox et al., 1996). This study showed that increasing IL skills through a formal program had lasting effects for nursing students.

Over a four-year period between 1992 and 1996, Verhey (1999) examined two different groups of undergraduate nursing students using Chi Square analysis on the level of comfort, the success in using information resources, and the barriers encountered in accessing information. Faculty changed curriculum to include an integrated program of IL. Using accreditation guidelines, the undergraduate nursing program added the ACRL's Information Literacy Objectives for Bibliographic Instruction to the nursing curriculum between 1992 to 1993. The curriculum focused on progressive use of information literacy from an initial instruction on lifelong learning and initial database searching to multiple database searching, critically evaluating the literature, and applying the literature for nursing practice (Verhey, 1999). In the pretest/post-test design, data were collected on information literacy concepts/skills, and confidence in information literacy on unmatched pairs of students from the first group of students in 1992 (N = 142) and a second group of students in 1996 (N = 145). The 17 item self-reported assessment, developed by Verhey (1999), had a content validity index (CVI) of 1.0 as rated by nursing faculty and a CVI of 0.91 by librarians. In a pilot test of 16 students, the correlation co-efficient was 0.72 for test-retest reliability. Over one third of both student groups had English as a second language. Over 70% of the two groups of students were enrolled in a traditional nursing program with the remaining students from the second-degree seeking students in a generic master's program (Verhey, 1999). In examining information resources used, students in the second group tended to use textbooks less than the first group and demonstrated a small difference in the use of journal articles ($p < .05$). Though both student groups used CINAHL and Medline databases, the difference in the type of information resources used was statistically significant ($p < .000$) for the 1996 student group demonstrating increased use of CINAHL and Medline databases as compared with other sources (Verhey, 1999). Comfort and success in using

information resources was increased on using databases for finding books ($p < .000$), journals ($p < .001$), and other materials ($p < .000$). Students in both groups felt that they were successful or very successful in finding information on a particular topic but differences were not statistically significant (Verhey). Despite receiving supplementary education on library use, 90 of the 145 students in the second group felt that they had inadequate knowledge on using information tools for success in IL skills (Verhey, 1999).

Hersh, Crabtree, Hickman, Sacherak, Rose, and Friedman (2000) used a set of short-answer questions designed to prompt a search of MEDLINE in a cross-sectional study in comparing senior medical students ($N = 20$) and nurse practitioners students ($N = 9$) on their IL knowledge on an information retrieval system to correctly answer clinical questions and the associated factors with successful use of the system. Five tests were performed on spatial visualization, logical reasoning, verbal reasoning, associational fluency, and standardized general knowledge tests – the Medical College Admission Test (MCAT) and the Graduate Record Examination or GRE (Hersh et al., 2000). The factors included demographics, computer experience, database searching experience, attitudes towards computer, personality using a Myers-Briggs Type Instrument, database search knowledge, certainty of answer, search mechanics, and use satisfaction. An introductory class and hands-on practice were provided on different occasions on skills using the Medline database for searching the literature (Hersh et al, 2000). On a pre-test before the introductory class and hands-on practice, the nurse practitioner students had lower scores on database searching knowledge. For the post-test after the class, there were comparable benefits with both the medical students ($p = .03$) and the nurse practitioners ($p = .02$) in learning to use the information retrieval system with no significant differences between means of the two groups in correctly answering the clinical questions.

Though not statistically significant, higher verbal reasoning and thinking personality type trended close to a significance level which may indicate improvement in test scores (Hersh et al., 2000, p. 329). The authors concluded that a significant factor associated with successful answering of the clinical questions was literature search experience as well as being a medical student, previous knowledge of the topic, and higher MCATS and GREs.

In an early study, Wallace, Shorten, and Crookes (2000) reported on IL skills and knowledge perception of the nursing students using objective questions after a 14 week intervention. Information literacy content into the curriculum was derived from the 1989 ALA definition of information literacy (Shorten, Wallace, & Crookes, 2001). The development of the questionnaire was not specifically discussed in terms of validity and reliability. In pre/post program design, 78% of the pre- program students (N = 108) completed the questionnaire initially while only 57% of the students (N = 72) filled out the post-program questionnaire (Wallace et al., 2000). A non-program cohort was used for comparison with 72 health and behavioral students which included nursing students. Student scores on the questionnaire were significantly higher post-program in database searching than pre-program scores and non-program scores ($p < 0.001$). Post-program students also performed better on a bibliographic citation skill ($p < 0.001$) than the non-program students thus demonstrating program effectiveness in two IL skill areas related to database access and searching (Wallace et al., 2000). One problem noted by the authors was that matching the program students pre/post reduced the number in the sample (N = 55) because students forgot their self-generated code (Wallace et al., 2000).

Studies that were authored by librarians used the term, information-seeking, for accessing information. In a mixed-mode study, Dee and Stanley (2005) collected data from graduate

nursing students (N = 25) and clinical nurses (N= 25) on demographics, current use of health care information resources, and frequency of using these information resources. This study used an actual observation of database searching skills by a librarian as its main source for data collection, with an additional survey on perceived database searching skills by each of the participants in the study. Actual observation is a very time-consuming process. Some form of electronic database and Internet was accessed by 96% of the nursing students for health information (Dee & Stanley, 2005). Twenty-five percent of the graduate students reported that they used their personal digital assistant (PDA) daily while 33% of clinical nurses reported using an Internet search engine daily. Only 4% of the nurses used CINAHL at work daily. Insufficient time was an issue cited frequently by 76% of the clinical nurses for not searching databases or stopping to complete a search at work. A large percentage of clinical nurses lacked computer skills (84%) and database searching training (76%) while fewer nursing students indicated a lack of database searching training (20%) as a hindrance for database searching. Dee and Stanley (2005) found that Google and Yahoo were favorite search engines of students because easy access to familiar databases was preferred over nursing and medical electronic databases (Dee & Stanley, 2005).

In an associate degree program, Courey et al. (2006) offered a one-day lecture to one group of nursing students. The objectives of the program were on the relationship of EBP with IL, the introduction of nursing information resources in the library, the experience in using a nursing database, the evaluation of information found, and the value of the nursing literature. Students had clinical assignments (N = 19; Control N = 39) throughout the first semester in the program, which required IL skills. Faculty developed a 22-item questionnaire that used a 4-point Likert scale to evaluate student perceptions and attitudes on program effectiveness. Principal

components analysis demonstrated two dimensions on the scale: access to information and attitude about information (Courey et al., 2006). Cronbach's alpha ranged from 0.798 to 0.886 for the scales (Courey et al., 2006). Mean scores showed a significant increase on access ($p = .000$) between the first semester and the last semester for both groups (Courey et al., 2006). Interestingly, attitude decreased significantly ($p = .003$) on the need to stay current with the literature in both groups which is a requirement for life-long learning.

Confidence in self-reported IL skills was measured by Franks and McAlonan (2006). The authors developed a quantitative questionnaire to identify student characteristics and to assess the level of confidence in key library skills but not their actual IL skill level. Training on key library skills was required by all beginning nursing students ($N = 43$). Key library skills identified were the effective use of academic sources and the ability to understand the structure of the library sources (Franks & McAlonan, 2006). Though the tool lacked detailed evidence of validity or reliability, both researchers and educators at the university reviewed the survey for concurrency with program objectives. Fifty-four percent had not received library training in the last two years with 49% of the students indicated that they prefer to use textbooks for library resources (Franks & McAlonan, 2006). Sixty eight percent of the 43 students expressed high confidence in using key library skills while 30% of the students were less confident in the range of library skills needed to practice in an electronic environment of the library (Franks & McAlonan, 2006). Grant and Brettle (2006) like Franks and McAlonan (2006) found that students had increased confidence in IL skills but the students overestimated their IL skills and their competence in using IL was low.

In a mixed-mode design, Gannon-Leary et al (2006) examined the information seeking behavior in 40 nursing honors students in adult health for a health needs analysis assignment.

Reference lists of the students were collected by the librarians to review each list quantitatively using citation analysis method. Citation analysis is an area of bibliometrics in information and library science that examines the frequencies and distribution of citations in article and books (Rubin, 2004). The mean number of references by assignment used by the students was 16 references. Duplicate sources published within five years of the assignment (2000 to 2003) were used by 56% of the students while 15% of the students used sources from 2004 (Gannon-Leary et al., 2006). Journal use as sources was higher (37%) than textbooks (27%). One problem noted by the authors was a lack of clarification on whether students used paper-based information or electronic information. The authors noted that students used trustworthy websites as sources. In database searching, students failed to broaden their search and used limited terms for database searching (Gannon-Leary et al., 2006). In the qualitative portion of the Gannon Leary et al. study, eight self-selecting students participated in a recorded, focus group interview with questions on how they found the assignment to be, which elements were easy to complete, what information was hard to find, and what support was received in information seeking (2006). Computer access and Internet access at home were other issues that students mentioned as problems (Gannon-Leary et al., 2006). The citation analysis offered an in-depth picture on students search and use of citations for their class projects. This study highlighted the importance of giving specific directions to students on the requirements of a assignment and offering guidance throughout the assignment because students may not know what support they need.

Craig and Correl (2007) found inconsistent results between skills and confidence in nursing students' IL. Nursing students in pre-licensure program in England were taught IL skills during three sessions in their first semester with subsequent embedding of support content on IL across the three year program. The IL competencies in England, named the pillars of IL by the

Society of College, National and University Libraries (2011), are similar to the five ACRL competencies. Currently, there are now seven pillars of IL not five pillars as identified in Craig and Corral's study: manage, evaluate, present, gather, identify, plan, and scope. Initially, 70 students took the pre-test but only 29 of those students completed the post-test. Students had diverse educational backgrounds and age levels. Seventeen students were age 31 or older (Craig & Corral, 2007). Confidence in IL skills increased from 76% pre-test to 97% on the post-test. Student confidence levels were high in their library skills level pretest but not on the post-test. Those who were 31 years or older rated their skills much lower post-test (Craig & Corral, 2007). The authors provided no evidence on reliability of the quantitative tool.

Using a focused interview in the same study by Craig and Corral (2007) five students provided validity to their questionnaire. The nursing students identified previous information technology use, library use, and Internet use as providing confidence in IL skills. Classes on IL skills and support mechanism through handouts and librarian assistance were positive in building confidence (Craig & Corral, 2007). In asking others for help, the students used this strategy to counteract low confidence. Insufficient practice time to apply skills was viewed negatively by the students (Craig & Corral, 2007). This focus group supplied evidence that prior use of information technology, the Internet, and knowing how to use the library provided students with additional support in learning new skills.

A questionnaire was used by Tarrant et al. (2008) to examine students' perceptions of IL skills and their writing skills. During an information management course to improve IL skills, Tarrant et al. educated RN/BSN students (N = 194) on reviewing literature, writing academically, formatting with the American Psychological Association style (APA), learning library skills, and critically appraising the literature for EBP with re-enforcement throughout the

two year program. Using a pre-test and post-test design, self-reported questionnaires completed by students assessed perceptions of their IL competencies and academic writing competencies at three times during the program of study – before the class, after the class, and at the end of the program. The information literacy scale (Cronbach's $\alpha = 0.97$) and the academic writing scales (Cronbach's $\alpha = 0.95$) were developed by the authors (Tarrant et al.). Content validity index was 0.93 for both scales and was confirmed by two experts in education and information literacy (Tarrant et al.). Ten of the fourteen questions on the information literacy scale related to accessing information. The academic writing scale with six questions focused on the writing process, content, plagiarism, and formatting. Though 159 students participated in the three evaluation times, one problem noted by the authors was the difficulty in matching the two previous test assessments with the final post-test assessments utilizing the procedure established by the authors to ensure anonymity of the students (Tarrant et al., 2008). The final sample consisted of 114 post-tests with matching to the two previous tests. Twenty-seven percent of the students had prior experience using accessing and using electronic databases while 42% indicated experience reading professional journals. Differences found were significant ($p < 0.001$) on the information literacy pre-test ($M = 2.68$) from the post-test ($M = 6.79$) on the total score in the 114 students (Tarrant et al., 2008). This study was one of the two studies to provide validity and reliability on the measurement scale.

Schutt and Hightower (2009) used a self-reported survey on the database search processes on with 22 RN/BSN students who were educated during an initial IL orientation class and in a five-hour computer training class on the first day of class. A simple count of correct responses measured the success on student assignments. The librarian developed an additional course tutorial via a web course to instruct how to do a search in CINAHL Plus Full Text. The

tutorial demonstrated the database search using a specific clinical scenario with three specific assignments for the students to complete. Only 13 students selected the appropriate database, ERIC, for the topic. The second assignment had students search a database using Academic Search Premier, which is a multi-disciplinary database (Schutt & Hightower). Although 21 students found two articles on the appropriate topic for both a patient and a health care professional, eleven of the students chose magazine or newspaper articles as opposed to journal articles. Students had to submit the articles using APA format where the authors described this proficiency as being poor (Schutt & Hightower). For the third database search assignment, instructions on the specified topic were for students to search multiple databases from the previous tutorial and the two assignments, and to provide peer-reviewed articles. The expectation was that various database search methods and strategies to be used for this assignment. The librarian commented that additional instructions and recommendations did not provide additional assistance for database searching. Only six of the 22 students completed the database search correctly. Note that the Library Database Survey with a five point Likert-type scale indicated that a total of 65% of the students agreed or strongly agreed that they developed an understanding how to do a database search (Schutt & Hightower, 2009). Eighty percent of the students either agree or strongly agreed that a live meeting with the librarian was helpful in the database searching. Eighty-five percent agreed or strongly agreed that learning to use the database with the assignments was a positive learning experience (Schutt & Hightower, 2009). Schutt and Hightower found that students had problems with search strategies such as using keyword searches from Internet search engines, applying limits to search terms, and in subject heading selections (2009). This study demonstrated the limits of self-reported skill abilities as compared to objective competency measurement.

As stated previously, the majority of the studies in IL focused on accessing the information. Surveys and self-reported questionnaires focused on affective measures of perception, confidence, and attitudes as the primary means of assessing this second ACRL Competency Standard. Authors found that students reverted back to familiar topics, search strategies, and easy to use search engines (Dee & Stanley, 2005). For Carlock and Anderson (2007), all students showed recidivism in reverting to key word searches on the Internet as well. Though IL skills were assessed objectively, many self-reported objective instruments were newly developed without using a standardized test, without reporting the validity or the reliability, and without linkage to the second ACRL Competency Standard, accessing the literature.

Evaluating the Literature

The third Competency Standard is the evaluation of the information found with the extraction of information, the synthesis in constructing new ideas, the comparison of old knowledge with new knowledge found, the impact of the new knowledge, the initiation of discourse with faculty and subject area expert, and the revision of the original query if necessary (ALA, 2000). Wallace et al. (2000) had Australian nursing students write a summary statement using support from the articles with bibliographic citations where faculty and students evaluated the articles critically. Evaluating the literature was not appraised objectively in this study. Anecdotal comments by faculty not familiar with the IL program indicated that IL skills learned persisted in the remainder of the nursing program (Wallace et al., 2000). In the qualitative portion of the Gannon-Leary et al. (2006) study, students identified that they had problems synthesizing and applying information for critical analysis of the assignment with students opting for a topic where they had some prior knowledge.

Ku et al. (2007) provided students with the opportunity to appraise literature found for their projects using an integrated IL curriculum within a nursing course. A quasi-experimental design provided for IL assessment in two unmatched groups of students, those with IL education and those without IL education. Using a convenience sample, the experimental group (n=32) consisted of RN/BSN students enrolled in a women's health course with integrated IL content. The control group (N = 43) was RN/BSN students enrolled in a Marriage and Family course with IL instruction (Ku et al., 2007). Tests were conducted prior to the classes and after the semester. The IL curriculum focused on the measurement of the first four ACRL competencies: identifying the information, accessing the needed information, evaluating the information found, and applying the information. Presenting information was an additional skills activity that measured using 18 Microsoft (MS) Word techniques, 18 MS Excel techniques, and 18 MS PowerPoint techniques correctly (Ku et al, 2007). The self-evaluation scale on IL, developed by the authors, used a 10-point Likert scale. A non-specified number of educational experts from the university validated the test through discussion. Demographically the students in both groups were comparable with no differences found on age, job title, work experience, and work unit using a Chi-square analysis (Ku et al., 2007). In the pre-test, there were no statistical differences found in the two groups using ANCOVA with IL as the co-variable. Using 2 x 2 Factorial ANOVA, improvements in IL were significantly improved for the experimental group on searching and screening ($p = 0.000$), integrating information ($p = 0.003$), analyzing information ($p = 0.02$), and applying information ($p = 0.005$) from pre-test to post-test (Ku et al., 2007).

In their study, Tarrant et al. (2008) found that overall confidence in knowledge scores were increased significantly ($p < .001$) in a post-test to nursing students on three of the six questions of an academic writing scale that was given at the end of two years. This self-

assessment of academic writing scale had questions on the outline of the paper, on the writing process, and on general academic writing skills. Tarrant et al. (2008) noted a decreasing trend on the academic writing scale as the age of the student increased.

For this third competency, Smith-Strom and Nortvedt (2008) used a group examination to appraise critically a scientific article. The small number of studies found on this third ACRL Competency Standard, evaluating the literature, indicated that there was limited exploration into this competency, and there is inadequate knowledge on this skill in the nursing students.

Applying the Literature

The fourth Competency Standard, a higher order skill, requires the application of the new information to produce a product or service, the revision of the product or service as needed, and the dissemination of the product or service effectively to others. None of the studies provided an objective evaluation applying the literature (ALA, 2000). The difficulty of using an objective evaluation for this competency limited evaluation to a writing a paper or a review for an assignment. In an early study on IL, Wallace et al. (2000) had Australian nursing students write a final assignment of an essay for future use as a literature review. Whereas Gannon-Leary et al. (2006) found students had difficulty in applying the literature found beyond the initial subject matter such as teenage pregnancy with public health. Using quasi-experimental design, Ku et al. (2007) required RN to BSN students in Hong Kong to identify a patient health topic and to identify interventions on the health topic to support their topic with a class presentation. The remaining studies (N =11) provided no apparent objective evaluation of this competency on applying the literature. The lack of studies with this competency demonstrated that objective measurement may be limited possibly due to time constraints and a lack of suitable assessments.

Understanding the Ethical, Socio-Economic, and Legal Issues in Using Information

The fifth Competency Standard requires the understanding of ethical, socio-economic, and legal issues in using information and technology with the demonstration of laws, regulations, policies, and etiquette in using and accessing information resources, and the acknowledgement of resources in communicating the product (ALA, 2000). Ku et al. (2007) discussed only the ability of students to publish in a women's health journal as an activity that was evaluated. Confidence was increased in Tarrant et al.'s (2007) study on two of the six questions from pre-test (M= 2.99) to post-test (M = 7.39) on the academic writing scale ($p < 0.001$). These two questions focused on formatting a paper using American Psychological Association Style of Format (APA) which is a set of rules for scholarly writing (American Psychological Association, 2010) and plagiarism (Tarrant et al., 2007). In another study, the students were required to document information resources using APA (Schutt & Hightower, 2009). The APA proficiency was noted to be extremely low (Schutt & Hightower). The remaining studies did not provide sufficient information to evaluate this competency standard (Carlock & Anderson 2007; Courey et al., 2006; Craig & Corral, 2007; Dee & Stanley, 2005; Fox et al., 1996; Franks & McAlonan, 2006; Gannon-Leary et al., 2006; Grant & Brett, 2006; Hersh et al., 2000; Smith-Strom & Nortvedt, 2008; Verhey, 1999; Wallace et al., 2000). Although only three studies examined this competency on issues in using information, the studies demonstrated students' ability to improve IL skills with education and practice in the issues on using IL.

Summary of the Literature in Nursing Education

Definitions of IL by the ALA were mentioned in a few studies. Conversely, the IL Competency Standards as developed by the ACRL were not discussed many of the studies. Of

note is that other countries such as the United Kingdom and Australia developed similar competencies to the ACRL but these competencies were not identified specifically as a framework in the international studies, either. Studies measuring the first Competency Standard, initiating the need for information, had researchers of the studies assigning the students articles or topics that they were to use for their studies. The researchers may have chosen a way of standardizing this first competency to ease its evaluation. The second Competency Standard, accessing the information, was the focus of many of the studies presented in this review of the literature. These findings indicated that students showed improvement on this competency with guidance and instruction on library and information databases. The self-reported assessments for the second competency were developed mainly for the studies that consisted of attitudes, confidence, and comfort in using IL skills.

The remaining three Competency Standards were addressed to varying degrees in the literature. The third competency, evaluating the information, provided substantial information. A few of the studies had students evaluate the information by critically appraising the information found. The fourth competency, applying the information, was difficult to measure objectively and not addressed in the studies since this competency is a contextual product, a project, or a service. To study a product or service implementation and dissemination would require a longitudinal project with grant support. Implementing and disseminating a product or service may be considered a higher order skill appropriate in the last semester of baccalaureate program or in the graduate program (ALA, 2000). The fifth competency, understanding ethical, socio-and economic, and legal issues in using information, was documented in three of the studies but was clearly not mentioned in 12 of the articles.

Although the studies included in this review of the literature noted that students had high confidence in using IL, high perceptions of IL, and improvement in attitude of IL, none of the studies provided an actual objective measurement of IL skills despite the fact that three standardized tools exist to measure these skills. Additionally, since no specific theories, competencies, or frameworks were used to guide the studies other than knowledge or skills mentioned in the literature reviews, this may have led to research studies that do not build on a broader understanding in using IL.

The validity and reliability of the assessment instruments were discussed minimally in only five of the studies. Convenience samples were used in all studies that limited the generalization to the nursing student population being studied. No power analyses were mentioned to address adequacy of sample size for any of the studies. The three studies that used a mixed-mode design provided additional context to the discussion in the studies and helped to provide validation for the quantitative study results. There was a lack of qualitative studies investigating nursing students and IL found in the literature search. Qualitative studies on faculty and students would assist to clarify some issues that students have in using and in developing IL skills toward their progression of IL higher order skills through the program. Only one qualitative study by Nayda and Rankin (2009) discussed that students and faculty do not have a complete understanding of IL. Faculty identified general literacy as IL. General literacy is the ability to read and comprehend documents and perform computation (National Institute for Literacy, 2008). Links between IL and life-long learning were not established after having a class on IL. Students relied on peers for help in finding information and did not link the use of scholarly journals to their professional development (Nayda & Rankin, 2009). From reading the research literature for this review, many college faculty and students were not aware of the

definition of information literacy or that the concept of information literacy existed even after being introduced to the concept of IL.

Use of a consistent definition and identification of the specific concepts such as in the ALA definition or a similar definition from other countries would assist with documentation of IL competencies in studies. Planned research designs, appropriate sample sizes with a priori power analysis, and accurate descriptions of assessment instruments (or the actual instrument) with good validity and reliability would provide strength to the research in this area and allow for replication of research projects. With the focus of libraries changing from paper-based to e-based over the last 15 years, the opportunity to evaluate students on information literacy is a challenging undertaking. Students may not use academic libraries for a variety of reasons. Barriers to IL that have been identified in nursing students ranged from simply having no library card to access the university library, physically or electronically, efficient and effective searching for information , and/or problems accessing a familiar database for an assignment (Dee & Stanley, 2005; Honey, North & Gunn, 2006).

Upon review of the research for evidence-based practice and information literacy in registered nurses, Gerrish, Ashworth, Lacey, and Bailey (2008) found that new nurses continued to rely on information from their nursing educational programs and colleagues for their practice, and had not sought updated information from organizational sources, research publications, and/or from the Internet to change nursing practice. These findings indicate that student nurses need both the education and the time to practice IL in nursing programs to develop proficiency in IL skills for EBP (Skiba, 2005; Feldman, 2006; Richard, 2008). The studies on IL and on EBP point to not one factor influencing IL but a number of factors as being pivotal to IL in nurses and education.

Research Literature on the ILT in Information and Library Science

In reviewing the literature by information and library science professionals, the studies indicated that use of models and objectives of IL assessment were early in their development. A number of factors were identified by investigators through self-reported perceptions and satisfaction surveys of students as affecting information literacy. Educational experience of students was reported as being one of the key determinants for being competent in IL (Whitmere, 2001; Kingry, 2002). Specifically, race, gender, standardized admission tests (ACT), being part-time students, income level, and working while going to school were found to affect library usage and IL skills (Grimes & Charter, 2000; Long, 2011; Warren, 2006; Whitmere, 2001, 2003). Skills were measured objectively using an earlier version of the ICT Literacy Assessment Core Level Test by Educational Testing Service where Foster (2006) noted that only 13 percent of the 3800 college students taking this test were information literate with four-year college students outperforming community college students. Additionally, O'Brien and Symons (2007) found that a student's source of information had an effect on library usage. With the exception of the Foster's study (2006), none of these studies provided an objective measurement of IL skills.

Two articles were found using a promising tool developed by the Center for Assessment and Research Studies at James Madison University, the standardized, objective Information Literacy Test (Madison Assessment LLC, 2012). In 2007, Gross and Latham's study of incoming college freshman (N = 51) at a four year university found a mean score 39.25 on the Information Literacy Test (ILT). The upper quartile freshman had a mean score of 42.15 while lower quartile freshman had a mean score of 33.94 indicating low IL proficiency. A t-test indicated that there was a significant difference between the skill levels of the freshman in the two quartiles

indicating that the instrument can discriminate levels of IL ,(p < 0.000). Forty-five percent of the students were found to be non-proficient in IL.

More recently, Gross and Latham (2009) examined perceptions of information literacy in 20 college freshmen at a Florida university. The Information Literacy Test determined quantitatively their level of IL skills while a structured interview took place with each of the students. Eighteen of the 20 students were proficient defined as receiving a score of 39 or higher with one student being non-proficient (scores below 39) and one student achieving advanced proficient (scores above 54 or higher) level of competence (Gross & Latham, 2009). From the interviews of the incoming freshman, information seeking was primarily self-taught without formal IL training by many of the students. Students tended to focus on the outcome of an assignment rather than attainment of knowledge and skills taught (Gross & Latham, 2009). Many IL Competency Standards were not performed by the students when they were working on assignments. For example, the quality of the references was ignored by students since students chose to use an easy source for a reference or the first resource found, and not search to find quality references for their assignments. If students were not required to provide higher quality resources for a higher grade, lower quality resources such as newspapers or magazine, were used for references by students in assignments and in projects (Gross & Latham, 2009). Note that the reliability was not discussed on the ILT in either of the these studies.

Further studies using standardized assessments such as ILT will help to promote the existence of standardized tests and to provide a baseline for colleges, and universities to plan and to evaluate IL activities on incoming and exiting students. Validity and reliability demonstrated in these information and library science studies help to strengthen the discipline by using a standardized IL assessment for evaluating college students and for promoting information and

library science research. The articles on perception and satisfaction inferred that a number of demographic and educational factors appeared to affect IL skills. The use of a standardized assessment that identifies influencing factors of IL would provide information to assist in developing and in improving IL programs for future college students.

Framework for the Study

The framework used to guide this research was the five IL Competency Standards developed by the Association on Colleges and Research Libraries in 2000 and approved by the American Library Association. These five competencies were developed using the American Library Association's concept of IL from 1989. Based on these requirements for college and university students in higher education, the American Association of Colleges of Nursing included information literacy as an expectation of entering students in the *Essentials for Baccalaureate Education for Professional Nursing Practice* document in 2008.

The five ACRL Competency Standards are:

1. "Need - The information literate student determines the nature and extent of the information needed (CS1).
2. Access - The information literate student accesses needed information effectively and efficiently (CS2).
3. Evaluate - The information literate student evaluates information and its sources critically and incorporates selected information into his or her knowledge base and value system (CS3).
4. Use - The information literate student, individually or as a member of a group, uses information effectively to accomplish a specific purpose (CS4).

5. Understand - The information literate student understands many of the economic, legal, and social issues surrounding the use of information and accesses and uses information ethically and legally (CS5)” (ALA, 2000, pp. 8-14).

Each of these five competencies has associated performance indicators with outcomes.

For Competency Standard 1 (CS1), there are four performance indicators which are: “1) defining and articulating the need for information; 2) identifying different types and formats of potential sources for information; 3) considering the costs and the benefits of acquiring new information; and 4) reevaluating the nature and the extent of the information required” (ALA, 2000, pp. 8-9). In other words, nursing students should be able to know when they need information for an assignment, have knowledge on the different types of formats for sources such as peer-reviewed articles, government websites, and nursing organization websites, what does it cost to obtain this information such as using a free library to them verses a website to buy an article, and evaluate what specific information they need to complete an assignment.

For Competency Standard 2 (CS2), there are five performance indicators which are: “1) selecting and appropriate method to find information or the database to retrieve the needed information, to know how databases are organized, and to select efficient and effective approaches to acquire the needed information; 2) developing and using effective search strategies in databases such keywords, synonyms, discipline specific controlled vocabulary, commands in the database, various search engines and procedures for researching; 3) retrieving the information online or other methods; 4) reefing search strategies as needed; and 5) recording and managing the information appropriately” (ALA, 2000, pp. 9-11). For this particular competency which has an information seeking component, not only do nursing students need to understand

the mechanics of finding information in a library or online but they also need to learn the language specific to nursing in order to find information for their assignments.

For Competency Standard 3 (CS3), there are seven performance indicators. These performance indicators include: “ 1) summarizing major themes from the information; 2) defining and using initial evaluation criteria to the information; 3) synthesizing these themes to define new views; 4) comparing old and new ideas of the information for value; 5) defining and reconciling the impact of the new knowledge on the individual; 6) discussing the information with knowledge experts and others for cross-validation; and 7) evaluating the need to revise initial search” (ALA, 2000, pp. 11-13). For this competency standard, nursing students have to be able actually acquire an article or the information, evaluate does this information fulfill the information needed for a nursing class assignment through discussion with the nursing faculty, and then the students need to re-evaluate if they need to find different information for the assignment.

For Competency Standard 4 (CS4), this performance indicator has three indicators. The performance indicators are: “1) applying old and new information to produce a new product; 2) revising the new product as needed; and 3) publicizing the new product” (ALA, 2000, p.13). For this competency, the nursing student develops a coherent, logical assignment based on the information found.

For Competency Standard 5 (CS5), the three performance indicators are: 1) understanding how ethical, legal, and socio-economic issues impact the use of information and technology; 2) complying with the laws, regulations, and policies affecting the access and use of information; and 3) knowing the appropriate procedures for documenting the information. For this competency standard, the nursing students understands and complies with regulations in

using an article or information from the library or the Internet in terms of copyright for copying information and the documentation style for nursing (ALA, 2000, p. 14).

CHAPTER THREE: METHODOLOGY

Though information literacy (IL) is an assumed skill on entrance into a baccalaureate nursing program by the American Association of Colleges of Nursing (2010), no articles in the nursing literature describe the results of an objective measurement of IL skills/competencies in baccalaureate nursing students. Therefore, the research design for this study was a descriptive, correlational design to assess the IL skills of nursing students admitted to a traditional baccalaureate degree program at a major metropolitan university. Prior to entering the nursing program, the students must complete two years of pre-nursing coursework that includes liberal arts courses and eight prerequisite courses.

This study utilized a standardized test from Madison Assessment LLC (Russell, 2009), the Information Literacy Test (ILT) to assess IL competencies in traditional nursing students. The ILT has reported validity and reliability that is based on the Association of Colleges and Research Libraries' (ACRL) five IL competencies (American Library Association [ALA], 2000). These five competencies include: (a) to identify when information is needed (CS1); (b) to access the needed information (CS2); (c) to evaluate the information found (CS3); (d) to apply the information to accomplish a specific purpose (CS4); and (e) to understand the economic, legal and social issues in using information in any context (CS5) (ALA, 2000).

The research questions were:

1. What are the information literacy (IL) competency levels of students entering their junior year in a traditional baccalaureate nursing program?
2. Are demographic and educational factors predictive of information literacy skills in students entering their junior year in a traditional baccalaureate nursing program?

Setting

The setting for this study was a college of nursing that admits 190 matriculated students each year in the traditional baccalaureate nursing program on three campuses. The main campus admits 120 students in the fall semester while the two regional campuses admit 35 students on each campus in the spring semester. All campuses use the same admission criteria to the college of nursing.

The program admits students after they complete two years of pre-nursing coursework that is achieved in a number of discrete pathways. Applicants for admission to the program come from many different feeder schools that include high school, community college, and with college degrees in other disciplines. The pre-nursing curriculum for admission into the traditional nursing program requires the completion of two years of general education courses and eight prerequisites with a minimum cumulative grade point average (GPA) of 3.0. The two-year associate of arts degree (AA) from a community college satisfies the general education requirement. In Florida, high school students may have advanced placement credit (AP), dual enrollment in a college and/or receive an AA degree at graduation from high school. Table 3 contains a list of the general education courses and nursing prerequisites with the required credit hours. Additionally, the applicant must achieve a current minimum score of 78 on a standardized nursing admission test, the Test of Essential Academic Skills (TEAS) by Assessment Technologies Institute, LLC (2012). The TEAS is a general, computerized test of academic knowledge that assesses knowledge on reading, mathematics, science, and English and language usage to predict success in a nursing program (Assessment Technologies Institute, LLC [ATI], 2013). English and language usage has questions on grammar, sentence structure, punctuation, spelling and contextual with some questions on simple, compound, and complex sentences. Test

questions in science and math require calculation, interpretation, application, and reading a table, graphs, and charts. Reading tests comprehension with some skills on rendering interpretations and on drawing conclusions to make inferences plus interpret graphic information. The TEAS can be described as an entry test of a nursing applicant's ability to make reasoned choices from comprehensive knowledge that is based on four academic subjects through critical thinking skills (ATI).

One additional requirement is foreign language that may be met by two years of a foreign language in high school, two semesters of college credit, or a prior bachelor's degree. The general education and prerequisite requirements are consistent with the liberal arts education identified in the *Essentials* document by the American Association of Colleges of Nursing (2010) for accreditation of the nursing program. This preparation is one strategy for developing information literacy in nursing students.

Table 2. General Education Courses and Prerequisite Courses for Admission to the Traditional Baccalaureate Nursing Program

General Education Courses	Total Credit Hours
Communication Foundations: English and Speech	9
Cultural and Historical Foundations: Humanities, History, Religion, Theater, or Philosophy	9
Mathematical Foundations: College Algebra or Finite Math; Statistics or Computer Science	6
Social Foundations: Economics, Psychology, Sociology, Political Science, or Anthropology	6
Science Foundations: Astronomy, Biology, Chemistry, Physics, Geology, Physical Science, Genetics	6
Total for General Education	36 credits
<hr/>	
Prerequisite Courses for Nursing	
Anatomy with lab	4
Physiology with lab	4
Microbiology with lab ^a	4
Fourth approved physical or life science ^b	3
Psychology ^c	3
Developmental Psychology	3
Statistics ^d	3
Human Nutrition	3
Total for Prerequisite Courses	27 credits

Note: University of Central Florida. (2012, May). *Nursing BSN*. 2012-2013 Undergraduate Catalog , 45(1), 268- 270. ^{a, b, c, d} Meets general education requirements.

Operational Definitions

Information Literacy Test

The Information Literacy Test (ILT) was used to assess information literacy competencies. The ILT was developed at James Madison University (JMU) through the Center for Assessment and Research Studies in 2009 (Madison Assessment LLC, 2012). This Center has as one of its goals to increase rigor in assessing students in higher education (Madison

Assessment LLC, 2012). The development of the ILT and the associated skills were guided by the five ACRL Competency Standards. The test was designed for students enrolled at a community college or a four-year university. The original test consists of 65 multiple-choice items – 60 items in final form and 5 items for pilot testing. Currently, no items are being pilot-tested. The test time is 75 minutes and the Information Literacy Test is given as a computerized test. The instrument has been used by 40 educational institutions globally (Russell, 2009). Actual test questions were not available for review but an item mapping was provided for the total scale and subscales. A copy of the receipt from the testing service will be provided (see Appendix C). The testing center provided a spreadsheet with the test scores and question responses for each of the individual students participating in the study.

Instrument Description

The ILT test items conform to the four of the five ACRL Competency Standards for Higher Education (Russell, 2009). The specific skillsets assessed by the ILT include the following: developing a research strategy, selecting and finding tools, searching, retrieving resources, evaluating resources, documenting resources, and understanding economic, legal, and social issues. Only four of the five competency standards are tested since one standard, Competency Standard 4 (CS4), is not compatible with a multiple-choice format (Russell, 2009). Table 3 provides an aligned list of the five ACRL Competency Standards with the ILT. Competency Standard 4 is to apply the information to accomplish a specific purpose, which requires the student to produce a project or service (ACRL, 2000; Russell, 2009).

Table 3. Association of Colleges and Research Libraries Competency Standards Aligned with the Information Literacy Test Subcales

Association of Colleges and Research Library (ACRL) Competency Standards	Information Literacy Test Subscales
Competency 1 - Identify when information is needed (CS1)	Defines and articulates the nature and extent of information needed
Competency 2 - Access the needed information (CS2)	Accesses needed information efficiently and effectively
Competency 3 - Evaluate the information found (CS3)	Evaluates information and its sources critically and incorporates selected information into his or her knowledge base and values
Competency 5 - Understand the economic, legal and social issues in using information in any context (CS5)	Understands many of the ethical, legal, and socio-economic issues surrounding information and information technology

Note: American Library Association. (2000, January 18). *Information literacy competency standards for higher education*. Russell, J. (2009, Revised December). *Information literacy test*.

Validity and Reliability

The internal consistency was 0.88 for the total scale when the 60 item test was initially given to 683 mid-sophomore students at James Madison University (Cameron, Wise, & Lottridge, 2007) which is also reported in the online test booklet from Madison Assessment LLC (Russell, 2009). The test booklet describing the ILT was developed by the Center for Assessment and Research Studies in 2009). Internal consistency was 0.84 from each group of students from a combined aggregate of four, four year colleges (N = 683) and a combined aggregate of five, two year colleges (N = 839). Content validity was established with three university librarians on 42 of 60 items (70% by three librarians) and 59 items (98% by two librarians) with the ACRL Competency Standards. Inter-rater agreement was 70% on 42 items from all three librarians

while two of the three librarians agreed on 59 items or 98% of the items (Cameron, Wise, & Lottridge, 2007).

Construct validity was provided in the test booklet from Madison Assessment, LLC (Russell, 2009). The construct validity initially established with the entire scale of an Information Seeking Skills Test (N = 295) taken by James Madison University (JMU) sophomore students ($r = 0.45$; $p < 0.001$; $r^2 = .203$). Three other studies were used to establish construct validity. The ILT was administered to freshman and sophomore 121 psychology students and checked for correlation with an eight item survey on information literacy activities. Sophomores at JMU were significantly higher on the ILT than the freshman ($t(119) = 2.06$, $p = .041$). Additionally, a significant correlation as found between the ILT and GPA ($r(119) = .20$, $p = .032$). On a third study between freshman and sophomores at JMU, the means of the two groups were found to be significantly different ($t(944) = 8.43$, $p < .001$). Means for 442 incoming freshman were lower ($M = 37.13$, $SD = 7.70$) while the means for the 524 sophomores ($M = 41.61$, $SD = 8.45$) were higher considering this group had instructional modules on IL. For the fourth study, the means of 423 students from JMU were compared with 683 freshman from four, four year institutions. The two groups of students were found to be significantly different ($t(1103) = 2.11$, $p = .0035$). An additional study found differences between 839 freshman from five, two year institution and the same 422 freshman at JMU ($t(1259) = 2.90$, $p = .0037$). The Center for Assessment and Research Studies (Russell, 2009) at JMU established that the ILT is sensitive in identifying differences among students and are interested to see if other difference re observed at different institutions.

Scores for the ILT and another standardized IL assessment, the SAILS test, demonstrated a correlation of 0.72 when adjusted for the disattenuation of the correlation between the two tests

(Project SAILS, 2012). Table 4 has specific information on number of items in each of the competency subscales with the internal consistencies and means of the total test and subscales of the ILT.

Table 4. Item Subscales with Number of Testing Items with Internal Consistency and Mean of the Information Literacy Test

ACRL Subscale Content Areas with Test Item Number	Internal Consistency (Mean)		
		(N = 4)	(N = 5)
	James Madison University α (M)	Four Year Institutions α (M)	Two Year Institutions α (M)
Competency Standard 1 (12)	0.65 (9.70)	0.54 (8.47)	0.58 (8.47)
Competency Standard 2 (19)	0.64 (11.16)	0.54 (8.67)	0.53 (8.28)
Competency Standard 3 (19)	0.76 (13.52)	0.69 (12.15)	0.70 (12.14)
Competency Standard 5 (10)	0.48 (7.18)	0.53 (6.44)	0.50 (6.45)
Total Score (60)	0.88 (41.61)	0.84 (36.12)	0.84 (35.77)

Note. Russell, J. (2009). *Information Literacy Test*. ^aN = 524. ^bN = 683. ^cN = 839.

Performance Levels and Proficiencies

Although specific scores are available on the total scale and four subscales, the developers of the ILT identified performance levels were set according to the “abbreviated Bookmark standard setting methods “ (Russell, 2009, p. 10) where college librarians and faculty determined the proficiency levels with a corresponding test score. These performance levels were developed in 2004 at a workshop that was attended by 10 experts in the library science discipline from various universities and community colleges in Virginia and an additional representative from assessment and measurement from James Madison University.

Students receive a total individual score based on the number of correct responses to 65 questions and a proficiency level based on 0% to 100%. Students who receive a 65% (39/65 questions) are designated *Proficient*. Students who receive a 90% (54/65 questions) are designated *Advanced*. If students receive less than 65% (< 39/65 questions), they are rated as *Below Proficient* (Madison Assessment LLC, 2012a). Subscale scores for each individual student are also available to help identify the content area where a student may need remediation.

Demographic Data

The demographic characteristics of the individual students were independent variables that were collected using a Demographics Questionnaire created by the researcher (See Appendix B). The demographic data included: age, race, gender, primary language, degrees for level of education, number of hours working per week while attending school, years since taking general education and nursing prerequisites courses, previous knowledge of information literacy, computer experience, and information resources used. Permission was obtained to access each student's cumulative grade point average (GPA), SAT (The College Board, 2009)/ACT score, and TEAS score for accuracy of the data. The student name was required initially with the self-assigned code. A self-assigned code was generated by each student using the first two initials of their high school, the number date of their birthday, and their last letter of their first name.

Sample

A convenience sample was used to study nursing students entering their junior year in a traditional baccalaureate nursing program. All nursing students in the traditional nursing program were eligible for inclusion in the study. Exclusion criteria were students who were designated registered nurses in the RN/BSN program or second degree seeking students enrolled in the

baccalaureate nursing program. The sample pool was approximately 199 admitted students per year. Both fall semester 2012 and spring semester 2013 were the periods for the collection of the data.

The sample size was estimated using GPower 3.1. The sample size for the Chi Square analysis for eight categorical independent variables with seven degrees of freedom was 88 subjects with effect size = 0.50, power = 0.95, and $\alpha = 0.05$. The sample size for the multiple regression analysis for five continuous independent variables was 122 subjects with effect size = 0.15, power = 0.95, and $\alpha = 0.05$. Recommended sample sizes should be large with 10 to 15 subjects per independent variable. Therefore, the target sample size was 122 subjects.

Recruitment

Multiple strategies were used to recruit first semester traditional nursing students. Recruitment took place prior to orientation day, during the orientation and the first four weeks of class before IL skills were introduced in the first semester for the new matriculated students of the nursing program. The junior nursing students enrolled in the Role of the Professional Nurse course receive instruction from a librarian and complete information literacy modules provided by the library for a class assignment approximately two to five weeks after starting the semester.

An informational letter was emailed to the junior nursing students through their individual, university email account to inform them of the opportunity to participate in the project approximately one week prior to the start of data collection. The mandatory, university email account, accessed by all college students, is the accepted means of communicating with students. The letter explained the study and created initial student awareness (see Appendix D).

A flyer/postcard was posted in public locations throughout the nursing building and was distributed to the students during orientation and the first four weeks of classes (see Appendix E). Announcements were made in class to request assistance in the project by the faculty teaching the courses and the principal investigator. Gift certificates of \$10 and a snack were given to students by the principal investigator after completing the Demographics Questionnaire and the Information Literacy Test as an honorarium for their time and to encourage participation in the testing.

Faculty and students were very responsive in assisting the principal investigator (PI) of this research project on information literacy. One hundred twenty students were needed for the required analysis and 121 students agreed to participate by showing up for the testing. The college of nursing supported the study by allowing reserved time for participation in this study in the computer labs. The college recognized that admission requirements and policies may be enhanced to identify possible IL issues with incoming students and to provide early assistance to these students. Staff emailed reminders to students and assisted with posting flyers where students congregate at the college campus. The program coordinators introduced the PI to students during a formal orientation of the nursing program and during class time with a brief introduction to the research project.

Benefits were presented to both students and faculty on why their assistance was needed for the study. Students were informed that they would be able to identify problem areas on information literacy since they received immediate feedback on their skills after the test and could print out a verification form of their completion of the test from home by logging into the testing website. The students were told that they would aid faculty and assist future students in nursing programs since the aggregate information on the tests would allow for better IL program

development. The faculty could then refer students for resources on information literacy education and practice if students sought assistance for weak skills. The explanation of the study to participants allowed students to learn about the research process by actively participating in a research project. Faculty would be able to develop and target programs with the college librarians to identify incoming students who may have difficulty with information literacy skills. The study was a collective gain for those who helped in the recruitment process. Faculty promoted participation in the project by making announcements and reminders in first semester courses during the testing period. Time was provided for the PI to address the students at the orientation and before the classes. Flyers were passed out with dates, times, and locations. Two faculty members did provide additional credit on their own for participation in the IL testing in their courses. Additionally, the college librarians were very helpful and accommodating in the testing processes on the satellite campuses as needed since the computer lab was used within the school library.

Ethical Considerations

Students are considered protected subjects when asked to participate in a research study. Full disclosure of the study purpose and informed consent was required without coercion on the part of the principal investigator for the study (see Appendix F). The principal investigator was not the instructor of record for credit courses for the students enrolled in the study. Information was kept private and confidential through the use of a self-assigned code by the student on both the demographic information and the Information Literacy Test (ILT). Anonymity was not possible because the demographics tool and the online assessment for the ILT needed to be matched for each student. However, a self-assigned code with each student's name was kept

separate from the Demographics Questionnaire and the ILT in a password protected file. Student records were also accessed for student entrance data into the program. The principal investigator received permission to complete the research from the University Institutional Review Board. The research was deemed exempt for documented consent (see Appendix G).

Data Collection

Madison Assessment LLC required a proctor to monitor the test in a university computer lab. A copy of the Information Literacy Test manual is available in Appendix H with permission from Madison Assessment LLC (2012). The traditional nursing program coordinator was contacted to gain access to the junior students and to discuss the best time and place for the assessment of the students on each of the campuses. The data collection took place live with the nursing students in the first five weeks of the fall and spring semesters and it was coordinated around the student class times. This was the optimal time to obtain a baseline measurement of students' IL skills before they received formal IL instruction.

Arrangements were made for the computer labs on the different campuses. The principal investigator was present for the data collection on the multiple campus sites. Before participating in the study all students who agreed to participate and showed up at the designated site, were informed of the purpose of the study as required by the IRB. Next, the self-assigned code was generated by each student examinee. The Demographic Questionnaire was completed by each student via Survey Monkey followed by the administration of the online ILT assessment. The individually self-assigned code with associated student names, Survey Monkey file with the Demographics Questionnaire, and the ILT results were maintained in separate online files off

campus in a password protected file. The students took approximately 90 minutes to complete both the Demographic Questionnaire and the Information Literacy Test (ILT).

Data Analysis

Preliminary Analysis

The processed data with the individual test scores and responses were received from Madison Assessment LLC (2012) as an Excel spreadsheet. Once the Demographic Questionnaire and the ILT assessment were matched using the self-assigned codes, the data were uploaded into the PASW©18. After data entry/upload, the data were screened using PASW List to print out the entire data set and proofread for accuracy of the data with assigned codes. Descriptive statistics were used to explore means, standard deviations, frequencies, and percent on the ILT assessment.

Missing data were checked for randomness. Any missing data that was randomly present were replaced by imputation. Missing data were minimal. Continuous variables were assessed for normality. Transformation was attempted to correct problems with normality. Even though transformations for age and hours working were made using square root, logarithmic, and Base 10 logarithmic, normality continued to be a problem with these variables. Internal consistencies of the ILT assessment were examined for each subscale. Additionally, scatterplots were reviewed for the demographic, work, and educational factors to be analyzed with the information literacy scores.

Principal Analysis

Data analysis was driven by the research questions:

1. What are the information literacy (IL) competency levels of students entering their junior year in a traditional baccalaureate nursing program?
2. Are demographic and educational factors predictive of information literacy skills in students entering their junior year in a traditional baccalaureate nursing program?

The dependent variable (DV) was the information literacy total raw score on the Information Literacy Test. The independent variables (IV) included: age, race, gender, primary language, cumulative grade point average (GPA), TEAS score, educational institutions attended for college credit, current number of hours working per week, information resources used, computer experience, and previous knowledge of information literacy. The categorical data were analyzed for an association between the DV and IVs using Pearson's Chi Square analysis. Data were checked for data in each of the cells and re-categorized if cell frequency was less than five. The SAT and/or the ACT scores were not consistently available from the university because 33% of the students did not submit a score on admission to the university. In this college, a student is not required to submit an SAT score or an ACT score if they transfer from a two year college or a four year college, or if the student has a prior bachelor degree in another discipline.

Therefore, only the GPA, TEAS score, age, and hours working were deemed suitable for the analysis. The continuous data were analyzed for meeting the assumptions of the linear model for use in multiple regression analysis. Multicollinearity, tolerance (value should be ≥ 0.20), homoscedasticity, and linearity (P-P plots) of the independent variables were assessed prior to the regression analysis. Kolmogorov-Smirnov Test was used to check normality. Square root, logarithmic, and Base 10 logarithmic transformation were used to eliminate linearity problems. Normality continued to be a problem. Levene's Test for Homogeneity of Variance was used to check homoscedasticity. Centering of the independent variables did not occur to eliminate

collinearity problems (Polit, 2010). In checking for outliers of predictor variables, the standard deviation was set to 3 and no outliers were found. Cronbach's alpha was performed on the total test scale and subscales to check the reliability of the Information Literacy Test. Mean scores and standard deviations from ANOVA were reported for the total scale and the four subscales of the Information Literacy Test. Pearson's Correlation analysis and Spearman Rho correlation analysis was used to examine relationships among the predictor variables with the ILT. Multiple regression analysis was used to analyze the relationship between the ILT raw score with the four continuous variables. Logistic regression analysis was performed to analyze the bivariate ILT Competency with one continuous variable and three categorical variables.

Methodological Assumptions

There were several methodological assumptions for the study. The traditional nursing students with differing demographic information were available for recruitment and participated in the study. Access to the participants fit their schedule to encourage their participation since an adequate sample size was needed to provide statistical power for detecting differences.

CHAPTER FOUR: FINDINGS

The purpose of this study was first, to describe information literacy (IL) competencies in traditional nursing students admitted to a baccalaureate degree program at a major metropolitan university using a standardized test, the Information Literacy Test from Madison Assessment LLC (2012), which has reported validity and reliability. Second, predictors of IL competency were examined using demographic data from nursing students collected on a sixteen item questionnaire. The dependent variable (DV) was the Information Literacy Test raw score. The categorical independent variables (IV) included ethnicity, race, gender, English as their primary language, educational institutions attended for college credit, years since taking general education and nursing prerequisite courses, computer experience, previous knowledge of information literacy, preferred source of information, and preferred online source of information. The continuous IVs included age, college general education and nursing prerequisites, cumulative grade point average (GPA), hours working and Test of Academic Essential Skills (TEAS) by Assessment Technologies Institute (2010). The SAT and ACT scores were not used in the data analysis because scores were not consistently available. Reliability of the Information Literacy Test for this sample was examined using Cronbach's alpha. This chapter describes the data analysis and the results of this study.

Description of the Sample

The total sample pool was 199 students who were admitted to the traditional baccalaureate nursing program for the fall and spring semesters within the same academic year. Of the 199 students, 121 students agreed to be tested by arriving at the test sites. One hundred four students participated in this study from the largest campus of the testing university with

three students from one satellite campus and 13 students from another second satellite campus. However, the Information Literacy Test data were not collected on one student because the computer screen froze during the testing period. The total number of ILT tests available for analysis was 120 for the first research question. Demographic data were lost on seven students due to a procedural error with the Internet Provider addresses tracked by SurveyMonkey (2012). One hundred thirteen students were available for analysis of the demographics collected with the Information Literacy Test for the second research question.

The demographic information on the nursing students (N = 113) who participated in the study is summarized in Table 5 for the continuous variables. The mean age of the students was 23 (SD = 6.16). The age of the students ranged from 18 to 56 years with 90% (N = 102) being younger than the age of 30. Forty six students (41%) were under the age of 21 while 56 students (40%) were between the ages of 21 to 30. The mean GPA for the nursing students was 3.71 (SD = .2359) with ranges from 2.91 to 4.0 while the mean admission TEAS was 83.82 (SD = 4.5) with the range from 74 to 95.3. Fifteen students (13%) indicated that they worked between one and 12 hours per week while 19 (17%) were employed more than 12 hours a week. Approximately 70% of the 113 students (N = 79) indicated that they were not employed while enrolled in the nursing program.

Personal demographic information on the nursing students is summarized in Table 6 for the categorical variables. The sample consisted of mainly females (N = 96; 85%). The predominant race was white (N = 93; 82%). The number of males was lower (N = 7; 15%). For race, 20 students identified themselves as non-white with eight African Americans (7%), nine Asians (8%), one Native Hawaiian or Pacific Islander (1%), and two Mixed Race (2%). Ninety-six students (85%) indicated that they were not Hispanic or Latino.

A summary of educational demographic information on the students is provided in Table 7. Students were asked to complete a multiple response question with eight categories describing where they completed their liberal arts and prerequisite college credits for entrance into the nursing program. Students attended multiple institutions to attain college credit for admission to the nursing program. College credits for general education and nursing prerequisites were earned in high school (N = 24; 20%) along with high school plus college courses through dual enrollment (N = 27; 22.5%) and advanced placement tests (N = 30; 25%). The remaining responses indicated that students received credits through two year educational institutions (N = 55; 45.8%), and four year educational institutions from the study university or by transfer (N = 64; 56.6%), and/or prior bachelor degrees in other disciplines (N = 7; 6%). Multiple responses revealed that many students attended differing academic institutions to earn the needed college credits and not just one institution. No student held a master's degree in another discipline.

The majority of students earned their general education credits (N = 54; 48%), science prerequisites (N = 55; 49%), and other nursing prerequisites (N = 58; 51%) within one year of entering the nursing program. There were nineteen students (17%) who indicated that credits in general education were three or more years old while 12 students (11%) had science prerequisite credits and 13 students (12%) had other prerequisite credits older than three or more years.

The Test of Essential Academic Skills (TEAS) is required for admission and students may take the test multiple times to achieve the desired score for entrance into the nursing program. Students were required to achieve a minimum score of 74 on the TEAS as a nursing admission requirement at that time. In order to meet these requirements, 60% (N = 68) of the 113 students took the TEAS one time while 30 % (N = 34) of the students took the TEAS two times

and 10% (N = 11) of the students took the test three times. The mean score for the TEAS was 83.82 (SD = 4.5).

Table 8 provides a summary of the computer expertise and library information of the students. Slightly more than half the students (N = 61; 54%) had a prior course on how to use a library. Students were asked to self-evaluate their computer skills expertise since computer skills are known to contribute to information literacy. Only 15 (12.5%) of the 113 students described their computer skills as novice while 91 (75.8%) students described their skills as intermediate. The remaining seven (5.8%) students designated their computer skills as being expert. These levels could be expected given the exposure to technology by the students.

In order to understand the preferences for finding answers for their assignments, students were asked to self-evaluate their sources of information that they used for their classes. Sixty five percent (N = 79) of the students responded that they used the Internet to find answers while 15 % (N = 19) used a textbook. Professional journals (N = 5; 8%) and no preference (N = 9; 7.5%) were the remaining responses for sources of information. One student responded that they asked another student for finding an answer. Students were also asked to identify their preferred online source for information. Google was the preferred online source for information by 60% (N = 72) students while the remaining responses were library at 18% (N = 14), government website at 18% (N = 14), and professional organization website at 17% (N = 13).

Table 5. Characteristics of the Continuous Variables

Variable	Frequency (N) and Percent	Mean (SD)
Age	113	23 (6.16)
Under age 21	46 (41%)	
Age 21 to 30	56 (40%)	
Age 31 to 40	8 (7%)	
Age 41 or older	3 (2%)	
Hours Working (Per Week)	113	4.5 (8.3)
0 Hours	79 (70%)	
1 to 12 Hours	15 (13%)	
> 12 hours	19 (17%)	
ILT	120	43.64 (5.243)
GPA	113	3.71 (.2359)
TEAS	120	83.82 (4.5)

Table 6. Characteristics of Categorical Personal Variables (N = 113)

Variable	Frequencies (N)	Percent
Gender		
Female	96	85%
Male	17	15%
Ethnicity		
Hispanic or Latino	17	15%
Not Hispanic or Latino	96	85%
Race		
White	93	82%
Non-white	20	18%
Black/African American	8	7%
Asian	9	8%
American Indian or Alaskan Native	0	0%
Native Hawaiian or Pacific Islander	1	1%
Mixed Race	2	2%

Table 7. Characteristics of Categorical Educational Variables (N = 113)

Variable	Frequencies (N)	Percent
Institution for College Credits (Multiple Responses)		
High School, Dual Enrollment, and/or AP	81	72%
Two Year Institution	55	49%
Four Year Institution	71	63%
1 Year Since Earning College Credit		
General Education	54	48%
Science Prerequisites	55	49%
Other Prerequisites	58	51%
2 years since Earning College Credit		
General Education	40	35%
Science Prerequisites	46	41%
Other Prerequisites	42	37%
3 or more years since Earning College Credit		
General Education	19	17%
Science Prerequisites	12	11%
Other Prerequisites	13	12%
Number of Times Took the TEAS		
1 time	68	60%
2 times	34	30%
3 times	11	10%

Table 8. Characteristics of Categorical Computer and Library Variables (N = 113)

Variable	Frequencies (N)	Percent
Computer Expertise		
Novice	15	13%
Intermediate	91	81%
Expert	7	6%
Prior Library Course		
Yes	61	54%
No	52	46%
Preference for Answers		
Internet	79	70%
Textbook	19	17%
Professional Journal	5	4%
No Preference	9	8%
Classmate	1	1%
Preferred Online Resource		
Google	72	64%
Library	14	12%
Government Website	14	12%
Professional Organization Website	13	11%

In summary, the sample was a homogenous group of students who were mostly young, white, and female with high GPAs and TEAS scores. The majority of students in this sample do not work. Many of the students received college credits from a number of institutions prior to entering the program. Half of the students in this sample had college courses for entry into the program that were completed at one year or less. Approximately half of the students took the TEAS test only one time. A large majority of the students indicated that they were intermediate in their computer skills. Half of all students in this study had a library course. Most students in this sample preferred the Internet as a source for information and Google was their preferred online source for information.

Analysis of the Information Literacy Test

The Information Literacy Test (ILT) was used to measure basic knowledge related to information literacy. Cronbach's alpha for the 60 item scale ($\alpha = 0.696$) was minimally adequate for reliability of the test in this sample. According Streiner and Norman (2003), the alpha was at the lowest end of the range for the Cronbach's alpha which should range between 0.70 to 0.90 for the total scale. Cameron, Wise, and Lottridge (2007) indicated that the initial Cronbach's alpha for the total scale on 524 sophomores was 0.88 at James Madison University (JMU). Additionally, the Madison Assessment LLC (Russell, 2009) had higher alphas in the online test manual that was developed by The Center for Assessment and Research Studies at James Madison University in 2009. The total test alpha for freshman at four, four year institutions (four year) and five, two year institutions (two year) were the same ($\alpha = 0.84$). Table 9 provides a summary of the ILT Scale, the four Subscales with the number of items and the Cronbach's alpha for this sample.

Table 9. Summary of the Information Literacy Scale with Subscales (N = 120)

Subscale for Information Literacy Test	Number of Items	Cronbach's Alpha
Standard 1. Defines and articulates the nature and extent of information needed	12	0.393
Standard 2. Access needed on information efficiently and effectively	19	0.461
Standard 3. Evaluates information and its sources critically and incorporates selected information into their knowledge base and value system	19	0.517
Standard 5. Understands many of the ethical, legal, and socio-economic issues surrounding information and information technology	10	0.268
Total Scale	60	0.696

The Cronbach's alpha was measured for each of the individual subscales. The number of items in each subscale varies from 10 questions to 19 questions. Standard 1 Subscale which was on defining information needed had a Cronbach's alpha of 0.393. Standard 2 Subscale on accessing needed information effectively and efficiently had a Cronbach's alpha of 0.461. Standard 3 Subscale which was on evaluating information and its sources had a Cronbach's alpha of 0.517. Standard 5 Subscale on understanding the ethical, legal, and socioeconomic issues on information and information technology had a Cronbach's alpha of 0.268. Inter-item measurement on the each of the four subscales ranged between 0.20 and 0.80 (Streiner & Norman, 2003) which was acceptable but still on the lower end of the range for acceptability for the test. Neither of the alphas improved substantially on the scales if items on the scale or the subscales were deleted for this sample.

The Cronbach's alphas for the subscales were not consistent with the initial subscale scores for the ILT by Cameron, Wise, and Lottridge (2007) or the subscales in the online test booklet (Russell, 2009). All the subscale alphas provided by the test developers and in the online test booklet were higher than the alphas in this study. Standard 1 Subscale (CS1) had an alpha of .65, Standard 2 Subscale (CS2) had an alpha of .64, Standard 3 Subscale (CS3) had an alpha of .76 and Standard 5 Subscale (CS5) of .48 for students at JMU (Cameron et al., 2007; Russell, 2009). The alphas for the subscales were Standard 1 Subscale of .54, Standard 2 Subscale of .54, Standard 3 Subscale of .69, and Standard 5 Subscale of .53 683 in the freshman sample at four year institutions. Two year institutions using freshman had alphas on the subscales of .58, .53, .70, and .50 for Standard 1, Standard 2, Standard 3, and Standard 5, respectively. Cronbach's alphas were reviewed if an item was deleted from each of the subscales and the total scale.

In summary, the Cronbach's alphas for the scale and the four subscales in this study were barely acceptable for testing of the students at the testing institution. The alphas for the total scale and the four subscales of the ILT were substantially lower in this study than those indicated in the test manual from Madison Assessment LLC (Russell, 2009) and on the initial development of the scale (Cameron et al., 2007).

Research Question Number 1

What are the information literacy (IL) competency levels of students entering their junior year in a traditional baccalaureate nursing program?

The ILT is a basic test to identify if students have met minimum standards as identified by the developers of the test which has its basis in expected standards developed by the Association of Colleges and Research Libraries (American Library Association [ALA], 2000).

The majority of the 120 junior students who completed the test were information literate (N = 102; 85%) with scoring 65% or higher while 18 students (13%) had raw scores of 38 questions or less, based on the cut scores provided for the Information Literacy Test Performance Standards (Russell, 2009).

For this sample, the overall ILT mean raw score and standard deviation for this sample was 43.64 and 5.243 with a standard error mean of .479. The median for this sample was 44 and the mode was 44. The test percentages ranged from 52% (raw score of 31 questions correct) to 92% (raw score of 55 questions correct) for 120 students. Two of the students in this sample were at the Advanced Proficient level with a raw score of 54 (90%) and 57 (92%). The mean score and standard deviation for those who had a raw score less than 39 was 34.22 and 2.13 with a median of 34. The mean and raw score for those who scored 39 and above was 45.30 and 3.609 with a median of 45. Table 10 provides a summary with the number of test items on the ILT Scale and four subscales answered correctly in this sample and the mean raw scores of the ILT Scale and the four subscales with standard deviations. All 60 items on the scale were equally weighted.

Table 10. Characteristics of the ILT Scale and Subscales on Number of Questions Answered Correctly for Each Subscale with Mean Raw Scores and Standard Deviations (N =120)

ILT Scale	Number of Questions	Answered Correctly	Mean (SD)
CS1 Defines and articulates the nature and extent of information	12	6 - 12	9.59 (1.637)
CS2 Access needed information efficiently and effectively	19	5 - 17	11.09 (2.362)
CS3 Evaluates information and its sources critically and incorporates selected information into their knowledge base and value system	19	9 - 19	15.42 (2.052)
CS5 Understands many of the ethical, legal, and socio-economic issues surrounding information and information technology	10	4 - 10	7.54 (1.485)
Total Scale	60	31 - 55	43.64 (5.243)

Appendix I has the individual test item responses of the 120 students in this sample. The students in this sample were proficient on more than 85% of the questions on each of Subscales for Competency Standard 1 on defining information needed, Competency Standard 3 on evaluating information, and Competency Standard 5 on understanding ethical, legal, and socio-economic issues on information and information technology. The Competency Standard 2 on accessing needed information efficiently and effectively indicated that only 48% of the students were proficient.

Individual test items were reviewed for those test items where a higher percentage of the 120 students in the sample responded incorrectly to determine weaknesses on content in this sample. Table 11 summarizes ACRL Competency Standards from the ILT SubScales with the number of incorrect test items where students missed 60% or more of the test items. The

majority of the test questions that proved difficult for all of the students were on CS 2, accessing needed information efficiently and effectively. Ten questions out of the 19 questions testing this standard were answered incorrectly by students with rates ranging from 40% to 96%. Database querying, searching for publications, search operators, and knowledge of reference types posed problems on the basic information literacy standards. Competency Standard 3, evaluating found information, had only two questions that posed significant problems to students but 85% of the students responded incorrectly on reading from a table. Some of the items had one to three questions on the same topic. Only the item mapping for each of the subscales in the ILT was available to review from Madison Assessment, LLC.

Table 11. Information Literacy Competency Standard Test Items Answered Incorrectly (N =120)

Competency Standard (ACRL, 2000)	Questions Answered Incorrectly (N)
2. Access needed information efficiently and effectively (CS2)	Database querying 1 (N = 98)
	Searching for publication 1 (N = 116)
	Searching for publications 2 (N = 102)
	Knowledge of search operators 4 (N = 74)
	Accessing a publication (N = 75)
	Knowledge of reference types 3 (N = 95)
3. Evaluates information and its sources critically and incorporates selected information into their knowledge base and value system (CS3)	Using data from a table (N = 100)

Cronbach's alpha for ILT = 0.696; Number of students not proficient = 18 (15%); Mean Raw Score = 43.7 (SD = 5.243); Range of Values for Raw Score = 31 to 55

The least problems in this sample were encountered on CS1, defining and articulating the nature and the extent of information needed that focused on acquiring a resource. Three out of the ten questions on CS5, understanding the use of information posed less problems for the students. Legal and ethical use of a source, knowledge of proper citations and knowledge of creating a reference were challenging to about half of the students. Overall on the subscales, the majority of students were rated as Proficient with a higher rate of difficulty noted for CS2.

In summary, the majority of students in this sample were information literate as determined. The raw mean scores on the total scale and subscales of the ILT were consistent or better than the raw mean scores provided by the test developers and the online test booklet (Cameron et al., 2007; Russell, 2009). For this sample, CS2 had the lowest mean scores and wider variation in standard deviation in this sample than the other subscales but remained consistent with the scores provided by test developers and in the online test booklet. Though the majority of students were information literate in this sample, a concern exists for 30 students of the 120 students in this sample who had lower raw scores between 39 and 42. This result may be explained by some of the test questions in the ILT being higher order skills since the some of the ACRL Standards have both lower order and higher order thinking skills on the student outcomes that are based on Bloom's Taxonomy of Educational Objectives (American Library Association [ALA], 2000). The Student Opinion Scale, taken after the ILT as part of the test package, indicated that some students may have not participated to the best of their ability on the test since there were no consequences for not performing well on the test.

Research Question Number 2

Are demographic and educational factors predictive of information literacy skills in students entering their junior year in a traditional baccalaureate nursing program?

Preliminary Analysis

Data were reviewed for cell sizes, linearity, and normality. Both a scatterplot and the P-Plot indicated only the TEAS and the GPA had a normal distribution. The skewness and kurtosis were less than 2 for ILT raw score, TEAS, and GPA. The ILT score was negatively skewed (-.525). One sample Kolmogorov - Smirnov (K-S) Test was performed on the ILT raw score, the TEAS scores, the GPA, the age, and the hours working to check for normality. The TEAS scores and the GPA were not significant. The ILT raw score was significant ($D(119) = 1.394, p = .041$). The K-S test indicated that age and hours working were significantly deviated from normality. Age was $D(112) = 3.102, p < .001$ and the hours working was $D(113) = 4.319, p < .001$ indicate a very significant deviation from normality. Transformation on the raw score, age and hours working using square root, natural logarithm, and Base 10 logarithm did not correct normality issues. Levene's Test of Homogeneity of Variance for the TEAS, the GPA, the age, and the hours working was not significant for homoscedasticity.

Variables that had less than 5 frequencies were collapsed to complete the statistical tests or eliminated for the data analysis. Race, number of hours working per week, length of time for general education, multiple response for college credits, years since completed science prerequisites and other prerequisites prior to admission, and resource preference for answers were also collapsed for the variable requirements deemed suitable for the statistical tests (Polit, 2010). The five categories of race were recoded into two categories, white and non-white. Years

since taking general education, science prerequisites, and other prerequisites were recoded for 1 year, 2 years, and 3 or more years. The multiple response variables on where college credits were obtained for general education and nursing prerequisites were collapsed from the eight individual categories into three categories. No students had a master's degree so this category was dropped from the analysis. Both preference for answers and preferred online resources were each collapsed into two categories.

The independent variable, Information Literacy Test, was re-categorized from the raw scores of the test into *Not Proficient* and *Proficient* of the ILT based on the Madison Assessment LLC (Russell, 2009) Manual for use in the Chi Square analysis and the logistic regression analysis which required a bivariate variable. *Not Proficient* was a raw score of 38 (or less than 65%) while *Proficient* was a raw score of 39 or 65% on the test.

Statistical Test Predictors

Chi Square Analysis

A chi-square test of independence was calculated comparing the frequencies on the bivariate dependent variable, ILT, with the independent categorical variables of English as their primary language, gender, ethnicity, race, number of times taking the TEAS test, years since completed general education, science prerequisites and other prerequisites, multiple responses for earning college credit, computer expertise, a course on how to use the library, resource preference for information, and online resource preference for information. Table 12 provides a comparison of the student characteristics with the proficiency levels through Chi Square analysis.

Table 12. Comparison of Student Characteristics with Bivariate ILT using Chi Square analysis (N = 113)

Characteristics	ILT Proficiency		Statistic (N = 113)
	Not Proficient (N = 18)	Proficient (N = 95)	
English Primary Language			$X^2 (1,113) = 15.911$
Yes	12 (67%)	91 (96%)	(p < .001)
No	6 (33%)	4 (4%)	
Gender			$X^2 (1,113) = .044$
Female	15 (83%)	81 (85%)	
Male	3 (17%)	14 (15%)	
Ethnicity			$X^2 (1,113) = .044$
Hispanic or Latino	3 (17%)	14 (15%)	
Not Hispanic or Latino	15 (83%)	81 (85%)	
Race			$X^2 (3,113) = 10.576$
Non-White	8 (44%)	12 (13%)	(p = .001)
White	10 (56%)	83 (87%)	
Times for TEAS			$X^2 (1,113) = 2.211$
1 time	8 (44%)	60 (63%)	
2 or more times	10 (56%)	35 (37%)	
Computer Expertise			$X^2 (2,113) = 2.638$
Novice	4 (22%)	11 (12%)	
Intermediate	14 (78%)	77 (81%)	
Expert	0 (0%)	7 (7%)	
Prior Library Course			$X^2 (1,113) = .784$
Yes	8 (44%)	53 (56%)	
No	10 (56%)	42 (44%)	
Preference for Answers			$X^2 (3,113) = .630$
Internet	14 (78%)	65 (68%)	
Professional Journal, Textbook, Classmate or No Preference	4 (22%)	30 (32%)	
Preferred Online Resource			$X^2 (3,113) = .081$
Google	12 (67%)	60 (63%)	
Library, Government Website, Professional Organization	6 (33%)	35 (37%)	
Years Since Completing General Education			$X^2 (2,113) = .448$
1 year	8 (44%)	46 (48%)	
2 years	6 (33%)	34 (36%)	
3 or more years	4 (22%)	15 (16%)	

Characteristics	ILT Proficiency		Statistic
Years Since Completing Science Prerequisites			$X^2 (2,113) = 6.643$ ($p = .036$)
1 year	7 (39%)	48 (51%)	
2 years	6 (33%)	40 (42%)	
3 or more years	5 (28%)	7 (7%)	
Years Since Completing Other Prerequisites			$X^2 (2,113) = .910$
1 year	11 (61%)	47 (49%)	
2 years	5 (28%)	37 (39%)	
3 or more years	2 (11%)	11 (12%)	
College Credit through High School, Dual Enrollment or AP			$X^2 (1,113) = 2.867$
Yes	5 (28%)	47 (49%)	
No	13 (72%)	48 (51%)	
College Credit through Two Year Institution			$X^2 (1,113) = 2.867$
Yes	9 (50%)	46 (48%)	
No	9 (50%)	49 (52%)	
College Credit through Four Year Institution			$X^2 (1,113) = .273$
Yes	10 (55%)	59 (62%)	
No	8 (45%)	36 (38%)	

Among the eleven categorical variables, only three variables demonstrated a significant relationship with the ILT ($p < .05$). A significant interaction was found between the bivariate ILT and the following three categorical variables of English as the primary language ($p < .001$), race ($p < .001$), and years since completing science prerequisites ($p = .036$) which indicates that these variables are not independent. The coefficients were calculated for the strength of the relationship between the significant variables and the ILT (Polit, 2010). For English as the primary language, the Phi indicated an inverse relationship between the ILT and English as the primary language ($\phi = -.375$). For White race, the Phi coefficient indicated a positive relationship with the ILT ($\phi = .305$). The Cramer's V coefficient for the years since completing the science prerequisites indicated a positive relationship ($\phi = .324$) with the ILT but with more

than two categories for this variable, coefficient may indicate that the association is greater with some of the categories.

Six of the eighteen students that were *Not Proficient* in IL had TEAS scores in the lower range from 74 to 77. Grade point average for the 18 students who were *Not Proficient* ranged from 3.2 to 4.0 with eight of the *Not Proficient* students having GPAs less than 3.5. Six of the 18 students that were *Not Proficient* in IL did not have English as their primary language. Table 13 provides a summary of student information literacy proficiency with student characteristics for the *Proficient* and *Not Proficient* students in this sample. The majority of the students who were *Not Proficient* were below the age of 30 (N = 17). For race, eight out of the 18 *Not Proficient* students were non-white with approximately half of the African American students and half of the Asian students. Fourteen of the 18 *Not Proficient* students indicated that they were intermediate on their computer expertise. Ten out of the 18 *Not Proficient* students indicated that they had not had a library course. Fourteen out of the 18 *Not Proficient* students prefer the Internet for answers. The preferred online source for information was Google by 12 out of the 18 *Not Proficient* students. Five of 12 students who had science prerequisites older than three years were *Not Proficient*.

In summary, a Chi Square analysis was performed with the bivariate ILT and the 17 categorical variables. Only three of the 17 categorical variables indicated a significant relationship with the ILT in this study. English as their primary language, race, and years for science prerequisites suggested an association with information literacy with post-tests of the three significant variables indicating an inverse relationship for English as their primary language, and a positive relationship for race and years for science prerequisites.

Analysis of Variance

An analysis of variance (ANOVA) was conducted on the means of the TEAS score, GPA, Age, and Hours Working with the bivariate ILT raw score on variability of the two groups in this study. Given that the ANOVA is fairly robust to assumption violations (Munro, 2005), the ANOVA was performed despite limitations regarding normality as discussed previously in the preliminary analysis. No post hoc tests are indicated since there are only two groups for analysis. The ANOVA indicated that only the TEAS scores were significantly ($p < .001$) different between the *Not Proficient* and *Proficient* groups. The mean TEAS for the *Not Proficient* group was 80.667 while the mean TEAS for the *Proficient* group was 84.376. The ANOVA indicates that there is a difference between the groups. The means for GPA, the age, and hours working were not statistically significant for the *Proficient* and the *Not Proficient* groups. Eta squared was .087 for the effect size. Table 13 provides a summary of the ANOVA of GPA, TEAS, Age, and Hours working with the bivariate ILT.

Table 13. ANOVA of GPA, TEAS, Age, and Hours Working with Bivariate ILT

	Sum of Squares	df	Mean Square	F	Sig
GPA between groups	.046	1	.046	.823	.366
Within groups	6.577	118	.56		
Total	6.623	119			
TEAS between groups	210.568	1	210.568	11.248	.001*
Within groups	2208.944	118	18.720		
Total	2419.512	119			
Age between groups	.000	1	.000	.000	.999
Within groups	4271.805	111	38.485		
Total	4271.805	112			
Hours working between groups	1.571	1	1.751	.022	.881
Within groups	7794.411	111	70.220		
Total	7795.982	112			

Multiple Regression Analysis

Before completing the multiple regression analysis, correlations were calculated to detect relationships among the predictor variables (IV) of GPA, TEAS score, age, and hours working with dependent variable (DV), the ILT raw score. Table 14 provides a summary of the correlations among the continuous variables. Pearson Correlation Coefficient was conducted on the GPA, TEAS, with the ILT raw score since these variables are meet the assumptions. A positive, low correlation was found between the ILT and the TEAS only ($r(111) = .370, p < .001$) with the TEAS contributing to the explained variance in the ILT. A Spearman Correlation Coefficient was conducted on the age, hours working, and the ILT raw score since these variables were not normally distributed. A significant, small inter-correlation was found between age and hours working ($\rho(111) = .237, p = .037$) but not with the ILT raw score. Only the TEAS had a positive relationship with the ILT raw score.

Table 14. Correlations between Information Literacy Test and GPA, TEAS, Age, and Hours Working (N = 113)

Variable	TEAS	GPA	ILT	Age	Hours Working
Pearson Correlation					
ILT			1.000		
GPA		1.000	-.038		
TEAS	1.000	.069	.355**		
Spearman Rho					
ILT			1.000		
Age			.077	1.000	
Hours Working			.037	.237*	1.000

* $p = .01$, ** $p < .001$

A multiple regression analysis was performed by entering the independent variables simultaneously given the low number of predictor variables and setting the standard deviation to 3 to check for the presence of outliers. No outliers were found to be above 3 or -3 in the

standardized residual values (Polit, 2010, p.247). Multicollinearity of the independent variables was not evident in tolerance or VIF on the screening of the data. Only the TEAS was a statistically significant predictor of ILT in the model in the ANOVA ($p < .001$). The analysis was rerun by removing the GPA, age, and hours working individually from succeeding models starting with the highest non-significant variable.

A final regression analysis was conducted on the TEAS score with the ILT raw score with the standard deviation set to 3. The analysis revealed that the TEAS accounted for 12.6 % of the variance in the ILT raw score yet was a significant predictor of the ILT ($p < .001$). The variance, $R^2 = .126$ indicated that the effect size is small. No outliers were indicated in the standard residual values. The regression coefficient for the ILT is presented in Table 15.

Table 15. Simple Regression Predicting Information Literacy (N = 120)

Predictor Variable	B	SE	β	t	p
Constant	9.083	8.402		1.081	.282
TEAS	.412	.100	.355	4.119	.000

A significant regression was found ($F(1, 118) = 6.148, p < .001$), with an R^2 of 12.6. Students' predicted ILT is equal to $9.083 + .412(\text{TEAS})$. Students' average ILT score increased .412 for every point increase in TEAS score. Appendix J provides the regression equation calculated for the predicted scores Figure 1 is a scatterplot of the TEAS with the actual ILT raw scores which indicates a positive increasing relationship between the two standardized tests.

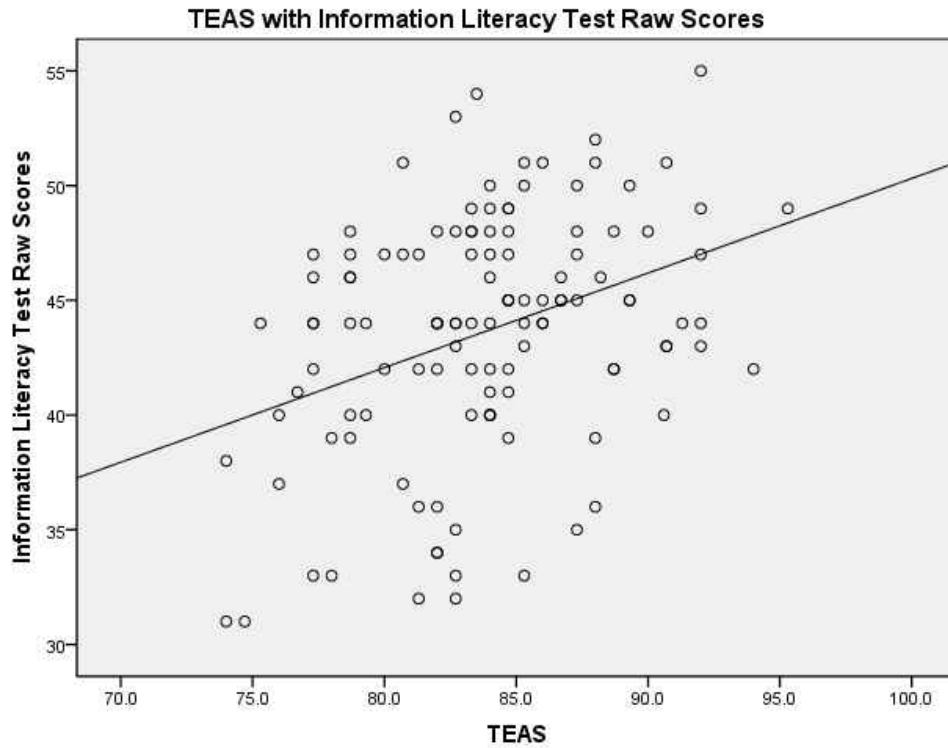


Figure 1. TEAS with Actual ILT Raw Scores

In summary, the TEAS was found to be significantly correlated with the ILT and the only predictor of the ILT. However, the TEAS accounted for only 12.6% of the variance and the effect was small. The GPA, the age, and the hours working were not correlated with the ILT and they were not predictive of ILT. One statistically significant correlation was found between TEAS and age.

Logistic Regression Analysis

A logistic regression analysis was performed initially using the variables that had been significant in the Chi Square analysis and the ANOVA. The categorical variables, English as their primary language, race, and years since completed science prerequisites (science

prerequisites), and the continuous variable, TEAS, were used to predict the bivariate dependent variable, the ILT. Nominal categorical variables were coded previously as 0 = no and 1 = yes. Assumptions were met for sample size, cell frequencies, and multi-collinearity. Sample size was deemed adequate with 113 cases since 20 cases per predictor variable is suggested to perform a logistic regression analysis (Polit, 2010). A logistic regression was performed with the standard deviation set to 3 to check for the presence of outliers. No outliers were found. The variables were entered in one block. Race was not significant in contributing to the model and was removed from the analysis.

A final logistic regression analysis was performed simultaneously using Enter with the TEAS score, English as the Primary Language, and years since completing science prerequisites to predict ILT. The model was found to be statistically significant ($p < .001$) and accounted for 21.2 to 36.3 % of the variance ($-2 \text{ Log Likelihood} = 72.201$). The Hosmer and Lemeshow Test indicated the model fit ($X^2 = 8.230$, $df = 8$, $p = .411$) for predicting proficiency on the ILT. The model correctly classified 87.6% of the cases. The overall effect size was moderate, with Nagelkerke R^2 equal to .363. Regression coefficients are presented in Table 16. Three of the variables, TEAS ($p = .004$), English as their primary language ($p = .010$), and science prerequisites (for 3 years, $p = .008$; for 2 years, $p = .023$; for 1 year, $p = 0.022$) were significant predictors of information literacy.

Table 16. Logistic Regression Coefficients in Predicting Information Literacy (N = 109)

	<i>B</i>	<i>Wald</i>	<i>df</i>	<i>p</i>	Odds Ratio	95% CI	Odds Ratio
TEAS	.258	8.446	1	.004*	1.294	1.088	1.539
English as their primary language	2.148	6.680	1	.010*	8.571	1.681	43.708
Science 1 year		7.597	2	.022*			
Science 2 years	1.869	5.205	1	.023*	6.479	1.301	32.256
Science 3 or more years	2.471	7.104	1	.008*	11.839	1.923	72.879
Constant	--23.168	9.380	1	.002	.000		

Wald statistics indicate that lower ILT scores are predicted if students have lower TEAS scores, English was not their primary language, and science prerequisites were older by two or more years. If a student does not have English as their primary language, a student is 9 times as likely to be not proficient in information literacy. If a student's science prerequisites were older than two years, a student was 6 times as likely to not be proficient in information literacy while science prerequisites that were older by three or more years indicated that a student was 12 times as likely to be not proficient in information literacy.

For the TEAS score, every point increase in the TEAS score will have one point increase in the ILT score. The odds ratio is best used with categorical variables and the interpretation of a continuous variable may not be as clear (Munro, 2005, p. 313). The TEAS was recalculated for a change of more demonstrative effect on the scores with the ILT using the natural logarithm which logistic regression used in the model. A change of 5 units was calculated for TEAS using the natural logarithm calculation with $e^x = 2.718^{(5 \times \beta)} = 2.718^{(5 \times .258)} = 2.718^{(1.29)} = 3.63$. This means that for every 5 point change in the TEAS score, the ILT score increased by 4 points.

Using predicted probabilities (ILT =1), the scatterplots in Figure 2 reveal the interaction for students who have lower scores in information literacy and lower TEAS scores, English is

not their primary language, and the science prerequisites are not completed within 1 year of starting the program. The relationship of the three predictor variables with the ILT predicted probabilities is curvilinear with a positive increase that gradually flattens for those with 1 year and 2 Years since completing science courses. For those who do not have English as a primary language, all three scatterplots display a positive increase on the ILT predicted probabilities with the TEAS and years since science prerequisites.

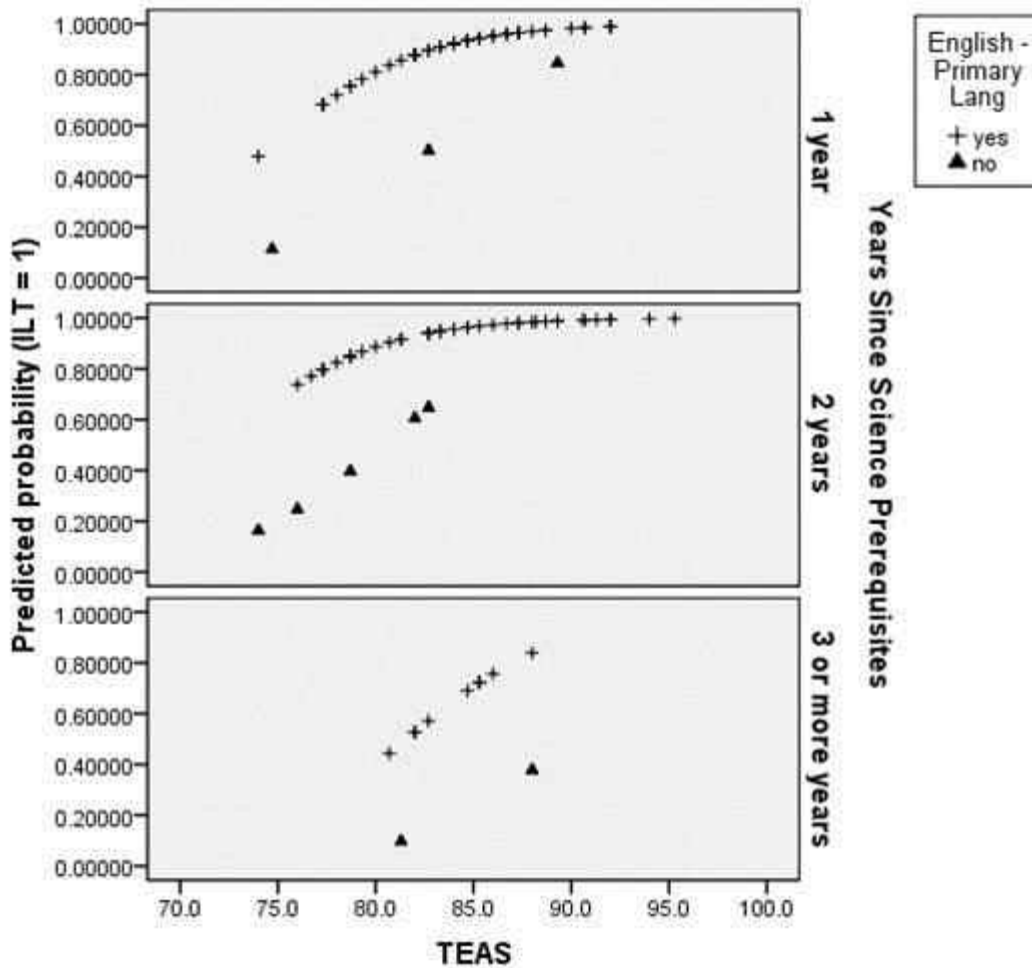


Figure 2. Predicted Probabilities (ILT = 1) with TEAS, English as the Primary Language, and Number of Years Since Completion of Science Prerequisites

A correlation co-efficient was calculated using the predicted probabilities of the ILT and the bivariate outcome for the ILT to determine the effect size index (Polit, 2010). The correlation coefficient ($r = .55, p < .001$) reveals that the effect size is modest for the study and consistent with nursing studies (Polit).

CHAPTER FIVE: CONCLUSION

This chapter discussed findings and implications of two research questions: 1) What are the information literacy (IL) competency levels of students entering their junior year in a traditional baccalaureate nursing program and 2) Are demographic and educational factors predictive of information literacy skills in students entering their junior year in a traditional baccalaureate nursing program? This chapter will address implications for nursing education approaches related to IL, discuss policies that may affect IL assessment and support, make recommendations for future research on information literacy in nursing education, and identify the limitations of this study.

Major Findings on the Information Literacy Competency Levels in Nursing Students

Though a limited number of studies exist that examine information literacy in nursing students, this study was the first to use the Association for Colleges and Research Libraries (ALA, 2000) IL competencies as a guide. This study also used a standardized test to assess IL skills objectively in nursing students since no studies were found to exist using a standardized test on beginning competency levels in nursing students. In addition, this study provides a beginning reference measure on assessing students' IL competency levels upon entering a nursing program which will allow for replication of the study to provide ongoing knowledge in this overlooked area of nursing research.

Of the 120 traditional students who participated in this research, 102 junior students entering the baccalaureate nursing program were classified by their performance on the ILT as information literate. Their mean ILT score was 43.64. This finding is not unexpected since these the nursing students in this study had a mean GPA of 3.6 and a mean TEAS test score of 83.82

upon admission to the program. What may be of interest is that the students in this study acquired their prerequisite credits from multiple educational institutions and it is unknown what the caliber of IL requirements is at the feeder institutions. Results indicate beginning general competence on information literacy for this sample.

Raw scores for sophomore students at JMU (N = 524) and freshman students at four year institutions (N = 683) and two year institutions (N = 839) had mean scores and standard deviations of 41.61 (8.45), 36.12 (7.71), and 35.7 (7.92), respectively. As compared in Table 9, the raw scores for the total scale from the JMU and the other institutions were not as high as the mean raw scores and standard deviations for this sample.

Table 17. Comparison of Mean Raw Scores with Standard Deviations using ACRL Competency Standards

Institution	CS1	CS2	CS3	CS5	Total Scale
Sample (N = 120)	9.59 (1.637)	11.09 (2.362)	15.42 (2.052)	7.54 (1.485)	43.64 (5.243)
JMU (N = 524)	9.70 (2.03)	11.16 (2.91)	13.52 (3.31)	7.18 (1.84)	41.61 (8.45)
Four, four year institutions (N = 683)	8.47 (2.00)	8.67 (2.53)	12.15 (3.04)	6.44 (1.90)	36.12 (7.71)
Five, two year institutions (N = 839)	8.47 (2.08)	8.28 (2.54)	12.14 (3.14)	6.45 (1.89)	35.77 (7.92)

(Russell, 2009)

When comparing the raw scores provided by Cameron et al. (2007) at James Madison University (JMU) and the online test booklet from Madison Assessment, LLC (Russell, 2009) with the raw scores of the students in this sample, the mean raw scores were fairly consistent

with students in this sample. However, the students in this sample had slightly higher raw total scores with less variability in the standard deviations. Sophomore students from JMU and the four, four year institutions had similar means and standard deviations to this sample in the study. For CS1, the mean and standard deviation for this sample was 9.59 (1.637) while the mean scores and standard deviations from the test developers at JMU and the online test booklet was 9.70 (2.03), 8.47 (2.00) at four year institutions, and 8.47 (2.08) at two year institutions. For CS2 the mean raw score and standard deviation in this sample was 11.09 (2.362) which was similar to JMU at 11.16 (2.91), but higher than the mean scores from the four year institutions and the two year institutions 8.67 (2.53), and 8.28 (2.08), respectively. CS3 raw mean score for this sample was 15.42 (2.052) which was higher than the mean raw score at JMU ($M = 13.52$, $SD = 3.31$), four year institutions ($M = 12.15$, $SD = 3.04$), and two year institutions ($M = 12.14$, $SD = 3.14$). For CS5, the raw mean score was 7.54 with a standard deviation of 1.485 in this sample. Students at JMU had a raw mean score of 7.18 ($SD = 1.84$) while four year institutions had mean scores of 6.44 (1.90) and two year institutions had mean scores of 6.45 (1.89). Overall, the students in this sample did equal or better on the ILT than the three student groups provided by the developers of the ILT (Cameron et al., 2007) and the online test booklet information from Madison Assessment, LLC (Russell, 2009). One reason for students in this study to have higher scores is that these students were junior students and not beginning freshman or mid-year sophomore students as the students at JMU and other academic institutions in the test results. Students in this study may have had more exposure in using IL since the nursing students were juniors level students.

Similar to this study, three peer reviewed articles in the library and information science literature report limited findings on the ILT (Gross & Latham, 2007, 2009, 2012) with freshman

students but only two of the three studies provide means and standard deviations for the ILT scores. The mean score was 39.25 with a standard deviation of 6.81 for the 51 freshman students in their study (Gross & Latham, 2007) while in a later study with two groups of first year students from two different universities, the means were 44.44 (SD = 11.72) and 53.74 (SD = 12.32), respectively (Gross & Latham, 2012). The scores for the students in this study were higher than one group of freshman but lower than another group as reported by Gross and Latham since the students in this study were juniors in their third year of college. This can be a concern but one reason that the scores are not higher in this study is that the students come with various educational backgrounds from their first two years of college and it is not known how much emphasis is placed on information literacy at these educational institutions. Analysis patterns for students who score below “proficient” may indicate the need to readjust prerequisite courses that are discussed in educational implications.

The Cronbach’s alpha for this sample ($\alpha = .696$) is lower on the total scale and subscales as compared with results provided by the test developers at James Madison University (Cameron et al., 2007) and in the online test manual from Madison Assessment LLC (Russell, 2009). The reliability level is minimally acceptable, and therefore, statistical power may be reduced which can increase the risk of a Type II error. This lower alpha requires caution in interpretation of results since only 69% of the variability in the ILT test scores is attributed to the correct individual differences in the information literacy construct while the remaining 31% reflect random fluctuations in the scores (Polit, 2010). Note though that Waltz, Strickland, and Lenz (2005, p. 142) state that the alpha is dependent on the distribution of the scores. With low variance and skewed test distribution and a homogenous sample, Cronbach’s alpha may be lower. The distribution of the scores in this homogenous sample had a negative skew (-.525) and

a narrow standard deviation in the scores ($SD = 5.243$). The lower Cronbach's alpha in this study may have resulted because the information literacy competencies may measure four distinct dimensions in the each of the subscales and the Cronbach's alpha is used to measure one dimension. Additionally, factor analysis is traditionally used to identify the dimensions of a test but the test developers never indicated the use of a factor analysis to identify dimensionality of the test. A factor analysis was not completed on the ILT by the principal investigator for this study since this was not the focus of this study.

In summary, the majority of students in this sample were information literate as determined by the Information Literacy Test from Madison Assessment LLC (Russell, 2009) and have a general knowledge on information literacy. The use of the ILT allows for cross comparison of student groups. The implication is that the majority of students in this sample are ready to learn content that is specific to the discipline of nursing and needed for evidence-based practice with their demonstrated information literacy skills. This study begins to fill the gap that exists in the nursing literature whereby no studies exist using a standardized assessment to measure information literacy in nursing education.

Student Performance on the Individual Subscales of the Information Literacy Test

Competency Standard 1

Competency Standard 1 (CS1) expects students to determine the nature and extent of the information needed in a particular search (ALA, 2000). The majority of students in this sample have acquired knowledge on the performance indicators for the ACRL CS1. Only one question, on acquiring a resource, was answered incorrectly by less than half of the 120 students. Students in this sample may not have encountered a reason to consider the costs or benefits of acquiring

the needed information. The test developers of the ILT only provide a brief description without specifying the exact content of the question.

Though no specific nursing studies were found to use the ILT or any other standardized assessment for IL, a limited number of nursing studies discussed elements consistent with CS1 by nursing students for class assignments with designated topics. Gannon-Leary et al. (2006) found in their citation analysis on sources of information and accessing information that 16 nursing students understood the need for a varied range of resources to develop a strong knowledge base for projects. In teaching evidence-based practice to students, Smith-Strom and Nortvedt (2008) used the PICO (problem, intervention, comparison, and outcome) format to have 48 students formulate a targeted question from two assigned research articles which provided the basis for the need for information. However, no discussion was provided in this study on how well the students actually performed this function. Class assignments in these studies required the students to identify when they needed to find information and to access a wide variety of information resources. Jacobsen and Andres (2011) noted that time constraints limit nursing students in their ability to select their own topics which would allow a wider interpretation on student abilities to know when they need knowledge and to know the nursing resources available at each institution. This lack of self-selecting a topic in assignments may have broader implications as students go from school into practice. For CS1, nursing students in the currently reported study are able to define the need for information outside the context of a given assignment.

The gaps in the nursing literature indicate that limited studies assess CS1 but the students are provided the topics for assessment of their skills. Students may produce a better quality assignment if they are allowed to choose topics of interest for assignments. In a mixed mode

study from information and library science, Gross and Latham (2009) used the ILT to measure IL in their study with perceptions and self-reports of information literacy on information seeking in 20 freshman. The processing of information was not seen as being important nor was learning new IL skills important to the students in their sample. Curiosity and self-interest in a topic was found to be positive in promoting a student's interest in finding information. Students believed that they would make better choices of needed information for assignments if given the opportunity to pursue a subject of interest to them (Gross & Latham, 2009).

In summary, the majority of students in this study are information literate on CS1. These skills have been acquired through their general education studies and nursing school prerequisites before entering the nursing program. Only one performance indicator on acquiring a resource posed problems for half of the students in this study. Current nursing studies indicate that measurement of CS1 in nursing students has been mainly through assigned topics and journals for students on defining and articulating the need for information. The implications are that students are knowledgeable on recognizing when they need information outside the context of nursing and are ready to learn to build on this knowledge as it pertains to the discipline of nursing.

Competency Standard 2

Competency Standard 2 requires students to access needed information effectively and efficiently. For Competency Standard 2 (CS2) the students in this study appear to have partial knowledge on the performance indicators for CS2. Students had difficulty in answering questions on database querying, searching for publications, search operators, accessing a publication, and type of reference. Appendix I displays the results of the CS2. The results of this

competency standard suggest that at least half of the 120 students in this study lack sufficient IL basic skills to carry out accessing information efficiently and effectively and are not prepared to be taught accessing and searching the information in nursing.

Similar to this study, there are limited studies found in the nursing literature that indicate students have the most problems with CS2. Many studies in nursing education focused on the self-assessment of skills or perceptions, attitudes, and confidence in using IL skills. Using a library database survey with 30 students in the United States, Schutt and Hightower (2009) found that 22 of the 30 RN-BSN students had difficulty in selecting the correct database and required more specific instructions on literature search techniques. Even with additional instructions, students needed assistance on using appropriate search terms, truncation, and Boolean operators (Schutt & Hightower). A quasi-experimental study indicated that 480 Norwegian nursing students had an initial lack of knowledge to conduct efficient search strategies in using Boolean operators, truncation and MeSH/Cinahl headings, and inability to identify the URL (Jacobsen & Andenaes, 2011). Craig and Corral (2007) developed 14 multiple choice questions to assess students on IL that are based on the previous Five Pillars of SCONUL IL from the United Kingdom which sets the standard for IL in that country. SCONUL stands for The Society of College, National and University Libraries (2011) that provides representation for all of the university libraries in the United Kingdom and Ireland similar to the role of the ACRL in the United States. SCONUL IL expanded the Five Pillars to have Seven Pillars of Information Literacy in the model. The Seven Pillars are to: Identify - Recognize the need for information, Scope - identify ways to address the gap in information, Plan - construct strategies for locating information, Gather - locate and access information, Evaluate - evaluate the information, Manage - organize and communicate information, and Present - synthesize and present the information

(The Society of College, National and University Libraries, 2011). Craig and Corral in this mixed-mode study found even after instruction that 20 of the 29 United Kingdom students in their first semester needed assistance on selecting appropriate search terms. Unlike some of these other studies on perceptions, attitudes, and confidence in using IL, one study did use citation analysis to quantify frequencies of citations on 40 nursing students on information seeking characteristics (Gannon-Leary et al., 2006) and another study used an assessment rubric on database search skills on 60 students (Carlock and Anderson, 2007). Students in these studies did not broaden their search terms, set too many limits on initial searches, or reverted back to using key word searches from previous search habits.

The gaps in the nursing literature are that the articles did not focus on understanding the basic IL skills that a student possesses on entering nursing, only on the outcomes of teaching IL. Many of the studies also did not report validity and reliability of their assessment instrument with many of the tools self-assessing IL skills by the nursing students. The self-assessment of IL skills and other studies on perceptions, attitudes, and confidence of IL skills does not provide a clear representation on actual IL skills in beginning nursing students.

In summary, student performance in this study is consistent with findings on other studies where CS2 poses problems for students accessing information. The gaps in the literature indicate that the focus of information literacy has been on outcomes of education programs and not on assessment of CS2 skills since many research articles based their outcomes after an instructional IL program to students in their nursing program. This study demonstrates that there is verification that nursing students are not well-prepared in CS2 skills as they enter nursing school. The implications are that students entering nursing programs need to be taught basic IL skills to access information even if they perceive themselves to be competent. Students need to be taught

to access nursing resources in using the different types of databases for querying, searching for publications, accessing of publications, and publication types available in the nursing and health literature.

Competency Standard 3

Competency Standard 3 (CS3) focuses on evaluating information and its sources critically and incorporating selected information into one's knowledge base and value system. For CS3, only one of four questions on reading data from a table posed a problem for a large majority of 120 students in this sample who did not answer the question correctly. Similar to students in this sample, an early study indicated that faculty and students perceived that they still needed improvement in evaluating and critiquing information found for their assignments throughout the nursing program (Verhey, 1999). Later studies found that nursing students were confident in the use of primary resources for their assignments, however students were challenged to make a judgment on the resources credibility and in their ability to apply the resources to a broader context outside their specific nursing topic of interest when questioned (Gannon-Leary et al., 2006; Schutt & Hightower, 2009).

Since no specific explanation was provided by the test developers of the ILT on the types of tables used to differentiate the questions on using data from a table in the ILT, the difficulty lies in discerning what caused so many students in this study to answer the one question incorrectly. One explanation is that the table was a complex table and the students may not have been educated on a complex table, such a nested table, where statistical data may have been presented. A gap in the literature exists since we have no information on nursing students and their understanding of data in tables. None of the literature specifically discusses the difficulty

that undergraduate students may have in interpreting data from tables in research studies used for assignments in a nursing research or evidence-based nursing course. Hayat, Eckardt, Higgins, Kim, and Schmiede (2013) stated that undergraduate students in nursing programs are admitted with evidence of completion of a general statistics course. Computation of statistics in these courses are calculated manually using a statistical calculator or/and software applications. Many statistics courses do not include a practical application of reading and understanding statistics from a journal. Jacobsen and Andenaes (2011) suggested that increasing the number of nursing assignments with bibliography and Internet resources during a clinical experience, may have led to a better understanding by students on using IL for evidence-based practice in the clinical. Only through practice in reading nursing journals, will nursing students be prepared to understand data from tables and be better equipped in nursing for evidence-based practice. There are implications related to students' ability to construct their own tables which may be necessary to support synthesis of information from a variety of sources.

In summary, students in this study are competent on CS3 but students may not have a clear understanding of evaluating some types of data from a table. The gaps in the literature indicate that CS3 skills have limited discussion in the literature and have not been tested with nursing students. Another gap is that no studies exist addressing the difficulty that nursing students may have reading a table, particularly related to statistics and tables found in scholarly journals. The implications are that students need practice reading and understanding the data presented in nursing journals throughout the curriculum in both written and clinical assignments.

Competency Standard 4 was not assessed by the ILT which focuses on producing a product or service.

Competency Standard 5

Competency Standard 5 focuses on students being able to understand economic, ethical, legal, and socioeconomic issues in using information and accessing information (ACRL, 2000). For CS5, knowledge on ethical/legal issues on using a source, knowledge of proper citation and knowledge of creating a reference may be sources of concern since less than 70 students in this sample were able to answer three of the ten questions correctly. Similar to the students in this sample, a few studies found that students lack an understanding of the formatting style that is specific to the discipline of nursing. Wallace et al. (2000) demonstrated that practice on writing bibliographic citations by students in their curriculum led to differences between pre-program and post-program nursing students in their constructing a citation using a Harvard reference formatting. Tarrant et al. (2008) found significant improvements in the use of American Psychological Association (APA) style formatting knowledge in their nursing students after a curricular intervention. In a more recent study, Schutt and Hightower (2009) identified that the nursing students had extremely low proficiency in use of APA style formatting for their citations and references.

Gaps in the literature indicate that a clear understanding of nursing students' comprehension on CS5 is limited since only formatting style was discussed in the studies. The studies did not consider whether nursing students understand the impact of ethical, legal, and socio-economic issues when using information nor does the literature address nursing student compliance with regulations such as copyright on using information. A number of studies took place outside the United States where the regulatory and cultural issues are different for each country which may be a limiting factor in the reporting of CS5 in some studies.

In summary, students in this sample are information literate on CS5 with the exception of copyright issues related to using a resource, knowledge of resources for a proper citation, and knowledge of creating a reference. A few studies in the nursing literature discussed the lack of knowledge on using a specific style for the discipline of nursing but there is a gap in the literature on what students know about using information when they write. The implications are that nursing students have basic knowledge of IL on some issues surrounding the use of information from CS5 and that the students need additional support on the style for documenting nursing literature.

Summary of the Competency Standards

In summary, students in this study were information literate on a number of performance indicators of the ACRL competencies as measured by ILT. Competency Standard 2 accessing information efficiently and effectively on the ILT posed the most problems for students in this sample since a higher percentage of the questions on the ILT were answered incorrectly by the students. The low scores specifically on Competency Standard 2 support what the nursing and health literature has shown to be a consistent theme in IL research education - additional instruction and practice on accessing and searching for literature.

Other areas of concern on IL skills with some of the students in this sample were not being able to understand and to use data from a table, and on ethical/legal issues on using resources, proper citations, and creating a reference. These areas of weakness in IL provide faculty with topics of reference since these areas can be integrated on assignments within the courses.

However, some of these study results may be explained in part by an additional Student Opinion Survey (SOS) completed immediately after the test from Madison Assessment, LLC (2012). The SOS results indicated that 39 out of the 120 students in the sample agreed or strongly agreed that they could have worked harder on the test. Seventy-seven percent of these students either agreed or strongly agreed that they were engaged in a good effort to take the test while 78% agreed or strongly agreed that they gave their best effort on the test. Engaging the student on taking the test may be a continuing problem because the test is not a high stakes test for the students and students take the test between limited class periods. Scheduling the test during a class may provide improvement in ILT scores.

None of the nursing studies found for the literature review allowed for comparison of information literacy levels with the nursing student population in this sample. The nursing studies did not use a standardized assessment test to assess IL skills. The studies did not clearly identify the specific ACRL competency standard being studied. Of the nursing studies using an assessment of IL skills, the studies used self-report by the students that has obvious limitations.

Predictors of Information Literacy

This is the first study to examine systematically predictors of information literacy as measured by the ILT. Higher scores on the ILT were related to higher TEAS scores, English as a primary language, fewer years since taking the science prerequisites, and classification of White race. The TEAS score was statistically significant with the ILT scores in four different analyses: the ANOVA ($p < .001$), the Pearson Correlation Coefficient ($p < .001$), the simple regression analysis ($p < .001$), and the logistic regression analysis ($p = .004$). This finding of a relationship existing between the TEAS and the ILT is a new, noteworthy finding in predicting information

literacy in nursing students. However, the eta square for ANOVA indicated that only 8.7% of the variance in the ILT score can be explained by the TEAS and the simple regression analysis similarly indicated a small relationship between the TEAS and the ILT. Nonetheless, using a standardized test such as the ILT quantifies the relationship and will allow for future comparisons among students in nursing programs. Similar studies have found a relationship using the TEAS with other standardized tests and GPAs in predicting passing of the NCLEX-RN exam for licensure (McGhee, Gramling, & Reid, 2010; Rogers, 2009; Trofino, 2013) but no studies in nursing education have been conducted using the TEAS and the ILT. Having these proficiencies on the TEAS may provide a basis for having mastered foundational IL skills as students proceeded through their liberal arts and prerequisite courses for admission to the nursing programs. This finding also means that nursing students possess basic information literacy skills when graduating from a baccalaureate nursing program.

A new finding is that English as a primary language (ESL) is a predictor of IL in nursing students. Note that the Phi coefficients in the Chi Square analysis for English as their primary indicate a weak relationship with the ILT (Polit, 2010) but the reliability of the ILT test may have affected this result (Norman & Streiner, 2008). The confidence interval for odds ratio are within the limits. No studies exist on information literacy that specifically includes English as their primary language in nursing. A few studies exist that examine perceptions and ESL on academic library usage. Dabbour and Ballard (2011) found in study of college student perceptions on IL skills that differences were found between Latino students and white students in California. Long (2011) indicated that Latino students in the Midwest need an exemplar of other peers using the library resources, need cultural understanding and support in using libraries, and an explanation on the range of library resources available and support by the

library. In addition, looking at cultural differences among the amalgamation of students in colleges across the United States may provide insight into problems for students in higher education who do not have English as their primary language. Kanno and Varghese (2010) in their qualitative study at a major public university suggested ESL students may not only have language constraints but institutional constraints, limited financial resources, and ESL students' self-limiting behavior from lack of legitimacy in the college community.

In nursing, as early as 1997, Endres found that foreign born students spend more semesters in nursing programs from course failures which translated to not being successful in passing the NCLEX-RN licensure exam. Linguistic challenges have been discussed in a number of articles with ESL students as nursing students (Bosher & Bowles, 2008; Olson, 2012; San Miguel, Townsend, & Waters, 2013; Scheele, Pruitt, & Johnson, 2011). Salamonson, Everett, Koch, Andrew, and Davidson (2008) demonstrated that a relationship exists between ESL students and academic success some of which may be attributed to information literacy. Olson (2012) recommended faculty be knowledgeable on methods to increase ESL student success in nursing programs. San Miguel et al. (2013) suggested that academic institutions need to respond by providing support to incoming ESL students through collaboration of nursing faculty and language teachers. Not only does faculty need to support students who do not have English as their primary language in nursing studies but this finding also means providing supplementary support is necessary to these students in learning information literacy for success in nursing.

A relationship between years since taking science prerequisite courses for entrance into the nursing program and information literacy is a serendipitous finding in this study. The number of years since taking science prerequisites was statistically significant for the Chi Square analysis ($p = .036$) and the logistic regression analysis for one year ($p = .02$), for two years ($p = .02$), and

for three or more years ($p = .008$). However, the Cramer's V coefficient for number of years since taking science prerequisites indicates a weak relationship with the ILT score in the Chi Square analysis but odds ratio in the logistics regression falls within the confidence intervals (Polit, 2010). Five of the seven students in this study who indicated in the demographic questionnaire that their science courses were older by three or more years were not information literate. Per ALA (2013), information literacy has a relationship to information technology skills, which requires the user to be familiar with computers, software applications, and databases that have a basis in science and mathematics. The National Science Education Standards implicated a relationship between information literacy and science literacy (Laherty, 2000) but this has not been studied to date. Students with general education credits and nursing prerequisites credits are accepted into the undergraduate nursing program without a limitation on years since earning those credits. Similarly in nursing, science scores on the TEAS (2009) and science GPAs (McGhee, Gramling, & Reid, 2010) were found to be predictors of NCLEX-RN success. Though students may know how to use a computer and the Internet for their own purposes and referred to as Net/Milleneal generation (Skiba & Barton, 2006), but new students are usually unfamiliar with the technology used in academic institutions as well as in nursing programs and they require assistance to learn the specific information literacy requirements. The TEAS does have subject specific scores on science which may be useful in the future in confirming a relationship with information literacy.

Two other demographic factors were statistically significant with the ILT. Being classified as White race was related to higher information literacy scores ($p < .001$) in the Chi Square analysis. Eight of the 12 students in this study who indicated on the Demographic Questionnaire that they were non-white were not information literate based on the ILT. The Phi

coefficients for race indicate a weak relationship with the ILT (Polit, 2010). However, race as well as other factors did not have a relationship with information literacy that was previously suggested in IL studies from information and library science on library use and satisfaction with IL skills (Whitmere, 2001, 2003). A positive, small correlation was found to be statistically significant ($p = .01$) between age and hours working indicating that as the age increased so did the number of hours working while going to school. This finding is not unusual since older students may have to work to support themselves and families as they go through school without financial support.

In summary, the findings in this study support a relationship between higher ILT score and higher TEAS scores, English as their primary language and fewer years since taking science prerequisites in predicting information literacy in nursing students. IL skills are central to many different aspects of student learning. These findings fill an important gap in the literature where demographic and educational factors are examined in relation to information literacy skills in nursing students. Neither studies in the nursing literature nor studies in the information and library science literature examined demographic and educational characteristics as important factors related to information literacy in nursing students.

Limitations of the Study

A number of limitations exist with this study. The low Cronbach's alpha of the ILT suggests thoughtful interpretation of the results of this study with this population and possibly other homogenous populations. With additional testing on different populations of nursing students, the ILT may provide assurance that students entering a nursing program are information literate.

Though the recommended sample size was achieved for the study, this study cannot be generalized to the general nursing student population except for the traditional baccalaureate nursing students at a program similar to the setting of this study. The sample was a convenience sample of self-selecting students mainly from one university site. Additionally, the research design only allows for the determination of IL skills in baccalaureate nursing students at one point in time, upon entrance into the nursing program. This study is a starting point to understand IL skills of students entering into baccalaureate nursing programs in the US since no research exists using a IL standardized test for measurement with this population. Using other research designs to follow students throughout the program for changes in their skills from entrance into the nursing program into practice would help to determine maintenance of IL skills for evidence-based practice for improving patient care as well as life-long learning.

Due to a smaller sample size for the second question, the power of the statistical analysis to detect differences and predict a student profile was lowered. The ILT instrument was designed to be used with two year and four year college students. Use of the ILT with traditional nursing students represented a different application for a report of the ILT instrument. The ILT assessment demonstrated validity and reliability with different college students, but further analysis for internal consistency was recommended by the test administrators and was assessed for this study (Russell, 2009).

Only a small percentage of the students in the study participated from the satellite campuses which may limit the external validity of the study. The challenges of recruitment issues posed problems on one campus may be eliminated by completing a pilot study on each of the campuses prior to the actual data collection. Issues such as scheduled timing, other days for testing, and more contact with the campus faculty and staff may help to mitigate the problems.

Adding a focus group with this particular faculty, staff, and students may help to determine why problems exist for recruitment on this particular campus with not only this study but other activities as well.

Theoretical Implications

The ACRL competencies on information literacy (IL) succeeded in guiding this study to assess basic IL skills of nursing students since each of the test items corresponded to four of the five competencies excluding CS4. Of note though is that the ACRL Competencies are only a framework for assessing an individual's IL skill (ALA, 2000, p. 5). One problem with this framework is that it does not take into account other factors that may affect an individual's IL skills. Other factors have been implicated in studies on IL as this study demonstrated. Personal characteristics, such as English language in this study, support this thought. Years since taking science prerequisites are a cognitive factor that is linked to IL skills.

A few studies identified anxiety, insecurity, and frustration affecting students' confidence as they proceeded through the process of finding information in nursing and other disciplines (Fox et al., 1996; Gross & Latham, 2012; Tarrant et al., 2008). These negative feelings led to students' abandonment of the search or just using what was found which could lead to using inappropriate information resources for assignments.

In summary, this study supplied initial answers on a few factors that may affect information literacy skills in nursing students. Questions still remain on other implied factors from the literature such as age and computer expertise that were suggested to affect IL skill development in all students (Whitmere, 2001, 2003). Further exploration is needed to identify

other factors affecting IL competencies that would initiate the development of a model or theory on IL competencies in nursing students.

Nursing Education Implications

Nursing faculty are charged with the responsibility of ensuring baccalaureate nursing students develop evidence-based practice in nursing which requires building of previous knowledge on basic IL skills. However, faculty may believe that all students enter nursing programs with these IL skills and are ready to start using IL skills that are specific to the discipline of nursing. This misconception may be because baccalaureate nursing students enter with a higher GPA and standardized entrance exams for nursing programs yet may only have minimal IL skills.

This study demonstrates that not all students enter nursing programs with the same basic IL skills. In general, nursing faculty members have subjectively identified those students who are not successful in writing papers or creating a project. But this may occur a few months after entering a nursing program and not at the beginning of the program. Creating faculty awareness of IL limitations in students would help faculty to create a path to build on an individual student's IL skills especially if a faculty member is new to academia. Specific student characteristics such as those identified in this study would alert faculty that this student may have problems in self-monitoring on IL in nursing. The faculty could augment this monitoring by providing a student with additional assistance from the librarian.

Faculty collaborations with academic librarians and a writing center need to be created and sustained for undergraduate nursing students just as they do for graduate students. Though many undergraduate nursing research courses monitor IL skills subjectively, other courses need

to incorporate IL skills so that students have the opportunity practice IL skills. A number of suggestions are available to faculty to have students to practice IL skills in courses. Allowing students to use a topic of their choice for an assignment may produce a better paper or project since their curiosity may be peaked through this motivation. Since students had difficulty in understanding tables for one question on the ILT, this problem may also imply that students may struggle with creating tables for assignments. Faculty need to require nursing students to practice this skill when they develop a written assignment for some courses such as nursing research or a similar course as well as understanding how to read a complex table. Presently, librarians are in the process of writing subject specific IL competencies for nursing (Phelps, 2013) that specifically incorporate the ACRL competencies and the requirements for accreditation of the nursing programs.

Incorporating the IL requirements within grading rubrics may guide students to use IL more appropriately if faculty has not already done so with the current ACRL competencies. Requiring the ACRL competencies in a major writing assignment would provide the opportunity for a dialogue between the student and the faculty. The use of specific resources for an assignment as a requirement in the grading rubric would direct students to make better choices on using peer reviewed journals to support their assignments both in class and in clinical. If a web-based course is used for teaching the class, allowing a librarian within a course is a valuable aid for questions on library resources throughout the course. With limited time during a clinical, another option is the incorporation of IL competencies into simulation assignments as an alternative method for students to practice IL skills in a clinical situation.

Nursing Research Implications

This study and the nursing literature have implied that some baccalaureate students may lack knowledge on information literacy when they enter a nursing program. Many of the nursing studies suggest that they are using the ACRL framework to guide the research but none of the studies identify which specific competencies the study is focused on. Additionally research using a standardized instrument such as the ILT would help to measure information literacy quantitatively in nursing education. The ILT from Madison Assessment LLC (2012) is a starting point to objectively measure the IL skills that nursing students may possess upon entering the nursing program and to assess if remediation in IL is needed.

A comparison between different types of nursing programs would also enhance external validity of the ILT. Outcomes can be measured in a longitudinal, quasi-experimental design by adding questions to supplement the ILT that specifically measure the context of nursing before graduating from the nursing program. Other studies might examine critical thinking scores, math scores, and science scores from the TEAS test with the ILT scores.

The ILT needs to be used in other studies to check the reliability with different populations since reliability was low in this study and was not reported in peer reviewed journals. A standardized instrument would also allow for replicating and understanding IL in nursing education which has been absent to date. Research with different nursing student populations would add to the knowledge base on the skills of students such as entering RN/BSN programs and the community college nursing programs since we do not know the IL skills in these students. This is particularly important with the expectation of increasing the number of bachelor's prepared nurses in the next few years. Though the majority of RN/BSN students are usually younger (Altman, 2011), some returning students may have not been in school for as

little as one month or as much as 30 years since their last class. Additionally, different research designs such as a quasi-experimental design with a control group would add another dimension on research of IL in nursing students. A consistent, easy approach is needed to test different populations such as the RN/BSN distance learning students. Only online tests exist for all of the standardized information literacy tests with a secured testing environment through proctors and these restrictions need to be taken into consideration when planning a research study using any of the current standardized tests.

A new instrument needs to be developed to demonstrate both nursing student and nursing program success in using evidence-based practice skills that are specific to nursing. The ILT has not demonstrated a strong reliability as discussed previously. Assessment tests should be based on both beginning skills from the ACRL Competency Standards (ALA, 2000) as well as competency standards that are specific to nursing (Phelps, 2013). Additionally, there needs to be studies to examine other factors that may contribute to poor IL skills. This study supports that there are intervening factors contributing to the development of IL skills but other factors need to be considered such as anxiety as previously discussed.

Nursing Policy Implications

Nursing education supports integrating information literacy throughout the curriculum of study. Standard setting bodies such as American Association of Colleges of Nursing and Southern Association of Colleges and Schools have included some tenet of information literacy in academic coursework. Incoming freshman within their general education courses and within their discipline of study usually receive education on information literacy in their course of study, directly or indirectly, consequently every student may not learn this knowledge equally.

This study on demographic and educational factors of nursing students provides a beginning validation that some of the students have limited skills on basic information literacy as they enter a nursing program.

Information literacy skills are not necessarily seen as a priority assessment in nursing education given the limited studies found on the topic. Nursing programs are also not required to confirm if their students are information literate when they enter into a program. Reasons for this lack of substantiation may be for a number of reasons that include lack of funding, time constraints, curriculum requirements for accreditation and licensure, and limited faculty due to the nursing faculty shortage. Nursing education is already resource intensive compared to other disciplines in institutions of higher education. In this time of budget constraints, the allotment of funding for information literacy requires a commitment by nursing administration in schools to devote limited resources to information literacy.

Given that information literacy is required for evidence-based practice in nursing after students graduate, monitoring of beginning IL skills is essential to understand the progression of entering nursing students on information literacy for outcomes in nursing programs. Nursing administration does not need to necessarily change admission policies but those charged with making decisions must create an environment to enhance existing IL skills or to remediate the lack of basic IL skills of students entering nursing programs that will bolster student skills for evidence-based practice. Furthermore, nursing faculty may not have an adequate understanding of what IL is (Nayda & Rankin, 2009). Nursing education administration is charged with providing education to faculty on continued modifications in educational requirements by the nursing accreditation programs. These changes require an understanding of IL competencies to make necessary changes in curricula.

Nursing education administrators have the responsibility to ensure that students enter nursing programs with the best preparation possible that assists in building information literacy skills before students enter a nursing program. Information literacy uses “problem solving and critical thinking skills” (ALA, 2000, p. 3) therefore, requiring higher level math and science courses assist students in practicing to solve problems logically. Both math and science courses have been implicated in facilitating problem solving skills which result in nursing student success on passing both nursing program requirements and N-CLEX licensure exams (Rogers, 2009; Trofino, 2013). Nursing programs that do not require students to take the tougher algebra and chemistry courses may place students at a disadvantage in practicing problem solving and critical thinking that is needed for information literacy in nursing and evidence-based practice in nursing.

The collaboration that takes place between nursing education administrators and feeder institutions to the baccalaureate nursing programs would promote seamless transitions as students move between educational institutions. Students are admitted to baccalaureate nursing programs from different educational institutions as demonstrated in this study with varying IL skills. By knowing the IL skills that entering students have on admission, nursing administration has the ability to dialogue with these educational institutions on what IL skills are required for success in the baccalaureate nursing program. Voorhees (2001, p. 11) reasons that knowing the competency levels allows educational institutions to have open discussions on educational achievements and provides “transportability of student learning experiences” as they move between differing institutions.

Nursing education administration provides the means for collaboration of librarians with nursing faculty on achieving successful IL skills in nursing school applicants early in the

program. If this collaboration has been started, other processes to increase IL skill comprehension are required. Mandatory practice sessions in the library or in computer labs are known to mitigate early IL problems in students but not all nursing programs provide this requirement. As the literature indicates, allowing practice sessions of IL skills in the library under the supervision of a librarian has helped to promote better IL skills on Competency Standard 2 such as database querying and search terms. Possibly creating tutors with graduate or doctoral students in nursing may be another way to boost IL skills for those needing help. Only nursing education administration can direct the resources to build on the basic IL skills that are specific for the discipline of nursing.

Summary

This study fills a gap that has been identified from the nursing literature which is the IL competency assessment in the traditional baccalaureate nursing student using a standardized test. The majority of students in this study possess basic information literacy skills with the exception of a small group of students who may present with one or more of the factors found to be predictive of IL in this study. Three factors from the study inform us on the factors that influence information literacy of students entering a nursing program. Students with higher TEAS scores, English as a primary language, and fewer years since taking science prerequisites demonstrate higher information literacy and are ready to learn information literacy pertinent to nursing practice. If a student lacks any or all three of these factors, they may require additional assistance with IL as they proceed through a nursing program.

**APPENDIX A: ALIGNMENT OF INFORMATION LITERACY COMPETENCIES
WITH THE ESSENTIALS OF BACCALAUREATE EDUCATION FOR
PROFESSIONAL NURSING PRACTICE**

Information Literacy	The Essentials
<p>Need - The information literate student determines the nature and extent of the information needed.</p>	<p>Essential I: Liberal Education For Baccalaureate Generalized Nursing Practice 9. Value the ideal of lifelong learning is for excellence in nursing practice.</p>
<p>Access - The information literate student accesses needed information effectively and efficiently.</p>	<p>Essential III: Scholarship for Evidence-based Practice 2. Demonstrate an understanding of the basic elements of the research process and models for applying evidence to clinical practice. Essential III: Scholarship for Evidence-based Practice 5. Participate in the process of retrieval, appraisal, and synthesis of evidence in collaboration with other members of the healthcare team to improve patient outcomes. 7. Collaborate in the collection, documentation, and dissemination of evidence.</p>
<p>Evaluate - The information literate student evaluates information and its sources critically and incorporates selected information into his or her knowledge base and value system.</p>	<p>Essential V: Healthcare Policy, Finance, and Regulatory Environment 10. Articulate, nursing perspective, issues concerning health care delivery to decision makers within healthcare organizations and other policy arenas. Essential VIII: Professionalism and Professional Values 11. Accessing inter-professional and intra-professional resources to resolve ethical and other practice dilemmas. Essential III: Scholarship for Evidence-based Practice 4. Evaluate the credibility of sources of information, including but not limited to databases and Internet resources.</p>
<p>Use - The information literate student, individually or as a member of a group, uses</p>	<p>Essential IV: Information Management and Application of Patient Care Technology 1. Demonstrate skills in using patient care technologies, information systems, and communication devices that support safe nursing practice. 6. Evaluate data from all relevant sources, including technology, to inform the delivery of care. Essential III: Scholarship for Evidence-based Practice</p>

Information Literacy	The Essentials
<p>information effectively to accomplish a specific purpose.</p>	<p>6. Integrate evidence, clinical judgment, inter-professional perspectives, and patient preferences in planning, implementing, and evaluating outcomes of care.</p> <p>8. Acquire an understanding of the process for how nursing and related healthcare quality and safety measure are developed, validated, and endorsed.</p> <p>Essential V: Healthcare Policy, Finance, and Regulatory Environment</p> <p>10. Articulate, nursing perspective, issues concerning health care delivery to decision makers within healthcare organizations and other policy arenas.</p> <p>Essential VII: Clinical Prevention and Population Health</p> <p>5. Use evidence-based practices to guide health teaching, health counseling, screening, our age, disease and outbreak investigation, referral, and follow-up through the lifespan.</p> <p>6. Use information and communication technologies in preventative care.</p> <p>Essential IX: Baccalaureate Generalized Nursing Practice</p> <p>8. Implement evidence-based nursing interventions as appropriate for managing the acute and chronic care of patients in promoting health across the lifespan.</p> <p>11. Provide nursing care based on evidence that contributes to safe and high-quality patient outcomes within healthcare microsystems.</p>
<p>Understand - The information literate student understands many of the economic, legal, and social issues surrounding the use of information and accesses and uses information ethically and legally.</p>	<p>Essential I: Liberal Education For Baccalaureate Generalized Nursing Practice</p> <p>3. Use skills of inquiry, analysis, and information literacy to address practice issues.</p> <p>Essential III: Scholarship for Evidence-based Practice</p> <p>7. Collaborate in the collection, documentation, and dissemination of evidence.</p>

APPENDIX B: DEMOGRAPHIC QUESTIONNAIRE

1. Student Code: _____
 2. How old were you on your last birthday? _____ years old
- Please respond to the following questions by marking an x in the box.
3. Is English your primary language?
 1. Yes
 2. No
 4. Gender:
 1. Male
 2. Female
 5. Ethnicity:
 1. Hispanic or Latino
 2. Not Hispanic or Latino
 6. Race:
 1. Black/African American
 2. White
 3. Asian
 4. American Indian or Alaskan native
 5. Native Hawaiian or other Pacific Islander
 6. Mixed Race
 7. What is the current number of hours that you are working each week while attending school? _____
 8. Where did you complete your general education and prerequisites for the nursing program? (Check all that apply)
 1. High School Diploma
 - Dual Enrollment
 - AP Courses
 2. UCF
 - All coursework completed at UCF only
 3. Transfer Student
 - Community or two year college
 - Four year college (other than UCF)
 4. Prior Bachelor degree in another major
 - Yes
 5. Master's or higher degree
 - Yes
 9. What year did you complete your general education requirements for the nursing program? _____
 10. What year did you complete your science prerequisites for the nursing program? _____
 11. What year did you complete your other prerequisites for the nursing program? _____
 12. How many times did you take the TEAS test until you achieved the required score? _____
 13. What do you consider your level of expertise in using computers and software applications?
 1. Novice (Basic Skills in using word processor, spreadsheet, powerpoint, and limited success on searches on the Internet and library databases)
 2. Intermediate (Basic Skills plus skills in, databases, and successful searches on the Internet and library databases)
 3. Expert (Intermediate Skills plus knowledge on developing databases)
 14. Have you ever been taught how to use the Library in a formal course (eg. Information Literacy modules at UCF)?
 1. Yes
 2. No
 15. What is your preference for seeking information to answer a question?

- 1. Professional Journal
- 2. Textbook
- 3. Classmate
- 4. Internet
- 5. No Preference

16. If you use an online source, what is your online preference for seeking information for a class assignment?

- 1. Google
- 2. Library
- 3. Government website
- 4. Professional organization website
- 5. Other

Thank you for your participation in this project.

**APPENDIX C: COPY OF INVOICE FROM MADISON ASSESSMENT LLC FOR THE
INFORMATION LITERACY TEST**

Madison Assessment Invoice - Outlook Web App, light version
SearchThis FolderEntire MailboxAddress BookContacts
Settings, Address Book, and HelpOptionsSign out

10/23/2012

12:54 PM.
Sent: Monday, October 22, 2012 11:32 AM
To: Patricia Lafferty
Attachments:

Madison Assessment LLC
P.O. Box 11053
Boulder, CO 80301
www.madisonassessment.com
202.480.8068 begin_of_the_skype_highlighting
202.480.8068 FREE
end_of_the_skype_highlightingInvoice
#267

Date: 10/22/2012
Purchase Order: Fall 2011 Testing
Send Payment To
Madison Assessment LLC
Attn: Accounts Receivable
P.O. Box 11053
Boulder, CO 80301Bill To
Patricia K. Lafferty, MSN, RN
University of Central Florida
P.O. Box 663
Winter Park, FL 32790-0663

Testing Window End Date: October 15, 2012
DescriptionQuantityPriceAmount
Information Literacy Test104\$8.00\$832.00

Payment Due Upon Receipt TOTAL USD: \$832.00
Assess Your Success!
Sorry, debit cards not accepted.

Sent: Tuesday, January 29, 2013 4:05 PM
To: Patricia Lafferty
Attachments:

Madison Assessment LLC

P.O. Box 11053
Boulder, CO 80301
www.madisonassessment.com
202.480.8068 begin_of_the_skype_highlighting
202.480.8068 FREE
end_of_the_skype_highlightingInvoice

#277
Date: 01/29/2013
Purchase Order: January 2013
Send Payment To
Madison Assessment LLC
Attn: Accounts Receivable
P.O. Box 11053
Boulder, CO 80301Bill To
Patricia K. Lafferty, MSN, RN

University of Central Florida
P.O. Box 663
Winter Park, FL 32790-0663
Testing Window End Date: January, 2013
DescriptionQuantityPriceAmount
Information Literacy Test16\$8.00\$128.00

Payment Due Upon Receipt TOTAL USD: \$128.00
Assess Your Success!
Sorry, debit cards not accepted.

APPENDIX D: RECRUITMENT LETTER



Date

Dear Student:

I am a doctoral student in the PhD program at the UCF College of Nursing. I am requesting your assistance on a research project for my dissertation. The purpose of my project is to examine the predictors of information literacy in junior traditional nursing students. I am planning to have students participate during the first four weeks of the nursing program before students receive an information literacy class.

Dates: MM/DD/YYYY Times: _____ Location: Campus, Building, Number

You will receive a reminder notice during the Orientation for the program, and a flyer will be handed out in classes with information for the location, dates, and times. If you choose to participate, you will be required to fill out an informed consent form with your permission to participate in the research. You will also fill out a Demographic Questionnaire and the Information Literacy Assessment. Approximate time is approximately 90 minutes of your time.

Your information will be kept confidential by being assigned a unique identifier number. Information containing your personal identifying information key, consent form, and the questionnaires will be placed in a locked file cabinet in a College of Nursing office. No individual personal identifying information will be used for a grade or reported to faculty. All information will be used as an aggregate group and not individually. For your time, each student will receive as a \$10 gift certificate and a snack.

I hope that you will consider my request for your assistance. Not only will this help me complete my education but you will be starting on your journey in promoting evidence-based practice in nursing.

Sincerely yours,

A handwritten signature in cursive script that reads "Patricia K. Lafferty, MSN, RN".

Patricia K. Lafferty, MSN, RN

APPENDIX E: RECRUITMENT POSTCARD AND FLYER

Recruitment Postcard



Study Participation

Help a PhD Student

Help Me Help Future Students

I need about 90 minutes of your time to complete my dissertation. You will be participating in a study on information literacy of nursing students.

Place: UT Computer Labs 332 Dates: August through September 24

Days and Times: Monday at 0900,

Tuesday at 1000 and 1330, Wednesday at 1330

\$10 Gift Card and a snack for participation.

Patricia K. Lafferty, MSN, RN

Patricia.Lafferty@ucf.edu

Recruitment Flyer



Help Me Help Future Students

I am a PhD student and I need about 90 minutes of your
time to complete my dissertation.

Place: UT Towers Computer Lab 332

Dates: August through September 24

Days and Times: Monday at 0900, Tuesday at 1000 and
1330, Wednesday at 1330

You will be participating in a study on information literacy of
nursing students.

Contact: Patricia K. Lafferty, MSN, RN
Patricia.Lafferty@ucf.edu

\$10 Gift Card and a snack for your
participation

APPENDIX F: UCF IRB APPROVAL



University of Central Florida Institutional Review Board
 Office of Research & Commercialization
 12201 Research Parkway, Suite 501
 Orlando, Florida 32826-3246
 Telephone: 407-823-2901 or 407-882-2276
www.research.ucf.edu/compliance/irb.html

Approval of Exempt Human Research

From: UCF Institutional Review Board #1
 FWA00000351, IRB00001138
To: Patricia K. Lafferty
Date: August 29, 2012

Dear Researcher:

On 8/29/2012, the IRB approved the following activity as human participant research that is exempt from regulation:

Type of Review:	Exempt Determination
Project Title:	Factors Associated with Information Literacy Competencies of the Traditional Baccalaureate Nursing Student
Investigator:	Patricia K. Lafferty
IRB Number:	SBE-12-08642
Funding Agency:	
Grant Title:	
Research ID:	N/A

This determination applies only to the activities described in the IRB submission and does not apply should any changes be made. If changes are made and there are questions about whether these changes affect the exempt status of the human research, please contact the IRB. When you have completed your research, please submit a Study Closure request in iRIS so that IRB records will be accurate.

In the conduct of this research, you are responsible to follow the requirements of the Investigator Manual.

On behalf of Sophia Dziegalewski, Ph.D., L.C.S.W., UCF IRB Chair, this letter is signed by:

Signature applied by Joanne Muratori on 08/29/2012 04:05:51 PM EDT

IRB Coordinator

APPENDIX G: EXPLANATION OF RESEARCH



EXPLANATION OF RESEARCH

Title of the Project: Factors Associated with Information Literacy Competencies of the Traditional Baccalaureate Nursing Student

Principal Investigator(s): Patricia K. Lafferty, MSN, RN

Faculty Supervisor: Susan Chase, EdD, ARNP, BC, FNP, Associate Dean for Graduate

Investigational Site(s): University of Central Florida College of Nursing

Introduction: Researchers at the University of Central Florida (UCF) study many topics. To do this we need the help of people who agree to take part in a research study. You are being invited to take part in a research study which will include about 122 people at UCF. You have been asked to take part in this research study because you are a new student entering the undergraduate nursing program.

You must be 18 years of age or older to be included in the research study.

The person doing this research is adjunct faculty in the College of Nursing. Because the researcher is a PhD student, she is being guided by Dr. Susan Chase, a UCF faculty supervisor in the College of Nursing.

What you should know about a research study:

- Someone will explain this research study to you.
- A research study is something you volunteer for.
- Whether or not you take part is up to you.
- You should take part in this study only because you want to.
- You can choose not to take part in the research study.
- You can agree to take part now and later change your mind.
- Whatever you decide it will not be held against you.
- Feel free to ask all the questions you want before you decide.

Purpose of the research study: The purpose of this study is to describe information literacy competencies and factors associated with information literacy in traditional nursing students admitted to a baccalaureate degree program. The expected results of this study will aid nursing programs to have a better understanding of nursing students' information literacy skills.

What you will be asked to do in the study: Your participation will include that you complete an online test called the Information Literacy Test, a demographic questionnaire about yourself, and an optional motivation survey. I am asking permission to access your UCF cumulative GPA, SAT and ACT scores, and your TEAS score that you submitted to UCF and the College of Nursing.

Location: University Towers Room 332

Time required: Completion of the questionnaire and test will take about 90 minutes. The test time is scheduled before and after your scheduled classes.

Risks: There are no reasonably foreseeable risks or discomforts involved in taking part in this study.

Benefits/Compensation: There is no direct benefit for you to participate in this research. You will be able to view your test scores immediately after completing the test. A gift card of \$10 and a snack will be given to you for your time.

Confidentiality: We will limit your personal data collected in this study to people who have a need to review this information. You will be required to generate a code using the first two initials of your high school's name, the day of the month that you were born, and the last letter of your first name to maintain anonymity. Your name and this code will be kept separate from your Demographic Questionnaire, and the Information Literacy Test and the Student Opinion Survey. Your instructors will not know how you performed on the test and your scores will not impact your grade in any courses. Information that is collected will be reported as a group.

Voluntary Participation: There is no penalty should you decide not to participate. You have the right to withdraw from this study at any time. You do not have to answer every question or complete every task. You will not lose any benefits if you skip questions or tasks.

Study contact for questions about the study or to report a problem: Contact Persons: If you have any questions, concerns, or complaints, please contact Patricia K. Lafferty, MSN, RN, Graduate student, College of Nursing, 407-765-4415 or Dr. Susan Chase, Faculty Supervisor, College of Nursing at 407 -823-2744 or by email at Susan.Chase@ucf.edu

IRB contact about your rights in the study or to report a complaint: Research at the University of Central Florida involving human participants is carried out under the oversight of the Institutional Review Board (UCF IRB). This research has been reviewed and approved by the IRB. For information about the rights of people who take part in research, please contact: Institutional Review Board, University of Central Florida, Office of Research & Commercialization, 12201 Research Parkway, Suite 501, Orlando, FL 32826-3246 or by telephone at (407) 823-2901. You may also talk to them for any of the following:

- Your questions, concerns, or complaints are not being answered by the research team.
- You cannot reach the research team.
- You want to talk to someone besides the research team.
- You want to get information or provide input about this research.

APPENDIX H: INFORMATION LITERACY TEST MANUAL WITH PERMISSION

The Information Literacy Test (ILT)

Test Manual

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The ILT Manual

Section 1. The Nature of the Instrument

The Information Literacy Test (ILT) is a 60-item multiple-choice test developed by librarians and assessment specialists (Cameron, Wise, & Lottridge, 2007). The ILT is based on the Association of College & Research Libraries (ACRL) Information Literacy Competency Standards (See <http://www.ala.org/ala/mgrps/divs/acrl/standards/informationliteracycompetency.cfm>). This instrument was designed to directly assess collegiate students' competencies in information literacy.

Section 2. Intended Use

2.1 Appropriate and inappropriate uses and interpretations

This instrument was designed to assist institutions in identifying students' abilities to "locate, evaluate, and effectively use information when it is required" (ACRL, 2003). It measures the information literacy skill of anyone who should have such skills. The ILT was developed for use at the programmatic level (Cameron et. al., 2007). Thus, inferences made about learning or mastery should be made *only* in the aggregate.

The ILT was *not* designed for making decisions about individual students (Cameron et. al., 2007). Currently, its psychometric properties are not sufficient to support high-stakes classifications for individuals (please refer to section 5.2 -- Evidence of reliability). This instrument was also not intended as a vehicle for providing individual students with feedback about their mastery of information literacy skills (Cameron et. al., 2007). Institutions may choose to provide their students with individual feedback, but results should *not* be used to make high-stakes classification decisions. According to the *Standards for Educational and Psychological Testing* (AERA, APA, & NCME, 2000), test users are responsible for collecting validity evidence for any uses of the test other than those recommended here. In addition, other institutions are encouraged to explore score reliability and to validate the inferences they wish to make at their home institution.

The data collected with the ILT can be used to provide information about student learning that can inform improvements to information literacy programming. The results of the ILT can and have been successfully used to meet the accountability demands. For example, the State Council of Higher Education in Virginia's (SCHEV) has mandated that all public institutions must report on student competencies in the area of technology/information literacy. The ILT has enjoyed widespread use at over 40 institutions around the globe.

2.2 Target population

The primary focus during test development was on college students, whether graduate or undergraduate, enrolled at either a four-year university or community college (Cameron et. al., 2007). To determine if the ILT is appropriate for any population, one should consider the learning objectives the ILT was created to assess. See Table 1 for a list of those standards. If these standards sufficiently align with the learning objectives of the information literacy program in question, the test may be considered appropriate. In addition, a potential test user should consider examining the items. Again, if the items appear to be covering the appropriate topic areas and skills, and if they appear to be written at an appropriate level of difficulty, the ILT could be considered as appropriate for that particular population.

2.3 Qualifications of users

Test users must be trained to administer assessments in standardized conditions. The Proctor qualifications and training section of this manual (Section 4.1) provides more information about how proctors can be trained for test administration. In addition, test users should be knowledgeable about how to interpret the statistical results from the test and how to make appropriate inferences about the program using the results. Test users who do not have a measurement background or do not have in depth knowledge of the program are encouraged to consult with colleagues who have the necessary knowledge.

Section 3. Test Development

3.1 Academic and theoretical basis

The ILT was designed to evaluate student learning in four content areas of the ACRL Information Literacy Competency Standards for Higher Education (Cameron et. al., 2007). The first has to do with defining and articulating the nature and extent of information needed. The second standard focuses on whether students can efficiently access and use needed

information. The third objective assesses students' ability to evaluate information and its sources critically and incorporate selected information into his or her knowledge base and value system. The fourth objective assesses students' ability to use information to accomplish a specific purpose. The last standard focuses on the student's understanding of the ethical, legal, social, and economic issues surrounding the use of information and information technology.

3.2 Item type selection

All ILT items are selected-response. The items were written as such to ease scoring, to maintain objective scoring, and to minimize test-taker fatigue (Cameron et. al., 2007). Most items follow a typical multiple choice format, in which an item stem is followed by alternative responses consisting of the correct answer and several distracters. The alternative responses to each item on the ILT range from three to six.

3.3 Item pool and scale development process described

There were several criteria that guided the development of the ILT. It was to be a multiple-choice test that should be completed within one hour. The items were to make frequent use of graphics and it was anticipated that approximately two thirds of the items would measure lower-order skills with the remaining one third measuring higher-order skills (as defined in the Information Literacy Competency Standards). In addition, The ILT was to be web-based (i.e., administered over the Internet).

It was planned that the ILT would measure the five ACRL standards. However, one of the standards was incompatible with a multiple-choice item format. Standard Four, which refers to the student's being able to use information effectively to accomplish a specific purpose, concerns skills that would be more reasonably assessed through an examination of products or performances that the student produced. Because of this constraint, the ILT items were developed to measure Standards One, Two, Three, and Five. In addition, it was judged that Standards Two and Three should receive greater emphasis on the test; consequently, it was decided that these two standards would each be measured by approximately one third of the test, with the remaining standards comprising the remaining third in roughly equal proportions.

During the first half of 2003, several university reference librarians developed and revised an initial pool of 80 items. The numbers of response options for these items ranged from two to five, with most of the items having four or five options. These items comprised the pilot form of the ILT, which was then entered into the Adaptex test administration software (Wise & Yang, 2003) and administered to a sample of 506 incoming freshmen at a moderate-sized southeastern public university. Based on an item analysis of the data from the pilot form, 60 items that exhibited good psychometric properties were selected for use on the final ILT form. The 60-item ILT was subsequently administered to a random sample of 524 mid-year sophomores in February, 2004 during the university's Assessment Day.

The final version of the ILT contains 65 multiple-choice items—the 60 items on the final form and 5 items being pilot tested. The pilot tested items will periodically change when adequate information is collected about them and they are replaced by new pilot items. The final test blueprint outlining the specifications for the ILT is shown in Table 1.

Table 1. *Test Blueprint for ILT*

Scales	# of Items	Items as numbered on the ILT
<u>Standard 1:</u> defines and articulates the nature and extent of information needed.	12 20% of test	1, 2, 4, 5, 6, 7, 8,9,10,12, 13, 53
<u>Standard 2:</u> accesses needed information effectively and efficiently	19 32% of test	14, 15, 16, 17, 18, 19, 20, 21, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 34
<u>Standard 3:</u> evaluates information and its sources critically and incorporates selected information into his or her knowledge base and value system.	19 32% of test	3, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 48, 49, 50, 51, 52, 54
<u>Standard 5:</u> understands many of the ethical, legal, and socio-economic issues surrounding information and information technology.	10 17% of test	56, 57, 58, 59, 60, 61, 62, 63, 64, 65
Total Test	60 100% of test	1-60

*Table adapted from (Cameron et. al., 2007)

Section 4. Administrative Procedures

4.1 Proctor qualifications and training

While administration of the ILT does not require intense training, proctors should be given guidance on standardized test administration. Proctor training can be accomplished in a brief session in which they are familiarized with the test instructions and the general procedures to be adhered to during the test administration. During training, proctors should be provided with the standardized instructions to be used in the actual testing session. Instructions for administration are provided in the following section.

4.2 Testing procedures

The ILT is currently administered via computer software provided by the Center for Assessment and Research Studies. There are certain technical requirements that must be met before the ILT can be administered on a computer. First, because the ILT is administered via the internet, the administering computers must have an internet connection. Second, the resolution on the computer screen must be set to 1024 x 768 and the font size must be set to *medium* so that test questions can be viewed clearly. Third, the *cookies* option on Internet Explorer must be enabled. Finally, the internet program cannot have any popup killers enabled; this will prohibit the test from working properly.

4.2.1. Security

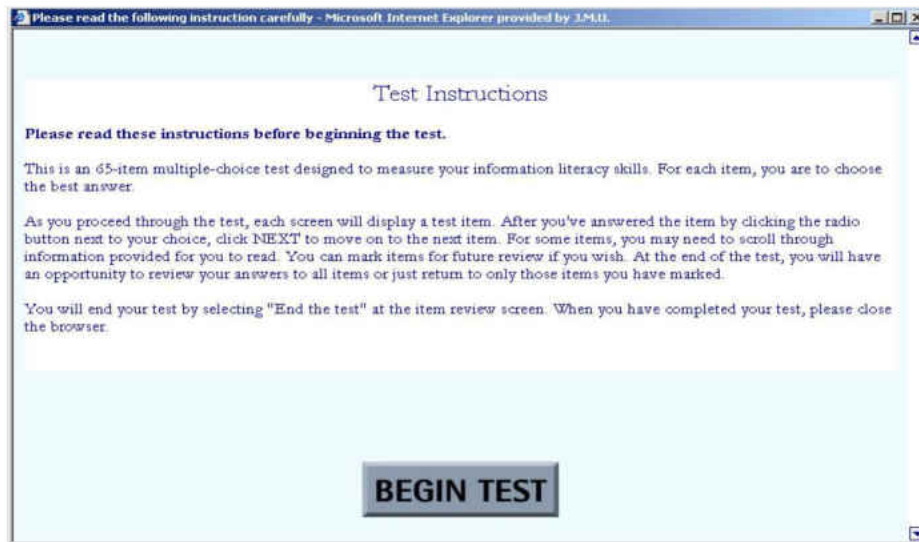
Because the ILT is currently being administered in many different settings, security is of utmost importance. Specifically, caution has been taken to ensure that these items are secure and we ask that test users take the same caution when they have access to the items. The following guidelines will ensure the security of the testing program and prevent any issues with cheating. These guidelines are also included in the Ordering Agreement institutions agree to prior to test use.

- All tests will be administered in a proctored test environment.
- Students, proctors, or other individuals will not leave the testing session with any recorded information about the content of the test. This includes scratch paper or notes taken during testing, and the ILT web address and passwords. Cell phones cannot be used in any way during testing.
- The web address and password for the ILT will not be shared with anyone other than those who need to have access to the test (i.e., examinees and proctors).

Depending on the situation in which the test is administered, other security concerns may arise. If there are questions regarding how to handle security in particular testing situations, please contact Madison Assessment. In addition, please report any situations, which indicate a problem with the security of the test itself.

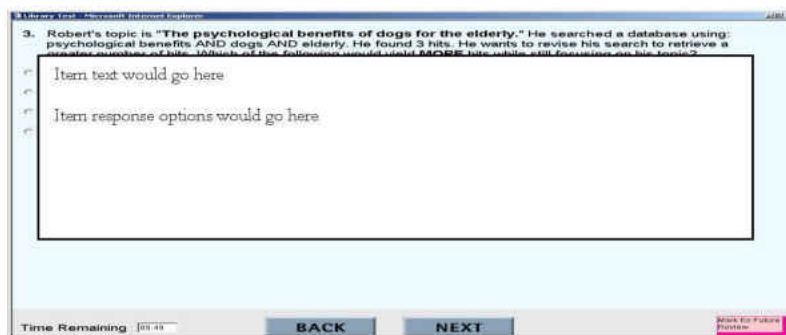
4.2.2. Process of Administration

The ILT is a web-based test that is currently supported by the Adaptex web-testing software developed at JMU. Test-takers enter a secure website and provide identifying information and a password to enter the secure software. At the beginning of the test the following testing instructions are presented to students.

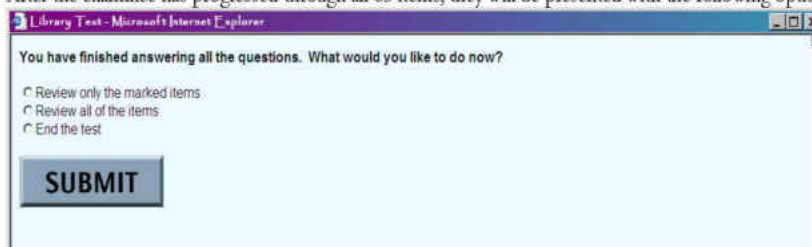


The ILT in its current version consists of 60 scored items and 5 pilot items. Traditionally, most students are able to complete all 65 items within a 75 minute time frame. However, the testing time allotted for a particular administration can be determined by the administrator. The ILT is not meant to be a speeded test (where students work quickly to see how much they can complete in a given time); however, it is important that students realize that there is a time limit so they will stay focused.

Each item is presented on a separate page as shown below (for security purposes, the item is not shown). Each window presents a single item's stem and response options. When students are ready to respond, they should click the radio button next to the desired response option and then click the *Next* button. If students desire to do so, they can select the *Mark for Further Review* option in the lower right hand corner to add the item to a list of those they want to flag for review before completing the test. Before moving to the next item, a response must be given for the current item.



After the examinee has progressed through all 65 items, they will be presented with the following options.



If examinees choose to do so, they can review only those items they marked for further review. A second option is to review all items on the test. The third and final option is to end the test and receive their final scores. Once an examinee submits his or her responses, they are immediately presented with their score on the test (in terms of percentage correct). The testing institution will be provided with a data file containing students scored responses and total scores for each examinee. This data file can either be provided in text format (delimited ASCII file) or in EXCEL format. The scored data files for each institution will be available upon request.

Section 5. Technical Information

5.1 Scoring and interpretation

All ILT items are selected response. The majority of items have three response options including the correct response. The range is between three and six response options. Three response options are considered the optimal number of choices for multiple-choice test items (Rodriguez, 2005). Items are scored dichotomously: a correct response to an item is given a score of '1' and an incorrect response to an item is given a score of '0.' The total score is obtained by summing the scored item responses. Higher total scores indicate that examinees have higher levels of information literacy, and lower total scores indicate that examinees have lower levels of information literacy.

5.2 Evidence of reliability

An important feature of any psychometric test is that it produces test scores that show sufficient reliability. The 60-item ILT was administered to a random sample of 524 mid-year sophomores in February 2004 during the university's Assessment Day. Table 2 shows, the means, standard deviations, and reliabilities (coefficient alphas) for the total ILT as well as for the items from each of the standards. On average, the sophomore group passed nearly 70% of the items, and exhibited a strong score reliability. The reliability estimates for the standards (subscales), while not as high, are adequate given the parameters for each standard. As noted in the table above, several of these standards are represented by a small number of items which can contribute to lower estimates of reliability. Because the reliability of these subscales are somewhat lower it is recommended that scores associated with the subscales be interpreted only on the group or descriptive level; in other words, these scores should not be used to make interpretations about the unique strengths or weaknesses of an individual student.

Table 2. Descriptive statistics and reliability estimates for the 2004 ILT administration at JMU

Scale	# Items	Mean	Standard Deviation	Coefficient Alpha
Total Test	60	41.61	8.45	.88
<u>Standard 1:</u> defines and articulates the nature and extent of information needed.	12	9.70	2.03	.65
<u>Standard 2:</u> accesses needed information effectively and efficiently	19	11.16	2.91	.64
<u>Standard 3:</u> evaluates information and its sources critically and incorporates selected information into his or her knowledge base and value system.	19	13.52	3.31	.76
<u>Standard 5:</u> understands many of the ethical, legal, and socio-economic issues surrounding information and information technology.	10	7.18	1.84	.48

N= 524 **Table adapted from (Cameron et. al., 2007)

Data from year 2008 and 2009 administrations of the ILT were obtained from an aggregated sample of 683 freshmen at four four-year institutions and an aggregated sample of 839 freshmen at five two-year institutions. For the four-year institutions Table 3 illustrates the means, standard deviations, and reliabilities (coefficient alphas) for the total ILT as well as for the items from each of the standards. Table 4 illustrates the same information for the five two-year institutions. On average the freshman students in the four-year and the two-year institution samples passed approximately 60% of the items, and exhibited strong reliability. These reliability estimates are similar to those observed with the JMU sophomore sample in Table 2. As mentioned with the JMU sample, reliability estimates for the subscales are affected by the small number of items associated with each standard. Consequently, subscale scores should only be interpreted at the group or descriptive level. Though the data trends provide further reliability and generalizability evidence for the use of the ILT, there are limitations to the inferences that can be made from these results. Comparability of institutions within the four-year and two-year institutions and comparability between both types of institutions is limited due to the lack of standardized data collection methods and testing environments. Mean scores, standard deviations, and reliability coefficients are sample dependent. Without further detail about test administrations and sampling techniques, comparisons should be made with caution.

Table 3. Aggregate descriptive statistics and reliability estimates for the ILT at four four-year institutions

Scale	# Items	Mean	Standard Deviation	Coefficient Alpha
Total Test	60	36.12	7.71	.84
<u>Standard 1:</u> defines and articulates the nature and extent of information needed.	12	8.47	2.00	.54
<u>Standard 2:</u> accesses needed information effectively and efficiently	19	8.67	2.53	.54
<u>Standard 3:</u> evaluates information and its sources critically and incorporates selected information into his or her knowledge base and value system.	19	12.15	3.04	.69
<u>Standard 5:</u> understands many of the ethical, legal, and socio-economic issues surrounding information and information technology.	10	6.44	1.90	.53

N=683

Table 4. Aggregate descriptive statistics and reliability estimates for the ILT at five two-year institutions

Scale	# Items	Mean	Standard Deviation	Coefficient Alpha
Total Test	60	35.77	7.92	.84
Standard 1: defines and articulates the nature and extent of information needed.	12	8.47	2.08	.58
Standard 2: accesses needed information effectively and efficiently	19	8.28	2.54	.53
Standard 3: evaluates information and its sources critically and incorporates selected information into his or her knowledge base and value system.	19	12.14	3.14	.70
Standard 5: understands many of the ethical, legal, and socio-economic issues surrounding information and information technology.	10	6.45	1.89	.50

N=839

5.3 Evidence of validity

Validity refers to the degree to which one can make inferences from the scores obtained on a test. Validity is not an absolute state, but rather a collection of evidence indicating that the scores obtained on a test are valid for their intended use (AERA, 2000). For the ILT, two types of evidence have been collected: that based on expert ratings of the items (content validity) and that based on the degree to which ILT scores statistically behave as we would expect a measure of information literacy to behave (construct validity).

To assess content validity, three university reference librarians were provided descriptions of the four ACRL standards measured by the ILT as well as the standard each item was intended to measure. The librarians then studied each ILT item and independently rated the extent to which the item matched its purported standard using three rating categories: “Matched the Standard,” “Uncertain,” or “Did Not Match the Standard.” The ratings of the items were favorable, as all three raters agreed that 42 of the 60 items (70%) matched their intended standard, with at least two raters agreeing that 56 items (93%) matched their standard. Regarding rater agreement, all three librarians agreed on 42 of the 60 items (70%), and at least two agreed on 59 items (98%). These results indicate that ILT items displayed content validity through alignment to the intended ACRL standards (Cameron et. al., 2007).

Construct validity evidence was obtained through four studies. The first study conducted by (Cameron et. al., 2007) used the data from the initial administration of the ILT to university sophomores (spring, 2004 Assessment Day) described earlier. Most of those students had taken the Information Seeking Skills Test (ISST), another Information Literacy Test, as first year students. The ISST was developed as a high stakes competency test for use only at James Madison University. The instrument measures skills and reference materials held at JMU. ISST scores were obtained for 333 students by Miller (2004) who found the correlation between the ILT and the ISST to be positive and significant [$r(331) = .38, p < .001; r^2 = .144$]. A problem with data collected on Assessment Day, or other low-stakes testing conditions, is that some students do not try very hard because there are no consequences for test performance. Wise and Kong (2005) showed that item response times can provide a valid measure of the amount of effort a student devotes to a computer-based test. There were 36 students who did not exhibit effort on at least 95% of their items. These students were deleted from the sample, and the ILT-ISST correlation increased to .45 [$r(295) = .45, p < .001; r^2 = .203$]. Both are reasonable effect sizes.

In the second study the ILT was administered to 121 introductory psychology students during the fall, 2004 semester, 75 of whom were freshmen and the remaining 46 were sophomores. Immediately after taking the ILT, students were administered an eight-item survey, which contained five questions regarding frequency of course-related information literacy activities and three questions regarding confidence in finding and evaluating information. The results showed that the sophomores scored significantly higher on the ILT than the freshmen [$t(119) = 2.06, p = .041, d = 0.39$]. In addition, ILT scores were significantly correlated with cumulative GPA [$r(119) = .20, p = .032$]. The analysis of the survey items revealed significant correlations between ILT scores and two of the three confidence items: “confidence in ability to find books and scholarly articles for project of interest,” [$r(119) = .33, p < .001$], and “confidence in ability to evaluate resources for their quality,” [$r(119) = .26, p = .005$]. The ILT scores were uncorrelated with all of the items regarding frequency of course-related information literacy activities; however, similar findings for the ISST were reported by Cameron (2004). These results show sensitivity to college level experience.

The third study compared the ILT scores of 422 incoming freshmen—collected in fall, 2004—with the scores of 524 mid-year sophomores—collected in spring, 2004. The freshman group showed a mean of 37.13 and a standard deviation of 7.70, while the sophomore group showed a mean of 41.61 and a standard deviation of 8.45. The means were found to be significantly different [$t(944) = 8.43, p < .001, d = 0.53$]. These results are consistent with the fact that the sophomores, unlike the freshmen, had been exposed to instructional modules in information literacy and had demonstrated competency on the ISST. The $d = .53$ indicates an effect size of more than one half standard deviation.

In a follow-up study, year 2008 and year 2009 ILT data from a sample of 683 freshmen aggregated across four four-year institutions were compared with the ILT scores collected from the sample of 422 JMU freshmen in 2004. The JMU group showed a mean of 37.13 and a standard deviation of 7.70, while the freshman from the four four-year institutions showed a mean of 36.12 and a standard deviation of 7.71. The two groups were found to be significantly different [$t(1103) = 2.11, p = .035, d = 0.13$]. Though these groups differed significantly on their mean scores, it is important to note that the magnitude of that difference may be considered as small. This magnitude is determined by Cohen's d . Though Cohen provided rules of thumb for interpreting the value of d , he also noted the importance of the researcher's judgment in determining the most appropriate interpretation (Cohen, 1988). These results indicate that entering first-year students from several different institutions were not dramatically different from JMU entering students. The significant differences observed were statistically different from zero, but the effect size of .13 is indicative of a slight difference.

ILT data collected in year 2008 and year 2009 from 839 freshmen aggregated across five two-year institutions were also compared with the year 2004 sample of 422 JMU freshmen. The JMU group showed a mean of 37.13 and a standard deviation of 7.70, while the freshman from the five two-year institutions showed a mean of 35.77 and a standard deviation of 7.92. Again, the two groups were found to be significantly different [$t(1259) = 2.90, p = .0037, d = 0.17$], but the magnitude of that difference is relatively small. These results suggest that JMU entering students were not dramatically different from entering students from several two-year institutions. Again, statistical significance was observed, but the effect size was really quite small.

These known group differences provide some evidence of construct validity. In each of the aforementioned studies group differences were realized as expected. In the JMU samples, sophomore students who had been provided educational opportunities in information literacy scored higher than the freshmen who had not experienced JMU's information literacy experiences. It was also expected that freshman attending a more selective university, JMU, would perform better than freshman at open enrollment institutions. Again, while the observed differences were statistically significant, it may be consoling to community colleges that their entering students did not perform remarkably different on information literacy upon entry. The primary issue they will be interested in is whether or not significant differences can be observed in their own students after experiencing relevant course work and experiences at their institutions. Results to date, suggest that the ILT is sensitive to identifying these differences.

Table 5 illustrates the data obtained from the administrations of ILT discussed in this section. Collectively, the evidence obtained thus far supports the validity of ILT scores as measures of students' information literacy knowledge and skills. This conclusion is supported both by content- and construct-related validity findings.

Table 5 Comparison of ILT mean scores across samples.

Sample	N	Mean	Std
JMU Sophomores 2004	524	41.61	8.45
JMU Freshman 2004	422	37.13	7.70
Four Four-Year Institutions Freshman 2008-2009	683	36.12	7.71
Five Two-Year Institutions Freshman 2008-2009	839	35.77	7.92

5.4 Proficiency Level Standard Setting

Without an interpretive context, test scores have little meaning. One way in which the ILT could be used is by administering it to students at two different points in time and assessing the average change in scores. In this context, the posttest scores are interpreted relative to the pretest scores. This value-added approach to assessing student outcomes is often used in higher education assessment.

A limitation to the value-added approach, however, is that it does not provide information regarding the degree to which the students have learned as much as you expect or intend them to. An alternative to the value-added approach is to identify the absolute point on the test score scale corresponding to a particular level of proficiency. The most rigorous methods available for test developers to obtain this information are collectively termed *standard setting methods*. In standard setting, a panel of judges is provided a definition of one or more levels of proficiency and a copy of the test items. The judges are then asked to make judgments regarding the test scores that correspond to those levels of proficiency. This provides a more absolute context in which to interpret test performance.

(Cameron et. al., 2007) conducted a standard-setting workshop for the 60-item ILT was conducted during March 2004. An abbreviated version of the Bookmark standard setting method (Lewis, Green, Mitzel, Baum, & Patz, 1998) was used that required two half-day sessions to complete. Ordered item booklets were compiled, using 43 ILT items whose Bookmark location values were computed from data from the fall, 2003 pilot testing of incoming JMU first-year students.

There was a diverse panel of 10 judges used in the workshop. Three were librarians from James Madison University, three were librarians from Virginia community colleges, one was a librarian at another Virginia university, two were faculty in our Center for Assessment and Research Studies (CARS), and one was a doctoral student in assessment and measurement.

Two performance standards were set. The first standard differentiated examinees who were *Proficient* from those that were *Below Proficient*. The second differentiated those who were *Advanced* from those that were *Proficient*. Prior to the workshop, definitions were created for what students should know and be able to do at the Proficient and Advanced levels. At the beginning of the workshop, participants discussed the definitions, which were then used by the judges as they made their judgments.

Table 6 shows the proficiency definitions given to the judges and the resultant performance standards that the panel recommended. For the Proficient designation, the judges recommended a performance standard of 39, which corresponded to 65% correct. For the Advanced designation the performance standard was 54, which corresponded to 90% correct. If these performance standards were applied to spring, 2004 administration of the ILT, the percentages of students in the Below Proficient, Proficient, and Advanced categories were 17, 77, and 4, respectively. Results like these can provide a clear interpretive benchmarks regarding how many students demonstrated adequate levels of proficiency in a particular sample.

Table 6. Performance level definitions and performance standards recommended for Proficient and Advanced levels on the 60-item ILT

Proficiency Level	Performance Standard	Descriptors
Proficient	39(65%)	<p><u>The student who is <i>Proficient</i> is able to:</u></p> <ul style="list-style-type: none"> Describe how libraries are organized. Define major library services. Choose the appropriate type of reference source for a particular information need. Identify common types of citations. Employ basic database search strategies. Locate a variety of sources in a library or online. Discriminate between scholarly and popular publications. Legally and ethically use information.
Advanced	54 (90%)	<p><u>The student who is <i>Advanced</i> is able to attain the criteria for Proficient and:</u></p> <ul style="list-style-type: none"> Modify and improve database search strategies to retrieve better results. Employ sophisticated database search strategies. Interpret information in a variety of sources. Evaluate information in terms of purpose, authority and reliability. Understand ethical, legal, and socioeconomic issues relating to information access and use.

It should be noted that these recommended performance standards are linked to the particular definitions we used in our standard setting workshop. They may provide meaningful interpretive benchmarks for other institutions that adopt our performance definitions. For institutions adopting different definitions, however, a separate standard setting would be appropriate. Establishing community expectations for student performance provides a highly valued interpretive framework.

Section 6. Additional Information

6.1 Where to get additional information

Additional information on the ILT may be obtained by contacting Madison Assessment LLC through the following Web site: <http://www.madisonassessment.com>.

6.2 Work to be conducted to enhance test use and interpretation

Future work with the ILT should continue to pursue those reliability and validity analyses that have already been conducted with the current versions of the instrument. Specifically, validity evidence should continually be gathered in hopes of strengthening the conviction one has about the inferences made about ILT scores. This will require more standardized administrations of the ILT across a variety of institutions. Other institutions are encouraged to conduct their own studies of the ILT utility and efficacy. Also, item-analyses need to continue to be conducted with the ILT to determine how well the items are functioning. Further analysis of the pilot items needs to occur as well.

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Washington, DC: U.S. Department of Education Fund for the Improvement of Postsecondary Education.

Section 8. Appendix

Troubleshooting guide for issues arising in computer-based test administration

There are several things that are important to be aware of before administering the ILT in any situation. Many of these specifics will be provided by JMU before the testing date (e.g., web address, passwords, etc.). In addition, the proctor should be familiar with some common questions from test takers that may arise during the testing session. Occasionally, the ILT program may freeze (crash). This is not a major problem; a simple recovery procedure is available to recover a student's data:

1. Close the browser if it is still open.
2. Open the Internet Explorer browser and type in the URL that the student was given. Click **CONTINUE**.
3. Fill in the name, ID in the appropriate boxes and select the institution on the login screen. Select an appropriate test and type the password. Click **SUBMIT**.
4. You will be prompted whether or not you want to resume the test you previously did not finish. Click **CONTINUE**. The program will take you to the question at which the crash occurred.

There are also some common problems that the test proctor should be aware of before administering the ILT. These problems, along with the appropriate solutions, are listed below. In addition, if the proctor experiences a problem for which a solution is not provided, they will be given access to a technical support line before administering the test. Technical support will be available at the provided phone numbers for all (pre-arranged) scheduled testing times.

Common problems

1. *A few students get blank screens.*

Recover the test

2. *Many students get blank/error screens and cannot recover the test.*

First, make sure that students start the test by typing the URL provided. When test administrators add the URLs as Favorites of the Internet Explorer, the different URLs may be registered because of the nature of our program. Students can check which URL is registered by going to *Favorites, Organize Favorites*, then right-clicking on the icon for the site they use in the Internet Explorer. Find *Properties* and check the URL registered there to make sure that it is identical to the one provided. You can find the URL assigned to each college in the L:\VCCS Testing\serverAssignment.xls. (Click the URLforEachCollege tab).

If students have the correct URL in the Favorites, then have all the students log out and restart the server by following the steps in the "locate a server" and "restart servers" section, then have them recover their tests. If the other servers are not getting maxed out, you can transfer some students to one of them. You will find the max number for each server to be able to handle in the "Servers running" section at the top of this document. L:\VCCS Testing\serverAssignment.xls (Click the assignment tab) tells you how many students are currently accessing each server.

3. *Students get "Page cannot be displayed" errors.*

Click the "Back" link to go back to the last question on which they were working. Tell the test administrator to restart the machines between sessions and to make sure that no one runs any other program **before and during taking the test**.

4. *The program does not accept the password provided.*

Make sure the keyboard is not caps-locked

5. *Cannot recover the test (the program has the student start the new test).*

Make sure the first name, the last name, the section number, and the test name are the same as before.

6. *Cannot see the whole screen.*

Change the screen resolution to 1024x768 and the font size in the browser to medium. You can change the screen resolution by right-clicking the desktop, going to properties, settings, and adjust the screen resolution as 1024 x 768. You can change the text size of the browser by going *View* then *Text Size*.

7. *Cannot find the institution in the dropdown box at login.*

Select any institution temporarily so that we will change the institution name for the student later. Please report this problem to the technical support at JMU so the student's score can be properly recorded under the correct institution.

8. *The test disappears after submit.*

Make sure that the pop up blocker is off. It should be under Tools-> popup blocker in IE.

9. *You see the following dialog box:*

“This page contains both secure and nonsecure items.
Do you want to display the nonsecure items?
[Yes] [No] [More info]”

Use the following solution in IE >Tools > Internet Options > Security > Custom Level > Miscellaneous > Display mixed content. By default it is set to prompt, reset it to *Enable*.

10. *Test does not advance past item 1.*

Exit the test and open a new IE.

Under IE >Tool > Internet Options > click “Settings...”

Select the option “Automatically” and click OK.

Now try to sign the back on to the test.

Notes for proctors

Students should not run any programs before or during the test. As the students arrive, please ask them to take a seat at a computer but DO NOT let them play on the computers. (When students open music files or play on the computers the files they access take up storage in the cache memory, which creates a problem for the program to run efficiently, so NO ONE is allowed to play at any time on the computers.)

There are two web addresses provided. Please make sure there are approximately equal numbers of students who receive each URL because the server cannot handle too many students.

Restart the computers between test sessions to clear out the computer memory.

If the program crashes or encounters any problems, you may recover the test (See Troubleshooting section in manual)

Make sure that the screen resolution is set to 1024x768.

Students should not double-click the Next/Back button, as it may cause a skipped question.

Re: ILT test manual

Richelle Burnett [richelle@madisonassessment.com]

ent: Tuesday, December 31, 2013 3:21 PM

o: [Patricia Lafferty](#)

Yes, permission granted! Thanks for asking and good luck on your dissertation!!
Happy New Year,
Richelle

Richelle Burnett
Chief Executive Officer
Madison Assessment LLC - Assess Your Success!
202.494.0961 (m)
www.madisonassessment.com

On Sun, Dec 29, 2013 at 7:19 AM, Patricia Lafferty <Patricia.Lafferty@ucf.edu> wrote:
Richelle,

May I have permission to insert a copy of the test manual in my Appendix for my dissertation? I know that it is available online but would like to make sure that this manual is available for the test.

After I defend my dissertation this semester, I will share the results of my research with you.

Pat

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APPENDIX I: INDIVIDUAL TEST ITEMS WITH CORRECT STUDENT RESPONSES
(N =120)

Item Number with Description and IL Competency	Yes	(%)
1. Appropriate resource topic (CS1)	105	87.5
2. Effective search terms (CS1)	111	92.5
4. Knowing appropriate resource (CS1)	74	61.6
5. Distinguishing between types of resources 1 (CS1)	73	60.3
6. Distinguishing between types of resources 2 (CS1)	112	93.3
7. Distinguishing between types of resources 3 (CS1)	114	95.0
8. Knowing where resources are located (CS1)	107	89.2
9. Acquiring a resource (CS1)	68	56.7
10. Narrowing information (CS1)	107	89.2
11. Distinguishing between resources (CS1)	102	85.0
12. Knowing what peer review is (CS1)	98	81.7
49. Distinguishing between references as works cited(CS1)	80	66.7
13. Database querying 1 (CS2)	22	18.3
14. Distinguishing between databases (CS2)	108	90.0
15. Searching publications 1 (CS2)	4	3.0
16. Searching publications 2 (CS2)	18	15.0
17. Knowledge of search operators 1 (CS2)	72	60.0
18. Knowledge of finding books in a library (CS2)	90	75.0
19. Knowledge of citing (CS2)	117	97.5
20. Knowledge of search operators 2 (CS2)	72	60.0
21. Knowledge of search operators 3 (CS2)	106	88.3
22. Knowledge of search operators 4 (CS2)	46	38.3
23. Accessing a publication (CS2)	45	37.5
24. Database querying 2 (CS2)	67	55.8
25. Knowledge of reference types 1 (CS2)	73	60.8
26. Knowledge of reference types 2 (CS2)	69	57.5
27. Knowledge of reference types 3 (CS2)	25	20.8
28. Knowledge of reference types 4 (CS2)	100	83.3
29. Knowledge of reference types 5 (CS2)	89	74.1
30. Knowledge of reference types 6 (CS2)	109	90.8
31. Knowledge of bibliography (CS2)	99	82.5
3. Refining the search and knowledge of operators (CS3)	67	55.8
32. Evaluating source credibility 1 (CS3)	119	99.1
33. Using data from a table 1 (CS3)	20	16.7
34. Using data from a table 2 (CS3)	109	90.8
35. Using data from a table 3 (CS3)	77	64.1
36. Using data from a table 4 (CS3)	119	99.1
37. Evaluating a claim 1 (CS3)	81	67.5
38. Using information 1 (CS3)	95	79.1
39. Evaluating source credibility 2 (CS3)	108	90.0
40. Knowing a sources purpose for facts, persuasion (CS3)	114	95.0

41. Identifying sources author 1 (CS3)	93	77.5
42. Evaluating source credibility 3 (CS3)	117	97.5
43. Evaluating source credibility 4 (CS3)	116	96.6
44. Evaluating a claim 2 (CS3)	113	94.1
45. Identifying sources author 2 (CS3)	117	97.5
46. Knowledge of source types (CS3)	103	85.8
47. Using information 2 (CS3)	115	95.8
48. Selecting an appropriate resource (CS3)	83	69.1
50. Selecting an appropriate source (CS3)	84	70.0
<hr/>		
51. Knowledge related t source credibility or access 1 (CS5)	112	93.3
52. Knowledge related t source credibility or access 2 (CS5)	91	75.8
53. Knowledge related to ethical legal issues of using resources 1 (CS5)	106	88.3
54. Knowledge related to ethical legal issues of using resources 2 (CS5)	67	55.8
55. Knowledge related to ethical legal issues of using resources 3 (CS5)	109	90.8
56. Knowledge of ethical legal issues of using sources tables and graphs (CS5)	88	73.3
57. Knowledge of resources for proper citation (CS5)	70	58.3
58. Knowledge of creating a reference (CS5)	64	53.3
59. Knowledge of ethical legal issues of sharing an audio source (CS5)	99	82.5
60. Knowledge of citing direct quotes (CS5)	99	82.5

(Madison Assessment LLC, personal communication, August 12, 2012)

**APPENDIX J: UNSTANDARDIZED PREDICTED SCORES FROM REGRESSION
FORMULA**

TEAS	UPS	TEAS	UPS	TEAS	UPS
1	9.45	40	25.518	79	41.586
2	9.862	41	25.93	80	41.998
3	10.274	42	26.342	81	42.41
4	10.686	43	26.754	82	42.822
5	11.098	44	27.166	83	43.234
6	11.51	45	27.578	84	43.646
7	11.922	46	27.99	85	44.058
8	12.334	47	28.402	86	44.47
9	12.746	48	28.814	87	44.882
10	13.158	49	29.226	88	45.294
11	13.57	50	29.638	89	45.706
12	13.982	51	30.05	90	46.118
13	14.394	52	30.462	91	46.53
14	14.806	53	30.874	92	46.942
15	15.218	54	31.286	93	47.354
16	15.63	55	31.698	94	47.766
17	16.042	56	32.11	95	48.178
18	16.454	57	32.522	96	48.59
19	16.866	58	32.934	97	49.002
20	17.278	59	33.346	98	49.414
21	17.69	60	33.758	99	49.826
22	18.102	61	34.17	100	50.238
23	18.514	62	34.582		
24	18.926	63	34.994		
25	19.338	64	35.406		
26	19.75	65	35.818		
27	20.162	66	36.23		
28	20.574	67	36.642		
29	20.986	68	37.054		
30	21.398	69	37.466		
31	21.81	70	37.878		
32	22.222	71	38.29		
33	22.634	72	38.702		
34	23.046	73	39.114		
35	23.458	74	39.526		
36	23.87	75	39.938		
37	24.282	76	40.35		
38	24.694	77	40.762		
39	25.106	78	41.174		

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