

Carol A. Leibiger, William E. Schweinle
The University of South Dakota / Boise State University

The South Dakota Information Literacy Exam: A Tool for Small and Medium-sized Universities to Document and Assess Information Literacy of Undergraduate and Graduate Students¹

Abstract

This paper describes the South Dakota state universities' development of a dual-measure instrument to test Information Literacy (IL) following the Association of College & Research Libraries' (ACRL) *Information Literacy Competency Standards for Higher Education* and using classical and modern psychometric methods. This tool can be used as an exit assessment for undergraduates and as an entrance assessment for advanced learners to indicate deficiencies in IL that must be addressed early in graduate education.

Introduction

This paper describes the development of the South Dakota Information Literacy Exam (SDILE), a valid, reliable, on-line, and very unique and useful psychometric instrument. The SDILE was constructed to tap the Association of College & Research Libraries' (ACRL) *Information Literacy Competency*

¹ The authors wish to acknowledge the contributions of all members of the South Dakota Board of Regents Information Literacy Subcommittee, past and present, in the creation of the SDILE, especially those who participated in the generation of questions and all revisions of the SDILE from 2004 to the present. The latter group comprises the following assessment experts, library faculty, students, and support staff from the six state universities of the South Dakota Regental System: Carrie Ahern, Lea Briggs, George Earley, Jacy Fry, Lynda Oldenkamp (co-chair of the IL Subcommittee from 2004-2006), Joann Sckerl, Sandra Schatz, Kristen Skrenes, Risë Smith, and Laura Wight. The authors also owe a debt of thanks to the Interlibrary Loan staff of I.D. Weeks Library (University of South Dakota) for their efforts to obtain the wealth of resources that supported the writing of this paper.

Standards for Higher Education and follows sound psychometric principles, including both classical and modern (Item Response Theory) psychometric techniques. This two-pronged approach has allowed us to arrive at discrete (threshold) and continuous (assessment) measurements using a valid and reliable test that is shorter and less expensive than the alternatives. In this paper we outline the history of the SDILE from its pilot in 2005-2006 as well as describe the analyses, scoring methods, and the subsequent revisions of the test items. We also touch on the SDILE's potential for use as an undergraduate exit assessment and as a graduate entrance diagnostic.

Information Literacy Instruction in Higher Education

Information Literacy is a set of skills that enables the finding, evaluation, use, and appropriate (effective, legal and ethical) use of information (Association of College and Research Libraries, *IL Competency Standards for Higher Education*), as described in Table 1 (below). These skills are increasingly necessary due to the well documented information explosion across so many different formats. This overwhelming availability of information necessitates that effective learners must develop sophisticated retrieval skills and use information effectively to fulfill personal, academic, and professional needs. The most problematic area of modern research involves Internet research, which requires especially well developed critical thinking skills (Macpherson, 2004). Finally, the ability to deal critically with information enables people to participate as informed and critical citizens in free and democratic societies (Shapiro & Hughes, 1996).

An information literate person is able to:
<ul style="list-style-type: none"> determine the extent of the information needed
<ul style="list-style-type: none"> access the needed information effectively and efficiently
<ul style="list-style-type: none"> evaluate information and its sources critically
<ul style="list-style-type: none"> incorporate selected information into one's knowledge base
<ul style="list-style-type: none"> use information effectively to accomplish a specific purpose
<ul style="list-style-type: none"> understand the economic, legal, and social issues surrounding the use of information, and access and use information ethically and legally

Table 1: The ACRL Information Literacy Competency Standards for Higher Education (2000)

Recognition of the need for IL instruction arose in the United States during the 1980s out of the realization of the value of library instruction for student academic success. Hardesty, Lovrich, and Mannon (1982) found that library instruction is more strongly correlated with students' information-finding skills than with their intellectual ability or academic effort. Additionally, it was increasingly obvious that the bibliographic instruction (BI) or "library skills" instruction that had been delivered in the past was not sufficient to meet the needs of students faced with the growing facility and availability of information.

American academic libraries have been providing library instruction since before 1876, the date of the founding of the American Library Association and the official beginning of professional librarianship in the United States (Hardesty & Tucker, 1989). Earlier BI instruction focused on information retrieval—retrieval from paper sources in a specific library. With exceptions such as the pioneering work of Patricia Knapp and Evan Farber, BI remained the normal type of instruction in academic libraries until the rise of the library instruction movement in the 1980s. At this time librarians became involved in course-integrated library activities in support of instruction and assignments and moved from BI to IL instruction (Rockman, 2002). Finally, the general education reform movement identified IL as necessary and equally as important as the communication, critical thinking, and math skills that should be included in the general education curriculum. This movement placed IL instruction inextricably within traditional general-education courses like Freshman Composition and necessitated collaborative relationships between librarians and instructors. Further, IL instruction in general education curricula has become required by more and more higher education administrations (Rockman, 2002).

It is clear that IL is now recognized by politicians, administrators, and accrediting bodies as both a necessary learning outcome of higher education and a lifelong learning skill. Since the 1970s, various American higher education reform movements have emphasized the role of libraries, research, and critical thinking skills in effective higher education curricula (see, for example, *Reform on Campus* and follow-up reports of the Carnegie Commission on Higher Education, the SCANS Report prepared by the Secretary of Labor's Commission on Achieving Necessary Skills, the

National Literacy Act of 1991, the Clinton era's Goals 2000: National Educate America Act, and *Greater Expectations: A New Vision for Learning as a Nation Goes to College*). These movements have also emphasized essential skills, especially lifelong learning skills, including the ability to acquire, evaluate, use, maintain, interpret, and communicate information as a job skill; and lifelong learning skills as necessary for success in a global information-based economy. Finally, national IL standards were articulated by the American Library Association (ALA) and its higher education and school library subdivisions (ACRL, 2000; ALA, 1989; American Association of School Librarians, 1998).

The European and Australasian educational reform movements have paralleled this movement in American public and higher education. For instance, British Commonwealth nations have developed the Key Competencies, the first of which is information-literacy related (e.g., New Zealand's "information skills" and Australia's "Collecting, analyzing, organizing information" [Scottish Qualifications Authority, 2003, p. 7]). These competencies have been aligned with post-secondary learning outcomes, a move that indicates the value of such skills (Down, Martin, Hager & Bricknell, 1999). Further, IL standards that closely resemble the American ACRL standards have been proposed on a national and international basis (see, for instance, the *Australian and New Zealand Information Literacy Framework* and the *IFLA Guidelines on Information Literacy for Lifelong Learning*.)

While IL in undergraduate education has received considerable attention in academic librarianship, little consideration has been given to the IL of advanced learners. The relatively small number of studies treating postgraduate IL suggests the need for undergraduate IL instruction as preparation for both professional information retrieval and further academic study and research for advanced learners. For instance, Powell and Case-Smith (2003) found that lack of time and unavailability of research libraries seem to result in minimal-effort approaches to information gathering by professional occupational therapists, along with a preference for the Internet and personal sources of information (e.g., colleagues, and supervisors) over the use of library resources like databases.

Alire (1984) points to a history of library concern with the information-seeking skills of graduate students. Unfortunately, this concern generally

limits itself to documentation of advanced learners' deficiencies in information finding. Studies examining the IL of postgraduate learners can be divided into three areas of investigation according to the type of students and the location of learning: traditional graduate students (Chu & Law, 2007; Cooney & Hiris, 2004; George, Bright, Hurlbert, Linke, St. Clair & Stein, 2006; Grant & Berg, 2003; Green & Macauley, 2007; Honey, North & Gunn, 2006; Perrett, 2004), nontraditional graduate students (Bellard, 2005), and distance graduate students (Liu & Yang, 2003). For all the differences among graduate students (traditional vs. nontraditional, distance vs. on-site, males vs. females, etc.), there is remarkable unanimity in their approach to information seeking, which is predictable primarily by convenience (George et al., 2006; Green & Macauley, 2007). In accordance with the principle of least effort, students tend to choose the easiest and most convenient resources (for instance, an Internet search engine like Google) over their home libraries' resources (George et al., 2006). The choice to use an Internet search engine rather than academic library resources should probably not be understood as an indicator of advanced learners' laziness. Rather, demographic changes in the graduate student population has given rise to a population of advanced learners who fall more readily into the description of the nontraditional student described below, with significant effects on graduate programs and the academic libraries that support them.

Today's typical graduate student is more likely to be a female in her mid-thirties. She attends graduate school part-time and carries both work (usually part-time) and family responsibilities. She has typically been away from higher education for at least 2 years and represents a broader range of linguistic, ethnic, educational, and socioeconomic groups than the predominantly white, middle-class, male students for whom most postgraduate programs were created (Bellard, 2005; Gordon, 2002). Additional factors associated with today's graduate students are time-management issues due to competing responsibilities like childcare and work, and psychological issues like feelings of inadequacy and anxiety about competing with younger, traditional students; and a lack of confidence in their learning and research abilities, compounded by their unfamiliarity with computers and electronic resources (Bellard, 2005).

Given the demographics of today's graduate students, it is not surprising that they seek information in the quickest and most convenient manner.

Unfortunately, this often results in use of lower-quality resources like Internet web sites rather than library resources, even online ones. Compounding the principle-of least-effort approach to resources is the information glut mentioned above, which makes the research process “too complex for students to acquire the necessary [IL] skills...on their own without guidance and instruction” due to the “staggering amount of resources...along with the growing amount of scholarly communication available worldwide...making it difficult for even the subject specialist to stay abreast in [her/his] field” (Bellard, 2005, p. 494). In spite of this increasing volume and complexity of information, most advanced learners consider themselves adept at research, despite not knowing enough about their disciplines or their organization to be effective searchers (Bellard, 2005). This distance between students’ inflated perceptions of their own research ability and the need for IL instruction is well documented in the literature on graduate student library and research skills (Bellard, 2005; Chu & Law, 2003, Grant & Bert, 2003).

Working in postgraduates’ favor is the fact that they are, in general, highly- and self-motivated learners (Green & Macauley, 2007). Additionally, graduate students are more cognitively mature, understand their own learning styles, and even apply meta-cognitive strategies to their information seeking. While they may turn to the Internet for their research needs, advanced learners are often familiar with higher-quality search engines like Google Scholar (Green & Macauley, 2007). Since many graduate student also function as instructors/teaching assistants in general education courses like Freshman Composition, a significant and positive attribute is their desire to function as effective teachers of their students; the fact that these instructors are an important conduit of IL instruction for their undergraduate students heightens the necessity that advanced learners receive IL instruction early in their programs (Given, 2007). Given this positive motivation and the fact that IL instruction is associated with “long-term changes in library-use skills” (Hardesty et al., 1982, p. 44), graduate students should benefit from early assessment that can help identify and inform remediation of IL deficiencies.

Information Literacy Assessment

According to Meulemans (2002), IL assessment arose out of three movements in American academia and academic libraries in the late 1980s and 1990s: the higher education assessment movement, the rise of strategic planning and Total Quality Management (TQM) in higher education, and most significantly, the aforementioned change in focus from instruction in rudimentary library skills to IL in academic libraries. The final report of the ALA's Presidential Committee on IL pointed out the need for educational institutions to include IL instruction and assessment in their learning programs in order to produce information literate citizens (ALA, 1989). Once preliminary IL standards had been articulated by the ALA, IL began to be included in accreditation requirements by such bodies as the Middle States Association of Schools and Colleges (2006). Since IL is recognized as a skill necessary for student success in academic and personal matters, and one upon which accreditation hinges, IL is now among the set of skills assessed to account for the essential lifelong learning skills taught in higher education (Meulemans, 2002). For instance, South Dakota's local accrediting body, the North Central Association of Colleges and Schools' Higher Learning Council, has adopted IL in its "Criterion 4: Acquisition, Discovery, and Application of Knowledge" (2003).

Criterion 4, "Acquisition, discovery, and application of knowledge"
<ul style="list-style-type: none"> • The organization demonstrates, through the actions of its board, administrators, students, faculty, and staff, that it values a life of learning.
<ul style="list-style-type: none"> • The organization demonstrates that <i>acquisition of a breadth of knowledge and skills, and the exercise of intellectual inquiry</i> are integral to its educational programs.
<ul style="list-style-type: none"> • The organization assesses the usefulness of its curricula to students who will <i>live and work in a global, diverse, and technological society</i>.
<ul style="list-style-type: none"> • The organization provides support to ensure that faculty, students, and staff <i>acquire, discover, evaluate, and apply knowledge responsibly</i>.

Table 2: North Central Association Higher Learning Commission's Accreditation Criteria

Ury et al. (2006) point out that library assessment has tended to take the form of student satisfaction surveys (formative assessment rather than summative assessment) like the ones reported most recently by Wong et al. (2006). The problem with formative, survey-type assessment is that it relies too heavily on self-reported evidence and too little on students' IL and the efficacy of library IL instruction. In recent years, several instruments have been

developed for summative assessment, e.g., Project SAILS, the ETS iSkills Assessment, and James Madison University's Information Literacy Test (ILT). While these tools have achieved some national recognition and use, they are not appropriate IL measures for all of higher education for reasons that we elaborate below (see "The South Dakota IL Exam").

As was noted above, the focus of IL assessment has been on undergraduate rather than graduate students. However, the need for IL testing of graduate students is obvious, given the well documented lack of IL among these learners (see the discussion of graduate students' IL above). Further, given that graduate degrees are research degrees, it makes sense to require IL skills from the beginning of graduate students' careers. Postgraduate learners need to be tested for IL upon matriculation in order to establish the levels of these skills, identify gaps in knowledge and capabilities, and allow immediate and appropriate remediation.

There does not appear to be much evidence of the systematic IL assessment of advanced learners. Isolated suggestions and tools are described in the literature, ranging from a proposed research paper required of all applicants to graduate programs (Lacefield & Mahan, 1988) to an IL skills audit or test required of entering graduate students at the University of Missouri - Columbia (Rice, 1978), Boston College (Morner, 1993), and Australian National University (Perrett, 2004). And, the assessments appropriate for undergraduate learners would not necessarily be appropriate for use among graduate students. However, an undergraduate exit assessment like the SDILE can serve as an entrance assessment of IL for advanced learners, since the skill set assumed for graduate students is congruent with that of undergraduate students who are information literate. The SDILE is a short yet valid and reliable instrument documenting and assessing IL—both. This tool can serve as an exit assessment of undergraduate IL, as well as an entrance measure of graduate student IL. Graduate students can be informed of their level of and weak areas of IL, and individualized instruction can be formulated accordingly.

The South Dakota IL Exam

Starting in 2000 the South Dakota regental system's general education goals included an Information Technology Literacy (ITL) requirement, and

universities were free to interpret and assess this goal as they saw fit. Only the University of South Dakota (USD) interpreted ITL as IL and assessed IL with an ITL Exam developed at USD.

In February 2004 the South Dakota Board of Regents (SDBOR) convened a group of administrators, instructors, and librarians from the six state universities, with a mandate to revise the system-wide general education goals and objectives and to implement the new goals in fall 2005. In discussions lasting until fall 2004, the team established seven general education goals, with objectives and lists of courses that fulfilled the goals (South Dakota Board of Regents Committee on Academic and Student Affairs, 2004).

Goal #1	Students will write effectively and responsibly and will understand and interpret the written expression of others.
Goal #2	Students will communicate effectively and responsibly through listening and speaking.
Goal #3	Students will understand the organization, potential, and diversity of the human community through study of the social sciences.
Goal #4	Students will understand the diversity and complexity of the human experience through study of the arts and humanities.
Goal #5	Students will understand and apply fundamental mathematical processes and reasoning.
Goal #6	Students will understand the fundamental principles of the natural sciences and apply scientific methods of inquiry to investigate the natural world.
Goal #7	Students will recognize when information is needed and have the ability to locate, organize, critically evaluate, and effectively use information from a variety of sources with intellectual integrity.

Table 3: The South Dakota System-Wide General Education Requirements Goal

The seventh goal, Information Literacy, was established with student learning outcomes that matched the five ACRL Information Literacy Competency Standards for Higher Education (ACRL, 2000; SDBOR, 2004).

Students will...
<ul style="list-style-type: none"> • determine the extent of information needed;
<ul style="list-style-type: none"> • access the needed information effectively and efficiently;
<ul style="list-style-type: none"> • evaluate information and its sources critically;
<ul style="list-style-type: none"> • use information effectively to accomplish a specific purpose;
<ul style="list-style-type: none"> • use information in an ethical and legal manner.

Table 4: Goal #7 IL Student Learning Outcomes (ACRL IL Competency Standards)

Unlike the other general education goals promulgated by the SDBOR, which are fulfilled by university courses, Goal #7 IL can only be fulfilled by “demonstrating competency through an assessment designed by the university” (SDBOR, 2004). Instruction in “formal research and documentation” was incorporated into the student learning objectives for Goals 1 (Writing) and 2 (Speaking), thus effectively locating IL instruction in Freshman Composition, and Speech Communication 101 (SDBOR, 2004).

Since the IL goal was a system-wide general education requirement, it was immediately recognized that an assessment instrument should be chosen or developed for the entire regental system. At that time, only two national standardized assessments were on the horizon, Project SAILS and the ETS ICT Literacy (now, iSkills) Assessment. The Strategic Leadership Team considered the two standardized assessments and decided against using either of them. Project SAILS was in development and, based on information available at the time, it would still be undergoing beta testing during the 2006-2007 year (M. Thompson, personal communication, February 9, 2005). The SD system needed a valid instrument in the fall of 2006, before Project SAILS would be fully vetted. Additionally, while Project SAILS makes use of Item Response Theory (IRT) for analysis and thus could locate students on a scale of IL, it does not do so (O'Connor, Radcliff & Gedeon, 2002). Rather, because its purpose is to enable cross-institutional comparisons of the IL skills of student cohorts rather than to assess the IL capabilities of individual students (O'Connor, Radcliff & Gedeon, 2001), it provides only institution- or cohort-level information on IL skills (Project SAILS, 2006). However, the SDBOR wished the exam used by the South Dakota System to provide student-level information appropriate for fulfilling a general-education requirement and for program evaluation (i.e., the exam was to tell us whether an individual student is information literate and *how* information literate s/he is). The ETS iSkills Assessment measures *both* Information Literacy and technology literacy (Educational Testing Service, 2006), which goes beyond the goal of the new SDBOR general education requirements. In addition to the two national standardized exams, the Committee considered James Madison University's Information Literacy Test (ILT) and rejected it as well. Like Project SAILS and the ETS iSkills Assessment, the ILT is lengthy (65 questions); additionally, it does not address all of the ACRL IL Standards, as

it omits Standard 4 based on the claim that this standard cannot be assessed using multiple-choice questions (James Madison University Institute for Computer-Based Assessment, 2006). Since students in South Dakota's state universities are encouraged to pass an IL assessment by the end of their sophomore year, and they are already burdened at that time with the CAAP Proficiency Test, it was deemed desirable to find an IL assessment that was shorter, addressed *all* of the ACRL IL Standards (rather than ITL), yet was valid and reliable. Since the CAAP Proficiency Test places a financial burden on our institutions, the IL Subcommittee was also interested in obtaining an affordable alternative to the aforementioned instruments.

Since no suitable national standardized assessment tool was available, the Strategic Leadership Team constituted the IL Subcommittee (consisting of 5 assessment directors, 5 academic librarians, 2 English instructors, and 1 Communication Studies instructor from the six state universities) in the fall of 2004, with a mandate to create a system-wide IL assessment based on the USD ITL Exam. While this exam had functioned to document IL during the years of the ITL requirement, it was fraught with problems that undermined its value as an IL assessment tool (Leibiger & Schweinle, 2007; Schweinle, 2004). In the following sections we will describe the development of items and the scoring methods used with the SDILE and how these helped us arrive at a measurement designed both to document minimal IL proficiency for summative purposes at the student level and simultaneously to assess IL on a continuum for formative purposes at the program or institution level. Additionally, we will discuss the role of the item analysis in the iterative revision of the SDILE's contents.

Method and Design of the SDILE

In its mandate to create the SDILE, the South Dakota Board of Regents specified that the exam be brief, online, reliable, and content valid vis-à-vis the five ACRL IL standards. The proposed instrument was also required to have a discrete cutoff or minimal IL proficiency passing score. In other words, the exam should be useful for *documenting* whether a student is indeed information literate. Finally the SDILE should be able to *assess* each of the five ACRL standards along a continuum.

The documentation *and* assessment requirement was the greatest psychometric challenge in creating the SDILE. For instance, a *documentation* exam, e.g. a written driving exam, is designed to help determine whether an examinee has attained a minimally acceptable level of proficiency. However, such an instrument will not help determine how much better one driver is compared to another. In other words, it would be a mistake to infer that one person is a better driver than another because s/he scored higher on her/his written driving exam. *Assessment* exams are different in that they are designed to differentiate examinees along a continuum, rather than categorizing examinees above or below a discrete point. Assessment exams, usually the type administered in classes for grades, are designed to yield information about who is more proficient and by how much in interval terms. Creating an exam that embodies both documentation and assessment properties was difficult.

The successful creation of such an exam lies in the carefully constructed and empirically vetted test items as well as in how scores are computed. First, we combined two different types of questions—documentation and assessment items—into a single test. Then, we also scored the test in two different ways; one method results in documentation scores and the other results in assessment scores.

Item Development

Content experts, i.e., librarians from each state university created questions for each of the five ACRL IL Standards (i.e., each of the 5 South Dakota Goal #7 IL student learning outcomes). Ten questions were created at each state institution—1 documentation and 1 assessment question for each of the 5 ACRL standards. These questions were combined with items from the University of South Dakota ITL Exam. (Psychometric analyses indicated that most of the older ITL exam questions were not psychometrically sound and that they did not fit well into the SDILE design. These items have since been thoroughly revised or completely eliminated from the SDILE.) The Subcommittee reviewed the questions for face validity and made suggestions for changes to the items. The final revisions were discussed and agreed upon, and the IL Exam was set up in WebCT® at USD. Piloting of the SDILE began in the spring of 2005 and continued into the fall of 2006.

Test Items

The SDILE presents each student with twenty-five items consisting of 5 sets of 5 questions in which each set addresses a different ACRL IL Standard. For each ACRL standard there are 3 documentation questions and 2 assessment items. In other words, 15 of the 25 SDILE questions presented to a student are documentation items and 10 of the 25 presented items are assessment items.

Questions 1-5 address ACRL IL Standard 1 (6-10 = ACRL IL Standard 2, 11-15 = ACRL IL Standard 3, etc.)
<ul style="list-style-type: none"> • Documentation question (9 alternates labeled 1D1a-i)
<ul style="list-style-type: none"> • Documentation question (3 alternates labeled 1D2a-c)
<ul style="list-style-type: none"> • Documentation question (3 alternates labeled 1D3a-c)
<ul style="list-style-type: none"> • Assessment question (7 alternates labeled 1A1a-g)
<ul style="list-style-type: none"> • Assessment question (2 alternates labeled 1A2a-b)

Table 7: Distribution of Documentation and Assessment Questions in the SDILE (examples)

The documentation items (see the example below in Table 8) are located lower on Ω (~ -1.95) and have steeper ICC slopes, i.e. discrimination. The assessment items (see the example below in Table 9) are typically located higher on Ω (~ 0 and ~ 1), are more thought-provoking, and have smaller slopes. The lower discrimination parameters of the assessment items allow better “partial credit” allocation (see the discussion of the Bock Nominal Model below) and, thus, more precise assessment of IL along a continuum.

Why is Interlibrary Loan so valuable to a student’s research?
<ul style="list-style-type: none"> • It allows a student to visit and check out materials from a library that is not his/her local library.
<ul style="list-style-type: none"> • <u>It allows a student to request materials from a library that is not his/her local library.</u>
<ul style="list-style-type: none"> • It allows a student to access online materials at a library that is not his/her local library.
<ul style="list-style-type: none"> • It allows a student to purchase materials not located in his/her local library.
<ul style="list-style-type: none"> • Difficulty = .87

Table 8: Example of a documentation question addressing ACRL Standard 2 (Accessing needed information effectively and efficiently)

Your instructor has given an assignment that requires the use of primary source materials. Which would you consult?
• a biography of someone involved in the issue with criticism
• <u>a diary written by someone who was involved in the issue</u>
• a textbook article about someone who was involved in the issue
• a journal article about someone who was involved in the issue
• Difficulty = .63

Table 9: Example of an assessment question addressing ACRL Standard 2 (Accessing needed information effectively and efficiently)

Note also that there are several possible items that can be presented to the student as “Question 1” and the item that is presented is randomly selected by WebCT®. The probability is very low that any 2 examinees will see the same set of items.

Documentation of Minimal Information Literacy via Classical Psychometric Methods

Because the IL Subcommittee approached the problem of a passing or “cut” score somewhat differently. We first decided on the number of items to include in the exam (25) and then on a cut score (13 out of 25 correct). We did this for at least two reasons. First, with 13/25 and 4 answer choices per item, the p (pass|chance selection) is very small ($\sim .0025$).

The second consideration is somewhat more complicated. With a passing score of 13/25 and with an average classical item difficulty of about .70 (i.e., 70% of respondents answered a given item correctly), then our expected failure rate would be less than 5%. This avoided political concerns. (Recall that taking and passing the SDILE is required for graduation at the six SD regental universities.)

We observed Item Response Theory (IRT) coefficients of location and slope (somewhat analogous to difficulty and discrimination) to decide whether to retain, revise or exclude items. (A full explanation of Item Response Theory is well beyond the scope of this paper.^{2,3})

² For further discussion of IRT, see Reise, S. P., Ainsworth, A. T., & Haviland, M.G. (2005). Item Response Theory: Fundamentals, Applications, and Promise in Psychological Research. *Current Directions in Psychological Research* 14 (2), 95-101.

Figure 1 (below) depicts some typical two-parameter ICC's for documentation and assessment items. The ICC traces represent the $p(\Omega | \text{correct response})$. As Ω (i.e. IL) increases, the documentation trace line is sharply sloped, indicating that the item discriminates well. Further, the point at which $p(\Omega | \text{correct response}) = .5$ is located about 1.8 standard deviations below average, which means that a respondent who is approximately 1.8 standard deviations below average has a 50% chance of responding correctly. The assessment item trace is located higher on Ω than the documentation item, indicating that a higher degree of IL is necessary to have $p(\Omega | \text{correct response}) = .5$. Notice also that the assessment item slope is smaller, i.e. the assessment item does not discriminate about its location as closely as the documentation item does. All of these characteristics are used to decide whether to delete, revise or add items to the SDILE.

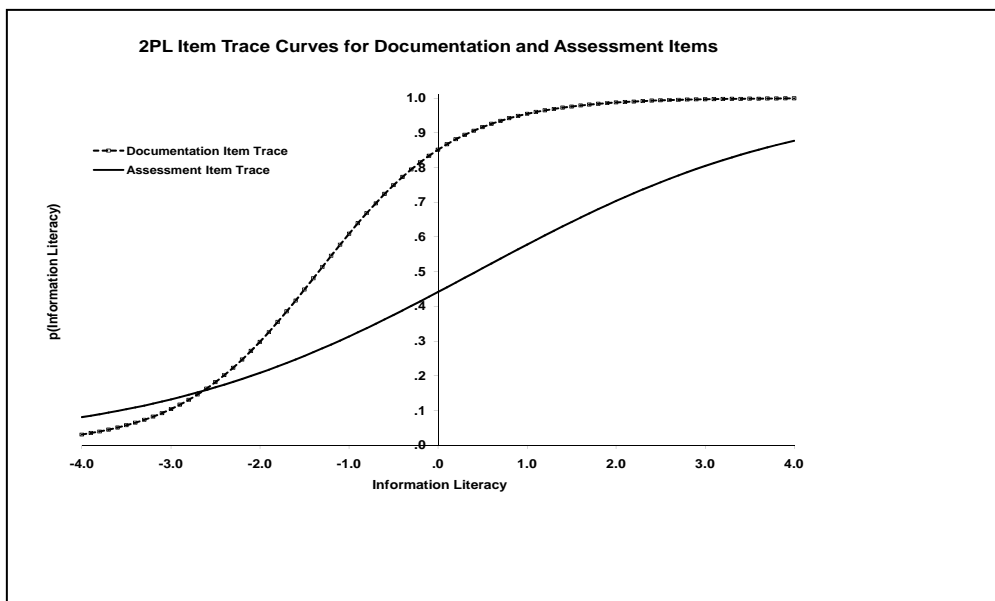


Figure 1

Assessment Scoring of the SDILE

Although we could count the number correct and arrive at a score, these scores would not be very precise, especially for the individual ACRL

³ For the application of IRT to IL assessment, see O'Connor, Radcliff, & Gedeon, 2001, 167- 168.

standards. This is because there are only 5 items for each of the ACRL standards. The internal reliability for each subscale would be very low. To overcome this problem, we used Bock Nominal scoring, which very efficiently captures information that is revealed in a given item response (Bock, 1972).

The Bock Nominal IRT method mathematically “assigns” numbers (i.e. locations) that are akin to “partial credit” for each response in an item. The efficiency of the Bock model allows the “correct” or best response to be located fairly high on Ω . Another choice might be located lower on Ω , indicating that a respondent who is lower in IL is more likely to make this choice. The Bock nominal method results in scores that are much more informed and much more informative than proportion correct scores. Figure 2 (below) depicts the Bock Nominal ICC traces for an assessment item. Each curve reflects the $p(\Omega | \text{that response})$. Response “c” is the correct choice and is located at the highest level of Ω (i.e., IL), whereas response “a” is the “worst” choice and is the likely response of a person who is relatively low in IL.

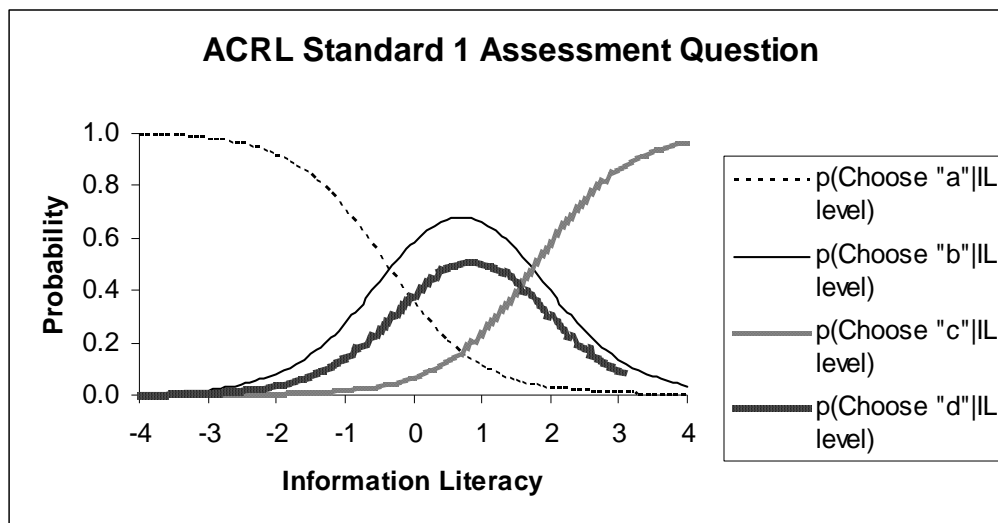


Figure 2

The Bock Nominal *assessment* score is the respondent’s maximally likely level of IL given her/his responses to all of the items. In this way the documentation items also serve assessment purposes and are scored using the Bock Nominal method. The resultant assessment scores can be used in the aggregate to assess overall levels of IL and to identify which of the ACRL learning goals is/are in need of attention.

The Interplay of Item Analysis and Item Revision: Revision of the SLO 4 Questions

The SDILE was pilot tested at the six South Dakota universities in the spring, summer, and fall of 2005 and again in the spring and fall of 2006. Data from each pilot administration was analyzed with classical and modern (IRT) psychometric methods. Only the questions relevant to SLO 4/ACRL Standard 4 (“Use information effectively to accomplish a specific purpose”) have required major revision.

The reason for this required revision is probably that the construct defined by SLO4 is intuitively difficult to tap with multiple-choice questions (see the claim supporting the exclusion of questions relating to ACRL Standard 4 from the James Madison University’s ILT above). This difficulty has been clearly evident as we have tried to create effective SDILE SLO 4 questions. However, we have been creating, piloting, revising and retesting items toward the goal of having a set that can validly and reliably tap SLO 4 as defined by the ACRL. Our revision of an SLO4 documentation question (below) reflects our use of empirical psychometric methods to create good test questions.

To best demonstrate the scope of a problem one should use...
• pictures
• <u>statistics</u>
• books
• articles

Table 10: The original form of a documentation question addressing ACRL Standard 4 (Old 4D2a)

When we fit an IRT model to the SLO 4 items, we found that some of them were reverse-scoring. For instance on item “Old 4D2a” (a documentation question designed to tap ACRL Standard 4) students were *less* likely to select choice “b” (the correct answer) when they were *higher* in Ω (i.e., more information-literate, see Figure 3).

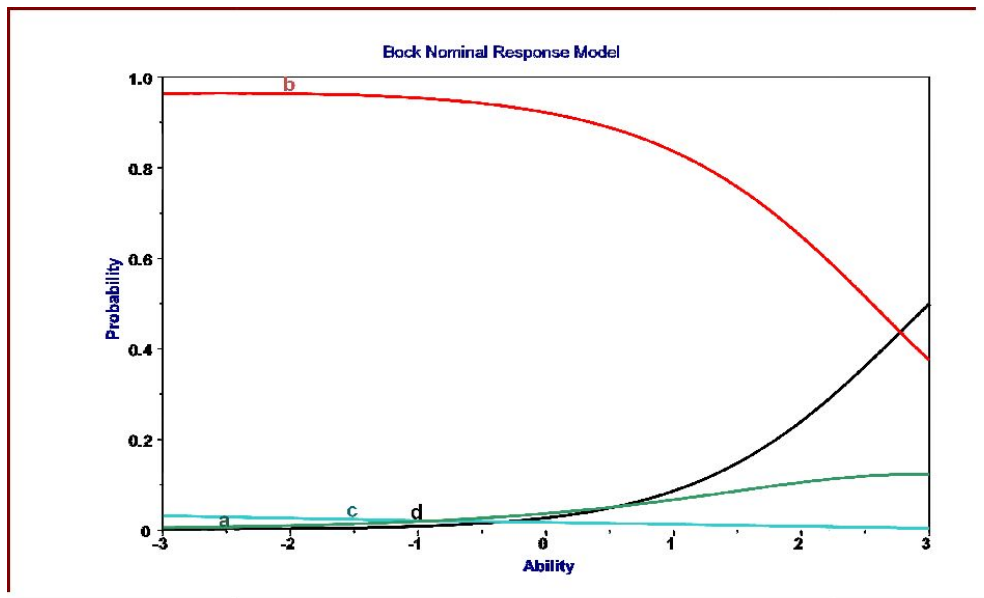


Figure 3: Bock Nominal Response Model for Old 4D2a

When we looked carefully at the question stem, “To best demonstrate the scope of a problem one should use...”, we realized that more thoughtful students over-intellectualize the question and answer incorrectly. Further, students who scored higher on the items related to ACRL Standards 1, 2, 3 and 5 performed worse than other students on the Standard 4 questions (see Figure 4 below).

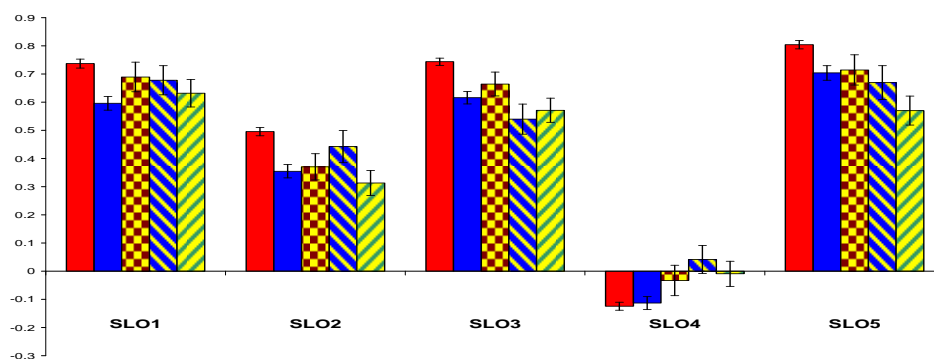


Figure 4: Nominal Scores of SDILE Questions Addressing ACRL Standards 1-3 and 5 Compared with those Addressing ACRL Standard 4 for the South Dakota BOR Universities

Based on the empirical psychometric information and our qualitative observations about Item 4D2a, we revised the item to include more contextual cues (see Table 11, below)

The best visual aid for a speech comparing changes in the profits of two or three competing companies over a three-year period is...
• a spreadsheet
• a market analysis.
• <u>a line chart.</u>
• a table

Table 11: Revised version of the documentation question addressing ACRL Standard 4 (New 4D2a)

We analyzed the revised 4D2a item and found the ICC traces depicted in Figure 5. These indicate that choice “c” is the best answer mathematically. It is also the correct answer. Choice “d” is the “lowest” response mathematically, and choices “a” and “b” were in between. We could revise choices “a” and “b” in order to make them more attractive distracters, but doing so would alter the *documentation* characteristics of question 4D2a by its empirically-derived psychometric properties. Although it may be difficult; time, effort, and continual revision make it possible to create multiple-choice questions that address ACRL Standard 4. The new Item 4D2a is a face valid measure of students’ ability to *use information effectively to accomplish a specific purpose* (ACRL Standard 4). Its validity is also supported and Item Response methods do allow us to create multiple-choice questions that address ACRL Standard 4.

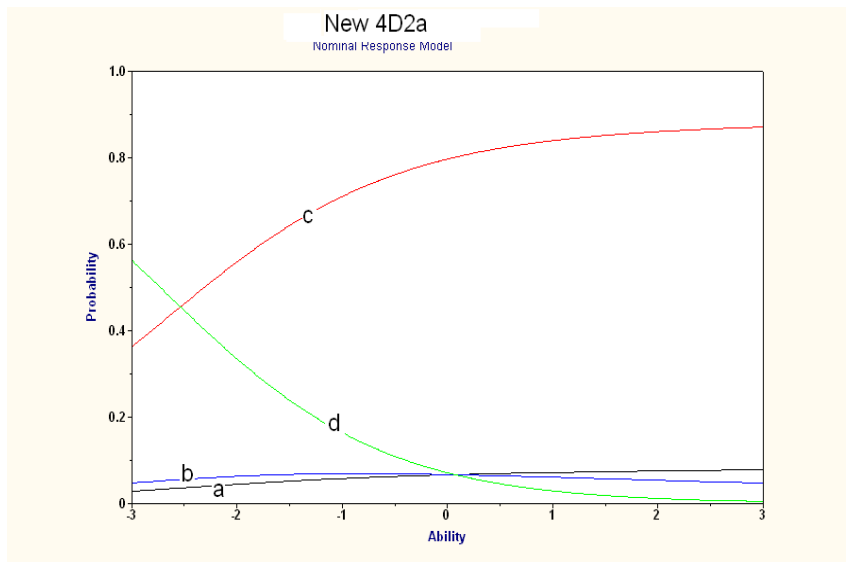


Figure 5: Bock Nominal Response Model for New 4D2a

Conclusion

Two sets of scores are computed for the SDILE. The first set of scores, the number of items correctly answered, can be used to document whether an individual student is information literate. The second set of scores is based on the Bock Nominal Model and can be used to assess the level of Information Literacy among groups of students. The SDILE is constantly being improved through item revision, addition, and deletion on the basis of empirical psychometric analyses.

The Information Literacy Subcommittee meets each academic term to review the SDILE items and related performance statistics. Items are revised, added and dropped on the basis of their psychometric properties and the purposes of the SDILE. Additionally, items are vetted for Differential Item Functioning (DIF) between genders, locations and ethnicities. Thus far none of the items has exhibited appreciable DIF. Because the student bodies of the state universities generally reflect the white, northern European heritage of South Dakota, the population of learners participating in the SDILE pilot is very homogeneous. The IL Subcommittee is soliciting beta-testing partners from more diverse regions and institutions to provide a more heterogeneous testing pool for the further development and revision of the SDILE. As a result of this beta testing, the SDILE will indeed develop into a valid and reliable tool for small and medium-sized universities both to document and assess student IL for the purposes of institutional assessment and cross-institutional comparison. In addition serving as a valid and reliable indicator of undergraduate IL, the SDILE can be developed into an entrance assessment for graduate students, offering advanced learners an opportunity to discover deficits in their IL and to remediate early in their graduate careers.

Notes

The authors wish to acknowledge the contributions of all members of the South Dakota Board of Regents Information Literacy Subcommittee, past and present, in the creation of the SDILE, especially those who participated in the generation of questions and all revisions of the SDILE from 2004 to the present. The latter group comprises the following assessment experts, library

faculty, students, and support staff from the six state universities of the South Dakota Regental System: Carrie Ahern, Lea Briggs, George Earley, Jacy Fry, Lynda Oldenkamp (co-chair of the IL Subcommittee from 2004-2006), Joann Sckerl, Sandra Schatz, Kristen Skrenes, Risë Smith, and Laura Wight. The authors also owe a debt of thanks to the Interlibrary Loan staff of I.D. Weeks Library (University of South Dakota) for their efforts to obtain the wealth of resources that supported the writing of this paper.

References

- Alire, C. A. (1984). *A nationwide survey of education doctoral students' attitudes regarding the importance of the library and the need for bibliographic instruction*. Unpublished doctoral dissertation, University of Northern Colorado, Greeley, CO.
- American Association of School Librarians. (1998). *Information Literacy Standards for Student Learning*. Retrieved October 26, 2007, from http://www.ala.org/ala/aasl/aaslproftools/informationpower/InformationLiteracyStandards_final.pdf
- American Library Association Presidential Committee on Information Literacy. (1989). *Final Report*. Retrieved October 26, 2007, from <http://www.ala.org/ala/acrl/acrlpubs/whitepapers/presidential.cfm>
- Association of American Colleges and Universities. (2002). *Greater Expectations: A New Vision for Learning as a Nation Goes to College*. Washington, DC: Association of American Colleges and Universities.
- Association of College & Research Libraries. (2000). *Information Literacy Competency Standards for Higher Education*. Retrieved October 26, 2007, from <http://www.ala.org/ala/acrl/acrlstandards/informationliteracycompetency.cfm>
- Bellard, E. M. (2005). Information Literacy Needs of Nontraditional Graduate Students in Social Work. *Research Strategies*, 20(4), 494-505.
- Blixrud, J. C. (2003). Project SAILS: Standardized assessment of Information Literacy skills. *ARL*, 230-231, 18-19.
- Bock, R. D. (1972). Estimating item parameters and latent ability when responses are scored in two or more nominal categories. *Psychometrika*, 37(1), 29-51.
- Bundy, A. E. (2004). *Australian and New Zealand Information Literacy Network: Principles, standards and practice*. Retrieved October 10, 2007, from <http://www.anziil.org/resources/Info%20lit%202nd%20edition.pdf>
- Carnegie Commission on Higher Education. (1972). *Reform on Campus*. New York: McGraw-Hill.
- Chu, S. K.-W., & Law, N. (2007). Development of information search expertise: Postgraduates' knowledge of searching skills. *portal: Libraries and the Academy*, 4(3), 295-316.
- Cooney, M., & Hiris, L. (2004). Integrating Information Literacy and its assessment into a graduate business course: A collaborative framework. *Research Strategies*, 19, 213-232.
- Department of Education. (1998). *Goals 2000: Reforming Education to Improve Student Achievement*. Retrieved October 26, 2007, from <http://www.ed.gov/pubs/G2KReforming/index.html>

- Down, C., Martin, E., Hager, P., & Bricknell, L. (1999). Graduate attributes, key competence and judgments: Exploring the links. In *Learning and teaching in higher education: Advancing international perspectives. HERDSA Annual International Conference* (pp. 1-14). Milperra: HERDSA.
- East, J. W. (2005). Information Literacy for the humanities researcher: A syllabus based on information habits research. *Journal of Academic Librarianship*, 31(2), 134-142.
- Educational Testing Service. (2006). *ICT Literacy Assessment*. Retrieved October 26, 2007, from <http://www.ets.org/ictliteracy/>
- Friedlander, A. (2002). *Dimensions and Use of the Scholarly Information Environment: Introduction to a Data Set Assembled by the Digital Library Federation and Outsell, Inc.* Retrieved October 26, 2007, from <http://www.clir.org/pubs/reports/pub110/contents.html>
- George, C., Bright, A., Hurlbert, T., Linke, E. C., St. Clair, G., & Stein, J. (2006). Scholarly use of information: Graduate students' information seeking behavior [Electronic Version]. *Information Research*, 11. Retrieved October 24, 2007, from http://www.library.cmu.edu/Libraries/ScholarlyUse_Grads.pdf
- Given, L. M. (2007). Affordance theory: A framework for graduate students' information behavior. *Journal of Documentation*, 63, 1115-1141.
- Gordon, C. (2002). A room with a view: Looking at school library instruction from a higher education perspective. *Knowledge Quest*, 30(4), 16-21.
- Grant, M., & Berg, M. (2003). Information Literacy integration in a doctoral program. *Behavioral & social sciences librarian*, 22(1), 115-128.
- Green, R., & Macauley, P. (2007). Doctoral students' engagement with information: An American-Australian perspective. *portal: Libraries and the Academy*, 7(3), 317-332.
- Hardesty, L., Lovrich, N. P., Jr., & Mannon, J. (1982). Library-use instruction: Assessment of the long-term effects. *College & Research Libraries*, 43(1), 38-46.
- Hardesty, L., & Tucker, J. M. (1989). An uncertain crusade: The history of library use instruction in a changing educational environment. In J. Richardson, Jr. & J. Y. Davis (Eds.), *Academic Librarianship Past, Present, and Future: A Festschrift in Honor of David Kaser* (pp. 97-111). Englewood, CO: Libraries Unlimited.
- Higher Learning Commission. (2003). *Institutional Accreditation: An Overview*. Retrieved October 26, 2007, from <http://www.higherlearningcommission.org/download/2003Overview.pdf>
- Honey, M., North, N., & Gunn, C. (2006). Improving library services for graduate nurse students in New Zealand. *Health Information & Libraries Journal*, 23(2), 102-109.
- James Madison University Institute for Computer-Based Assessment. (2006). Information Literacy Test (ILT). Retrieved October 26, 2007, from http://www.jmu.edu/icba/prodserve/instruments_ilt.htm
- Johnston, B., & Webber, S. (2003). Information Literacy in higher education: A review and case study. *Studies in Higher Education*, 28(3), 36-49.
- Lacefield, W. E., & Mahan, J. M. (1988). Factors influencing satisfaction of non-traditional students with mainstream graduate programs. *Educational Research Quarterly*, 12(2), 36-50.
- Lau, J. (2006). Guidelines on Information Literacy for Lifelong Learning. Retrieved October 10, 2007, from <http://www.ifla.org/VII/s42/pub/IL-Guidelines2006.pdf>
- Leibiger, C. A., & Schweinle, W. E. (2007). The South Dakota Information Literacy Exam: A tool for small and medium-sized universities to document and assess Information Literacy. In H. A. Thompson (Ed.), *Sailing into the Future--Charting our Destiny: Proceedings of the ACRL 13th National Conference* (pp. 264-276). Chicago: Association of College and Research Libraries.

- Lightman, H., & Reingold, R. N. (2005). A collaborative model for teaching e-resources: Northwestern University's graduate training day. *portal: Libraries and the Academy*, 5(1), 23-32.
- Liu, Z., & Yang, Z. Y. L. (2003). Factors influencing distance-education graduate students' use of information sources: A user study. *Journal of Academic Librarianship*, 30(1), 24-35.
- Macpherson, K. (2004). Undergraduate Information Literacy: A teaching framework. *Australian Academic and Research Libraries*, 35(3), 226-241.
- Meulemans, Y. N. (2002). Assessment city: The past, present, and future state of Information Literacy assessment. *College & Undergraduate Libraries*, 9(2), 61-74.
- Middle States Commission on Higher Education. (2006). Characteristics of excellence in higher education. Retrieved October 26, 2007, from <http://www.msche.org/publications/CHX06060320124919.pdf>
- Morner, C. J. (1993). *A test of library research skills for education doctoral students*. Unpublished doctoral dissertation, Boston College, Boston, MA.
- National Institute for Literacy. (1991). National Literacy Act of 1991. Retrieved October 26, 2007, from <http://www.nifl.gov/public-law.html>
- O'Connor, L. G., Radcliff, C. J., & Gedeon, J. A. (2001). Assessing Information Literacy Skills: Developing a Standardized Instrument for Institutional and Longitudinal Measurement. In H. A. Thompson (Ed.), *Crossing the Divide: Proceedings of the Tenth National Conference of the Association of College and Research Libraries* (pp. 163-174). Chicago: Association of College & Research Libraries.
- O'Connor, L. G., Radcliff, C. J., & Gedeon, J. A. (2002). Applying systems design and Item Response Theory to the problem of measuring Information Literacy skills. *College & Research Libraries*, 63(6), 528-543.
- Perrett, V. (2004). Graduate Information Literacy skills: The 2003 ANU skills audit. *Australian Library Journal*, 53(2), 161-171.
- Powell, C. A., & Case-Smith, J. (2003). Information Literacy skills of occupational therapy graduates: A survey of learning outcomes. *Journal of the Medical Library Association*, 9(14), 468-477.
- Project SAILS: Standardized Assessment of Information Literacy Skills. (2006). Retrieved November 20, 2006, from <http://www.projectsails.org>
- Reise, S. P., Ainsworth, A. T., & Haviland, M. G. (2005). Item Response Theory: Fundamentals, applications, and promise in psychological research. *Current Directions in Psychological Research*, 14(2), 95-101.
- Rice, J. G. (1978). *An inventory to test library competencies of doctoral candidates in education*. Unpublished doctoral dissertation, University of Missouri-Columbia, Columbia, MO.
- Rockman, I. (2002). Strengthening connections between Information Literacy, general education, and assessment efforts. *Library Trends*, 51(2), 185-198.
- Schweinle, W. E. (2004). *Report on the University of South Dakota Assessment of Outcomes Relevant to the Student Information Technology Literacy (ITL) Requirement*. Vermillion: University of South Dakota.
- Scottish Qualifications Authority. (2003). Key Competencies--some international comparisons. Retrieved October 10, 2007, from http://www.sqa.org.uk/files_ccc/Key_Competerencies.pdf
- Secretary's Commission on Achieving Necessary Skills. (1991). *What Work Requires of America's Schools: A Scans Report for America 2000*. Washington, DC: Department of Labor.

- Shapiro, J. J., & Hughes, S. K. (1996). Information Literacy as a liberal art: Enlightenment proposals for a new curriculum. *Educom Review*, 31(2), 31-35.
- South Dakota Board of Regents Committee on Academic and Student Affairs. (2004). System General Education Requirements: Recommendations on Goals and Student Learning Outcomes. Retrieved October 26, 2007, from http://www.sdbor.edu/administration/academics/documents/200304_sgr_cover_sheet_06-04BOR.pdf
- Ury, C., Park, S. G., Baudino, F., & Ury, G. (2006). Piloting the ILT: Lessons learned and future turns. In F. Baudino & C. J. Ury (Eds.), *Brick & Click Libraries: An academic library symposium* (pp. 22-33). Maryville, MO: Northwest Missouri State University.
- Williams, H. C. (2000). User education for graduate students: Never a given, and not always received. In T. E. Jacobson & H. C. Williams (Eds.), *Teaching the New Library: Reaching International, Minority, Senior Citizens, Gay/Lesbian, First-Generation, At-Risk, Graduate and Returning Students, and Distance Learners* (pp. 145-172). New York: Neal-Schuman Publishers.
- Wong, G., Chan, D., & Chu, S. (2006). Assessing the enduring impact of library instruction programs. *The Journal of Academic Librarianship*, 32(4), 384-395.