

# The South Dakota Information Literacy Exam: A Tool for Small and Medium-sized Universities to Document and Assess Information Literacy<sup>1</sup>

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## **Abstract**

This paper describes the South Dakota state universities' development of a dual-measure instrument to test Information Literacy (IL) following the ACRL *Information Literacy Competency Standards for Higher Education* and using classical and modern psychometric methods.

## **Introduction**

In an article published in *College & Research Libraries News* in 2005, Ilene Rockman prefaced her discussion of current information literacy (IL) assessments with the statement that, in addition to such well known tools as Project SAILS and the ETS Information and Communication Technology (ICT) Literacy Assessment, there are homegrown, paper-and-pencil instruments that have not been psychometrically vetted.<sup>2</sup> The present paper describes the development of the South Dakota Information Literacy Exam (SDILE), a "homegrown" IL exam that is indeed valid and reliable, while bearing some very unique and useful psychometric properties. The SDILE is an online measure constructed using the Association of College and Research Libraries' (ACRL) *Information Literacy Competency Standards for*

*Higher Education* and according to sound psychometric principles. Classical and modern (Item Response Theory) psychometric methods are being used to arrive at discrete (threshold) and continuous (assessment) scores, while providing validity and reliability information about the items. Because the SDILE was created for a system of small and medium-sized universities, it can function as an alternative to the longer and more expensive IL assessments currently available. This paper traces the history of the SDILE from its beginnings in the Information Technology Literacy Exam in 2000 through its pilot in 2005 and 2006, its item analysis, the development of its scoring according to IRT analyses, and its subsequent revisions.

## **Information Literacy Instruction in Higher Education**

Information literacy is a set of skills that enables the finding, evaluation, and appropriate (effective, legal and ethical) use of information.<sup>3</sup> Breivik claims that information has doubled every year since 1965;<sup>4</sup> this "information flood" in so many different formats necessitates training in choosing and manipulating information resources so that learners develop sophisticated retrieval

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**Table 1: The ACRL Information Literacy Competency Standards for Higher Education**

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| <p>An information literate person is able to:</p> <ul style="list-style-type: none"> <li>• Determine the extent of the information needed.</li> <li>• Access the needed information effectively and efficiently.</li> <li>• Evaluate information and its sources critically.</li> <li>• Incorporate selected information into one's knowledge base.</li> <li>• Use information effectively to accomplish a specific purpose.</li> <li>• Understand the economic, legal, and social issues surrounding the use of information, and access and use information ethically and legally.</li> </ul> <p>American Library Association, <i>Information Literacy Standards for Higher Education</i> (2000)</p> |
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skills and use information effectively to fulfill personal, academic, and professional needs. Of course, the most problematic area of modern research involves the Internet, and Web research requires especially well developed critical thinking skills.<sup>5</sup> Learners must acquire the knowledge and skills necessary to deal critically with information not only in order to fulfill their information needs, but to enable them to participate actively and effectively in democracy.<sup>6</sup>

Recognition of the need for explicit IL instruction arose in the 1980s out of the realization, on the one hand, of the value of library instruction for student academic success. For instance, Hardesty, Lovrich, and Mannon demonstrated empirically that library instruction is more strongly correlated with students' information-finding skills than is intellectual ability or academic diligence.<sup>7</sup> On the other hand, there was a growing realization that the bibliographic instruction (BI) or "library skills" instruction of earlier decades was insufficient to meet the needs of students engaged in higher education.

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.<sup>8</sup> Earlier BI instruction focused on information retrieval, usually from paper sources and in a specific library. Rockman points to the rise of the library instruction movement in the 1980s, with librarians "heavily involved in course-integrated library activities" in support of course instruction and assignments as an important step in the shift from BI to IL instruction.<sup>9</sup> Finally, the general education reform movement identified IL as necessary and on a par with the communication, critical

thinking, and math skills that should be in the general education curriculum and taught through collaboration with the instructors of general education courses. This movement established IL instruction even more thoroughly within traditional general-education courses like Freshman Composition.<sup>10</sup>

Today IL is recognized as both a necessary learning outcome of higher education and a lifelong learning skill, not only by academic librarians, but also by politicians, administrators, and accrediting bodies. Since the 1970s, various higher education reform movements have produced documents emphasizing the role of libraries, research, and critical thinking skills in effective higher education curricula and the desirability of IL as a student learning outcome (e.g., *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*).<sup>11</sup> All of these documents emphasized the importance of the library and research in undergraduate higher education in terms of quality assignments, a greater emphasis on essential skills, especially lifelong learning skills; the ability to acquire, evaluate, use, maintain, interpret, and communicate information as necessary future job skills; and adult literacy and lifelong learning skills as necessary to compete in a global economy. Finally, national IL standards were articulated by the American Library Association (ALA) and its higher education and school library subdivisions (the ACRL's *Information Literacy Competency Standards for Higher Education* [1989] and the American Association of School Librarians' (AASL) *Information Power National School Library Information Literacy Standards* [1998]).<sup>12</sup>

### Information Literacy Assessment

According to Meulemans, IL assessment arose out of three movements in 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 library skills to IL in academic libraries.<sup>13</sup> The final report of the ALA's Presidential Committee on IL, published in 1989, pointed out the need for educational institutions to include IL instruction and assessment in their learning programs in order

**Table 2: NCA Higher Learning Commission Accreditation Criteria**

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| <p>Criterion 4, “Acquisition, discovery, and application of knowledge”</p> <ul style="list-style-type: none"> <li>• 4a: The organization demonstrates, through the actions of its board, administrators, students, faculty, and staff, that it values a <i>life of learning</i>.</li> <li>• 4b: The organization demonstrates that <i>acquisition of a breadth of knowledge and skills</i> and <i>the exercise of intellectual inquiry</i> are integral to its educational programs.</li> <li>• 4c: The organization assesses the usefulness of its curricula to students who will <i>live and work in a global, diverse, and technological society</i>.</li> <li>• 4d: The organization provides support to ensure that faculty, students, and staff <i>acquire, discover, evaluate, and apply knowledge responsibly</i>.</li> </ul> |
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to produce information literate citizens.<sup>14</sup> 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. Since IL is recognized as a skill necessary for student success in academic and personal matters, and one upon which accreditation hinges, it has joined the set of skills assessed when institutions of higher education account for the essential lifelong learning skills that they impart to their students.<sup>15</sup> 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.”<sup>16</sup>

Ury et al. point out that library assessment has tended to take the form of student satisfaction surveys (formative assessment), like that reported most recently by Wong et al., rather than summative assessment.<sup>17</sup> The problem with formative, survey-type assessment is that it relies too heavily on anecdotal, self-reported evidence and too little on empirical data for the evaluation of library IL instruction. In recent years, several instruments have been developed for summative assessment, e.g., Project SAILS, the ETS Information and Communication Technology (ICT) Literacy 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 “Phase Two: The IL Exam”). The following discussion traces the development of the SDILE,

a short yet valid and reliable tool that provides discrete and continuous scores that allow higher education both to document and assess IL, respectively.

### Phase One: The Information Technology Literacy Exam (2000–2004)

In the fall of 2000, the six universities of the South Dakota Regental System (Black Hills State University, Dakota State University, Northern State University, South Dakota State University, the South Dakota School of Mines and Technology, and the University of South Dakota [USD]) implemented an Information Technology Literacy (ITL) general education requirement mandated by the South Dakota Board of Regents (SDBOR). This requirement originated in the spring of 1999 as system-wide, general-education requirement whose interpretation was left to the discretion of the individual universities, thus allowing each university to interpret, instruct, and assess ITL as it chose. While creating a single set of learning outcomes for the ITL requirement,<sup>18</sup> the USD Information Technology Literacy Task Force, comprised of representatives from the School of Education, the Departments of English and Communication Studies, and the I.D. Weeks Library (the general university library), decided that the concept *Information Technology Literacy* could best be addressed by dividing it into Information Technology and Information Literacy. (The other five universities interpreted ITL as either IL or IT—usually the latter—and assessed that one concept only.) The task force also established five ITL student learning outcomes, only the first and fourth of which were true IL outcomes; the second and third are IT (or ICT) standards, while the fifth is attitudinal rather than behavioral and thus not readily testable.

**Table 3: South Dakota Information Technology Literacy Student Learning Outcomes**

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| <p>All degree-seeking students under the 2000-2004 catalogs are required to satisfy the Information Literacy (IL) requirement through the demonstration of the following competencies:</p> <ol style="list-style-type: none"> <li>1. the ability to critically analyze information sources and the information they provide;</li> <li>2. the ability to use contemporary technologies;</li> <li>3. the ability to communicate using contemporary technologies;</li> <li>4. to understand and respect the ethical and legal aspects of information and information technology; and</li> <li>5. to understand information technology as an essential component of lifelong learning.</li> </ol> |
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Information literacy instruction at USD followed the national pattern of embedded instruction in required freshman writing and communication courses. IL was integrated into regular, remedial, and honors Freshman Composition (ENGL 101, 101+, and UHON 110, respectively) and Speech Communication 101. The library developed five online IL lessons (see the Library's IL web site at <http://www.usd.edu/library/ilgateway.cfm>) with corresponding WebCT quizzes, on the research process, catalog searching, database searching, web evaluation, and academic integrity; the students' composite IL quiz score comprised 10 percent of the Freshman Composition grade. In addition, the I.D. Weeks Library faculty facilitated research sessions for the individual Freshman Composition sections to support student research for the course's general research paper. In Speech Communication 101, library faculty facilitated research sessions to support the course's persuasive group speech, and librarian feedback on the research sessions was incorporated into each group's grade for that speech. (USD's Information Technology requirement was fulfilled by a course, CSCI 105, which covered the Microsoft applications Word, Excel, PowerPoint, and Access. Alternatively, students who passed the Computer Science 105 examinations with a grade of B or higher were awarded course credit by examination.)

After successful completion of Freshman Composition and Speech Communication 101, students were ready to take the ITL Exam. This was a twenty-four-question, multiple-choice exam, administered online via WebCT. The passing score was set at thirteen out of twenty-four (54%), yielding a 95 percent pass rate. The majority of exam questions addressed ITL Competencies 1 and 2 (using information sources and contemporary technologies, with eight questions apiece) and Competencies 3 and 4 (communicating via information technologies and understanding the ethical and legal aspects of information technologies) were addressed with four questions apiece. Competency 5 was not addressed by the ITL exam. While ITL competencies were to be equally emphasized in instruction, the exam was obviously weighted in favor of finding, evaluating, and manipulating information and data. Additionally, because the committee that wrote the ITL exam was chaired by the director of the Speech Communication 101 course, the exam's questions privileged those students who had successfully passed Speech Communication 101 at USD.<sup>19</sup> Thus, while the ITL Exam certainly tested students' ability to find information, it went beyond a very limited construction of IL to include as-

**Table 4: Sample ITL Exam Question**

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| <p>What is one possible unspoken assumption present in this argument?</p> <p>Every computer should come with software built into the computer that automally prevents access to web sites that are inappropriate for children under the age of thirteen.</p> <p>a. Limited censorship is acceptable when dealing with the Internet and children.</p> <p>b. Everybody is able to buy a new computer</p> <p>c. People like surfing on the World Wide Web and learning about new forms of software.</p> <p>d. Children enjoy computer games.</p> |
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pects of argumentation. Listed in table 4 is an example of a question from the USD ITL Exam that does not address an IL skill.

The example above actually tests students' knowledge of Toulmin logic, which relates to argumentation rather than IL. Five of the twenty-four questions on the ILT exam similarly emphasized the structure and use of argument over IL. Another problematic type of question involved the use of *Yahoo! Map Finder* to determine the distance between two American cities; this information proved so unstable that the correct answer in the ITL exam rarely matched the answer provided by *Map Finder*, requiring USD's Information Literacy Coordinator to refresh this question before every iteration of the ITL Exam (i.e., at least twice a semester).

**Phase Two: The Information Literacy Exam (2005–present)**

In February 2004 the SDBOR convened the Strategic Leadership Team, 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 deliberations lasting until the fall of 2004, the team established seven general education goals, with objectives and lists of courses that fulfilled the goals.<sup>20</sup>

The seventh goal, Information Literacy, was established with student learning outcomes that matched the five ACRL Information Literacy Competency Standards for Higher Education.<sup>21</sup>

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.”<sup>22</sup> Instruction in “formal research and documentation” was incorporated into the student learning

**Table 5: The South Dakota System-Wide General Education Requirements**

- 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.

objectives for Goals 1 (Writing) and 2 (Speaking), thus effectively locating IL instruction in Freshman Composition, Advanced Writing, and Speech Communication 101. Library instruction remained embedded in USD's Freshman Composition; online library lessons and quizzes were retained, and library IL research instruction was increased to support both a general research paper *and* a literary analysis paper. Speech Communication experimented with various embedded IL assignments and then returned to librarian-facilitated research for persuasive group speeches.

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 Assess-

**Table 6: Goal #7 IL Student Learning Outcomes (ACRL IL Competency Standards)**

- Students will...
- Determine the extent of information needed;
  - Access the needed information effectively and efficiently;
  - Evaluate information and its sources critically;
  - Use information effectively to accomplish a specific purpose;
  - Use information in an ethical and legal manner

ment. 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.<sup>23</sup> 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.<sup>24</sup> 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,<sup>25</sup> it provides only institution- or cohort-level information on IL skills.<sup>26</sup> 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 ICT Literacy Assessment measures *both* information literacy and technology literacy,<sup>27</sup> 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 ICT Literacy Assessment, the ILT is lengthy (sixty-five 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.<sup>28</sup> Since students in South Dakota's state universities need 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 five assessment directors, five academic librarians, two English instructors, and one Communication Studies instructor from the six state universities) in the fall of 2004, with a mandate to create a homegrown system-wide IL assessment based on the USD ITL exam. 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 to document minimal IL proficiency for summative purposes at the student level and an instrument that simultaneously assesses 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 several requirements for the instrument. Specifically, the exam should be brief, deliverable online, and reliable and content valid vis-à-vis the ACRL IL standards. Also, the SDILE should have a discrete cutoff or passing score by which information literate students can be differentiated from information illiterate students. 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* student information literacy along a continuum.

The last two requirements—documentation and assessment—posed the greatest psychometric challenge for the creation of the SDILE. For instance, one test may be constructed to *document* whether an examinee has attained a minimally acceptable level of proficiency, e.g., a written driving exam. One of the drawbacks of this type of test is that it is not very helpful for determining who is a better driver. In other words, it would be foolhardy to infer that someone is a better driver than another person because the former scored higher on her/his written driving exam. Another type of exam is designed to *assess* examinees along a continuum, rather than about a fixed point. These exams, usually the type administered in classes for grades, are designed to yield information about who is more proficient and by how much. An exam that combines both properties would be a difficult instrument to construct.

The solution arrived at by the IL Subcommittee lies as much in the carefully constructed and empirically vetted test items as it does in how the instrument is scored. While the IL Subcommittee was asked to create an instrument that simultaneously documents and assesses IL, in actuality the production of such an instrument amounted to combining two different types of questions—documentation and assessment items—into a single tool. Further, the test is scored in two different ways; one method yields documentation scores and the other yields assessment scores.

### Item Development

In order to create questions as quickly as possible so as to enable piloting of the new IL exam in spring 2005, the IL Subcommittee decided to have members from each state university create a pair of questions (one documentation, one assessment, see below for examples) for each of the five ACRL IL Standards (i.e., each of the five South Dakota Goal #7 IL student learning outcomes) by early December 2004. Since each of the six state universities produced ten questions, sixty questions were collected in this way. In addition, the better, truly IL-related questions that were not bound to USD's library resources were gleaned from the ITL exam (analysis of the pilot results indicated that most of these questions were problematic, and they have since been thoroughly revised or dropped from the SDILE). These questions were grouped together by content into sets of question alternates. The subcommittee reviewed the questions in late December for face validity and made suggestions for changes to the items in early January 2005, and the final revisions were discussed and agreed upon via conference call in late January. The IL Exam was set up in WebCT at USD in February and exported to the other campuses via e-mail in March. The piloting of the SDILE began in the spring of 2005 and continued into the fall of 2006.

### Test Items

A student who sits for the SDILE is presented with twenty-five items, consisting of five sets of five questions, each set addressing a different ACRL IL Standard. Examinees are presented with three documentation items and two assessment items for each of the ACRL standards. Fifteen of the SDILE questions (the first three of each set of five questions) serve documentation purposes and ten (the last two of each set of five questions) are for assessment.

The documentation items are less difficult and have higher discrimination properties. The assessment items are more difficult, more thought-provoking, and have

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

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| <p>Questions 1-5 address ACRL IL Standard 1 (6-10 = ACRL IL Standard 2, 11-15 = ACRL IL Standard 3, etc.)</p> <ol style="list-style-type: none"> <li>1. Documentation question (9 alternates labeled 1D1a-i)</li> <li>2. Documentation question (3 alternates labeled 1D2a-c)</li> <li>3. Documentation question (3 alternates labeled 1D3a-c)</li> <li>4. Assessment question (7 alternates labeled 1A1a-g)</li> <li>5. Assessment question (2 alternates labeled 1A2a-b)</li> </ol> |
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**Table 8: Example of a documentation question addressing ACRL Standard 2 (Accessing needed information effectively and efficiently)**

- Why is Interlibrary Loan so valuable to a student's research?
- It allows a student to visit and check out materials from a library that is not his/her local library.
  - It allows a student to request materials from a library that is not his/her local library.
  - It allows a student to access online materials at a library that is not his/her local library.
  - It allows a student to purchase materials not located in his/her local library.

*Difficulty = .87*

**Table 9: Example of an assessment 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
  - a diary written by someone who was involved in the issue
  - a textbook article about someone who was involved in the issue
  - a journal article about someone who was involved in the issue

*Difficulty = .63*

lower discrimination properties. The lower discrimination properties permit better partial credit assignment (see the discussion of the Bock Nominal Model below) and, thus, more precise assessment of IL along a continuum.

For the each item presented to the student, there are several possible alternates. In other words, "Question 1" is randomly selected by a Course Management System like WebCT from several possible "Question 1's" and presented to the examinee. Each question is thus randomly selected from a set of alternates such that the probability is very low that any two examinees will see the same set of items.

### Documentation of Minimal Information Literacy via Classical Psychometric Methods

Because the IL subcommittee was starting from the ground up, it decided on the number of items in the exam (twenty-five) and on a cut score before creating the items. The score chosen was thirteen out of twenty-

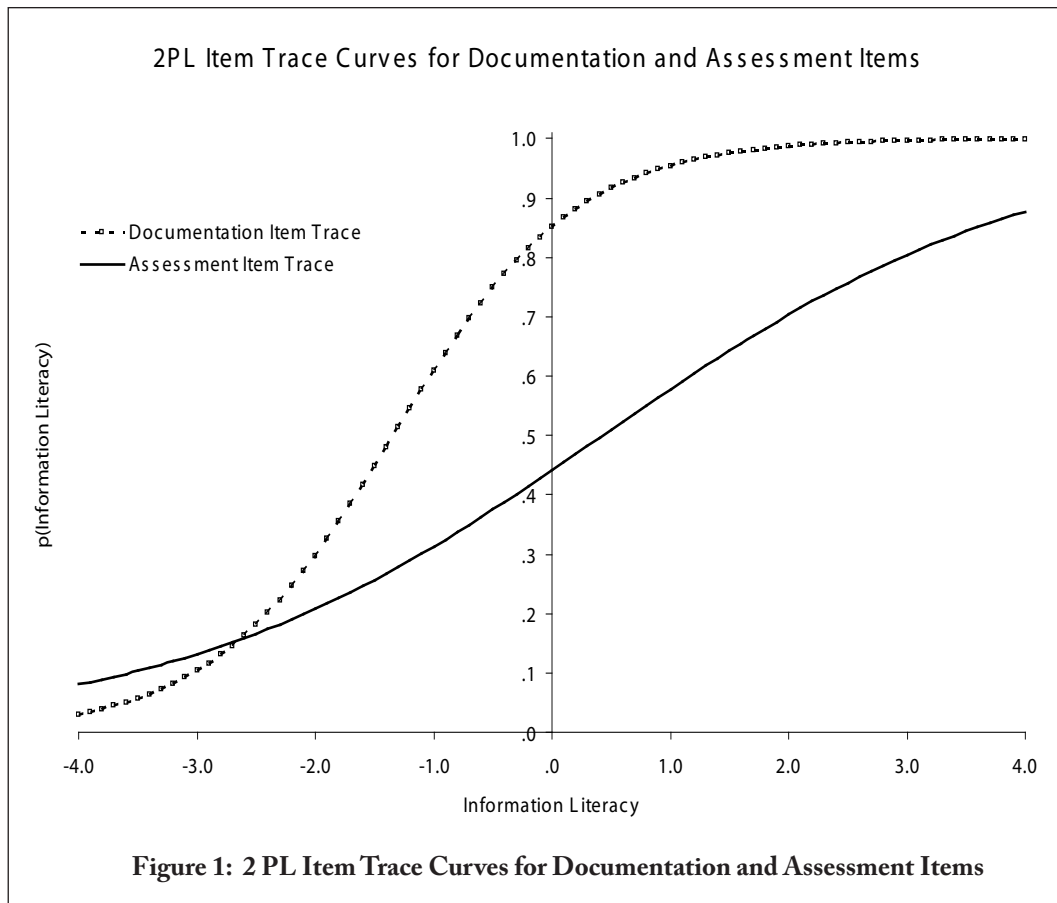
five correct, for several reasons. First, thirteen is more than half of the twenty-five items, and with four answer choices per item, the possibility that a student would pass by chance alone, i.e., by selecting "b" for all items, was relatively small. Second, as item difficulties vary from .5, the individual item variances will decrease, which yields greater classical reliability. However, it was desirable for items to possess as much variance as possible in order to better serve our assessment purposes.

The third consideration is somewhat more complicated. With a cut-score of thirteen out of twenty-five and with item difficulties averaging at about .70 (i.e., 70 percent of respondents answered a given item correctly), fewer than 5 percent of respondents would be expected to fail the exam. The IL subcommittee chose this particular item difficulty and projected pass-rate to avoid the problems it would encounter if a test were promulgated that failed students at a higher rate. Recall that passing the SDILE is a graduation requirement for all students in the six SD regental universities.

It is important to note at this point that both classical discrimination indices, i.e., point biserial correlations, were observed to determine an item's discrimination properties as well as Item Response Theory (IRT) coefficients of location and slope, which are analogous to difficulty and discrimination. (A full explanation of Item Response Theory is well beyond the scope of this paper.<sup>29</sup>) Figure 1 depicts typical two-parameter IRT results for the two different item types. The trace lines represent the probability of a respondent's IL given her/his response to the item. Note that as IL increases, the documentation trace line steeply rises. In other words, the item discriminates well, and a respondent approximately 1.8 standard deviations below average has a 50 percent chance of responding to this item correctly. The assessment item trace is located to the right of the documentation item, indicating that a respondent must have greater IL in order to have a 50 percent chance of responding correctly. Further, the assessment item slope is flatter, which indicates that the assessment item does not discriminate as much as the documentation item. Items are added, dropped and revised on the basis of these characteristics.

### Assessment Scoring of the SDILE

While it would be possible simply to count the number of correct responses and arrive at a score that might be used to differentiate students along a continuum, the scores would not be very precise, particularly since there are only twenty-five items in the SDILE, and there



are only five questions for each of the five different constructs of interest: the ACRL standards. The resulting internal reliability for each standard would be relatively low. Therefore, we chose the Bock Nominal Model scoring method, because it more efficiently captures the information contained in a student's response to each question.<sup>30</sup>

The Bock model is an IRT method for mathematically assigning "partial credit" to each choice within an item. While the correct response might indicate that the respondent is fairly high in IL, another choice might suggest that the respondent is almost as proficient in IL. The Bock model assigns these "partial-credit" numbers based on how respondents answer all of the items they are presented. The end result is a set of scores that are much more informative than scores that equal the number of items answered correctly. Figure 2 depicts the Bock Nominal scoring for an assessment item. Each curve reflects the probability that a respondent will select an answer determined by her/his level of IL. Choice "c" is the correct choice and is associated with higher levels of IL. On the other hand, choice "a" would be the "worst" choice and would more likely be made by a person who is relatively low in IL.

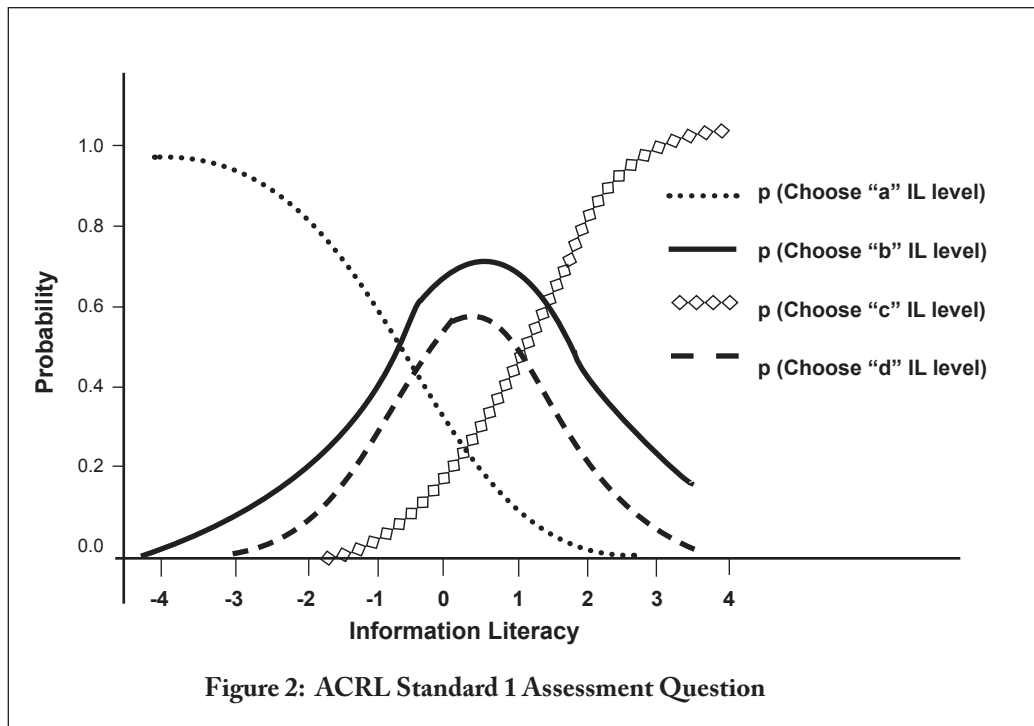
The *assessment* score is computed as the respondent's most probable level of IL given her/his responses to all of the items, including the documentation items, which also serve assessment purposes and are scored using the Bock Nominal method. Assessment scores are best used at the institutional level to determine students' overall level of IL and the students' proficiency relative to each of the ACRL standards.

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

The IL Exam was piloted at the six state universities in the spring, summer, and fall of 2005 and the spring and fall of 2006; data from each pilot was analyzed both classically and with modern IRT methods. Item analysis has served to indicate questions that require revision. Thus far, the only group of questions that has required extensive revisions has been those questions addressing SLO 4/ACRL Standard 4 ("Use information effectively to accomplish a specific purpose").

Simply on its surface, the construct defined by SLO4 would seem difficult to measure with a multiple choice format (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 borne out in the subcommittee's efforts to create effective SDILE SLO 4 test items. However, the IL subcommittee is creating, empirically testing, revising, and retesting items in order to develop a set that can indeed effectively tap the SLO 4 construct. The following example of the revision of a SLO4 documentation question reflects this use of empirical data in effective test question creation.

Bock Nominal analyses of the "Old 4D2a" question (i.e., a documentation question addressing ACRL Standard 4, see table 10) revealed that it was reverse scoring, i.e., students who were *higher* in IL were less likely to select choice "b", the correct answer (see figure 3). Given the lack of context included in the question stem, "To best demonstrate the scope of a problem one should use..." it is easy to see that a more thoughtful student might read too much into the question or otherwise over-intellectualize it in an effort to provide a context and as a result select an incorrect answer.

In fact, the overall effect of the Standard 4 questions was to counter indicate IL, i.e., students who were identified as information literate by the SDILE questions addressing Standards 1 to 3 and 5 did poorly on Standard 4 questions, and vice versa (see figure 4).

Given the hypothesis that Question 4D2a was problematic because it lacked a context, it was revised to

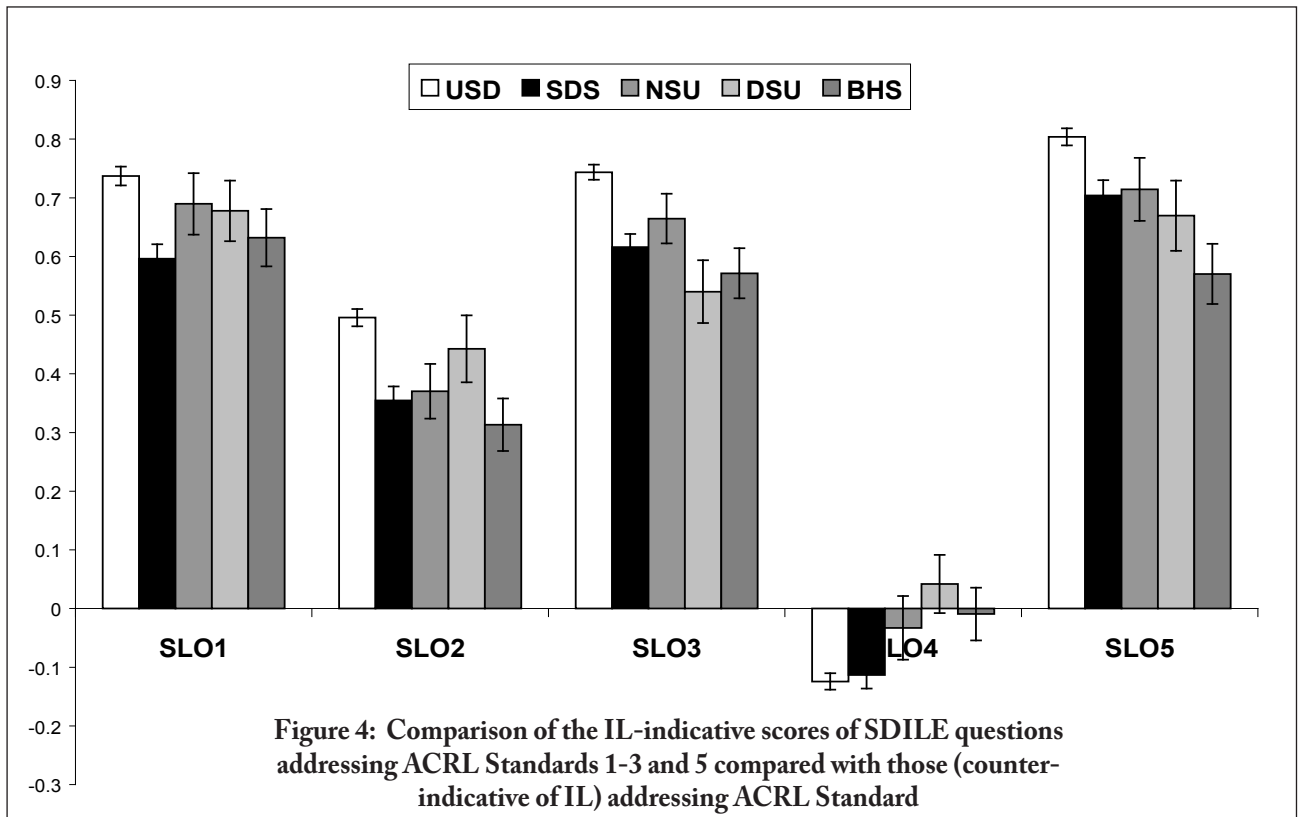
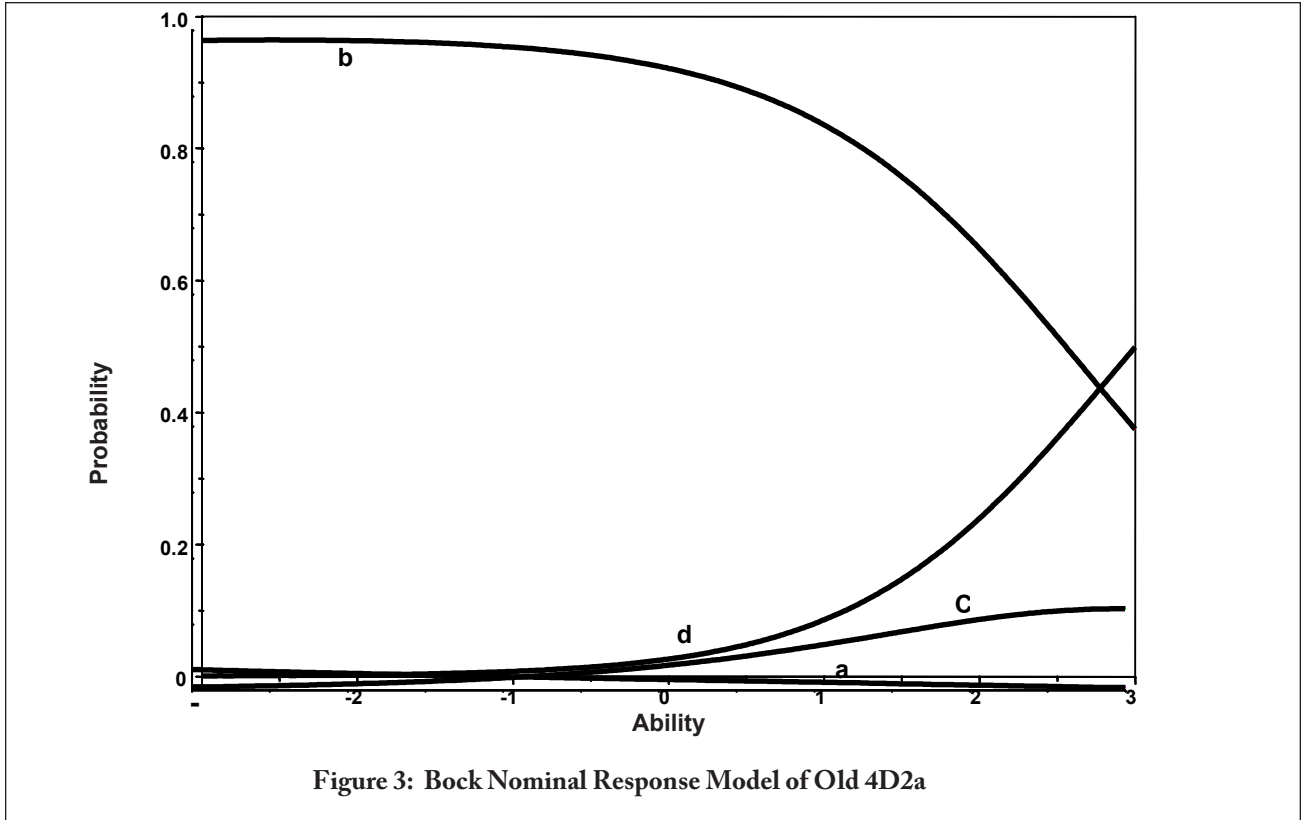
include more contextual cues (see table 11).

The Bock Nominal item traces for the new 4D2a are depicted in figure 5 and indicate that choice "c," the correct answer, is also the best answer mathematically and that choice "d" is perhaps the "lowest" response. Choices "a" and "b" were not very helpful in determining a respondent's IL. However, students' responses to other items can help locate the students along the IL continuum. (It would be possible, of course, to revise choices "a" and "b" to make them more attractive distracters and thus more informative in the assessment sense. However, this increased variance would substantially alter the *documentation* characteristics of question 4D2a.)

The current new form of Item 4D2a is indeed face valid as a measure of students' ability to *use information effectively to accomplish a specific purpose* (ACRL Standard 4). And, Item 4D2a now possesses psychometric properties that are congruent with this aim. It would seem that, while difficult, it is indeed possible to create multiple-

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

|  |
|--|
| To best demonstrate the scope of a problem one should use... |
| a. pictures.   |
| b. <u>statistics</u> .                                       |
| c. books.  |
| d. articles.   |



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

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.
- a line chart.
- a table

choice questions that address ACRL Standard 4.

## Conclusion

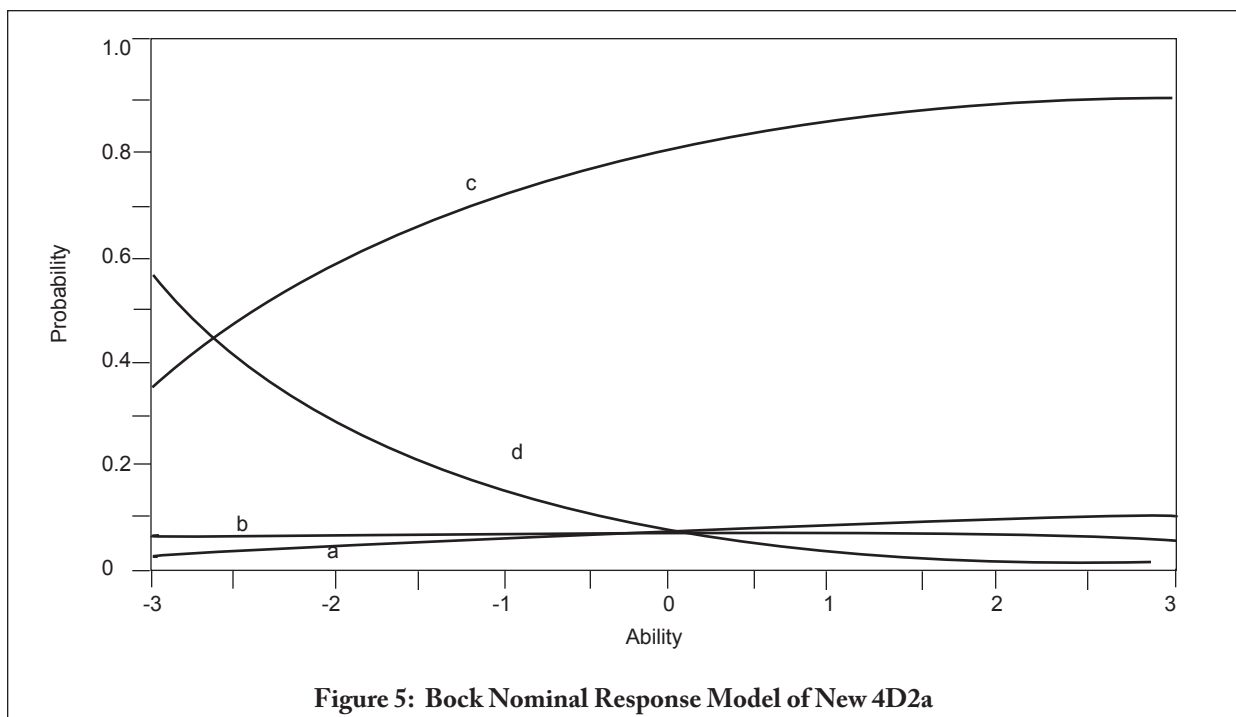
Thus two sets of scores are computed for the SDILE. The first set of scores, the number of items correctly answered, can be used to document whether an individual student is information literate. The second set of scores is based on the Bock Nominal Model and can be used to assess the level of information 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) be-

tween 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.

## Notes

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**Figure 5: Bock Nominal Response Model of New 4D2a**

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