Attaining information literacy: An investigation of the relationship between skill level, self-estimates of skill, and library anxiety

Melissa Gross*, Don Latham

*Corresponding author.
E-mail address: mgross@ci.fsu.edu (M. Gross).

Abstract

Competency theory predicts a miscalibration between students’ self-assessments of their information literacy skills and their actual skill level. This study investigates whether such a disparity is evident among incoming freshmen who test as non-proficient on a standardized test of information literacy. In addition, this study analyzes Information Literacy Test scores and library anxiety test scores to provide preliminary data on whether library anxiety is related to information literacy skill attainment. Findings reveal that the relationship between information literacy skills and self-assessments predicted by competency theory are evident in the domain of information literacy. This study did not find an association between information literacy skill scores and total library anxiety scores. However, a significant negative correlation between information literacy scores and the subscale “knowledge of the library” indicates that as information literacy scores rise, anxiety scores related to a lack of knowledge of the library fall. The findings suggest that traditional information literacy instruction may not be effective with non-proficient students, who are unlikely to see themselves as needing or benefiting from such instruction.

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1. Introduction

The acquisition of information literacy skills in society is a serious issue. Today, the consequences for reaching adulthood with limited information literacy skills are becoming increasingly severe. Individuals who are unprepared to participate in our information-rich society are at an increasing disadvantage. This means that it is crucial to integrate information literacy skills education into higher education effectively if we wish students to be full participants in tomorrow’s workforce. Students need to achieve a level of information literacy that will allow them to find, assess, and use information in order to succeed in school, the workplace, and their personal lives.

Information literacy has received increasing attention in research and professional practice with the emergence of electronic resources. There is growing recognition that information literacy is necessary to participate in the information age. In the United States, there are two main definitions of information literacy that guide the professional work of librarians. For K-12 students, the definition is found in Information Power: Building Partnerships For Learning (American Association for School Librarians [AASL] & Association for Educational Communications and Technology [AECT], 1998). At the post-secondary level, Information Literacy Competency Standards for Higher Education (Association of College and Research Libraries, 2000) informs information literacy practice. These publications provide standards and indicators that facilitate the development of information literacy programs, as well as assessment tools to measure the attainment of information literacy skills. Information Power identifies three broad areas within its Information Literacy Standards for Student Learning—information literacy, lifelong learning, and social responsibility. Within information literacy, three core competencies are defined: the information literate student “accesses information effectively and efficiently,” “evaluates information critically and competently,” and “uses information accurately and creatively” (American Association for School Librarians and Association for Educational Communications and Technology, 1998). The Information Literacy Competency Standards for Higher Education takes its definition of information literacy from the final report of the American Library Association’s Presidential Committee on Information Literacy. According to this report, information literacy is “a set of abilities requiring individuals to recognize when information is needed and have the ability to locate, evaluate, and use effectively the needed information” (Association of College and Research Libraries, 2000). The ACRL standards have been widely adopted by many colleges and universities.

Another framework for examining students’ information literacy is provided by the outcomes assessment model. Accrediting agencies in particular are placing increasing emphasis on outcomes assessment. Not surprisingly, most institutions of higher education now incorporate such a framework into their overall institutional assessment plans (Hernon & Dugan, 2004). As Dugan (2004) explains, “Outcomes assessment places shared responsibility on all institutional units for providing evidence of how they contribute to desired educational outcomes and how they incorporate outcomes assessment into planning and improvement” (p. 103). Student learning outcomes can be assessed, and as such, they provide a useful and important way to measure what students have learned—including what
they have learned from information literacy instruction. By working together, librarians, faculty, and administrators can achieve the “strategic triad” of planning, implementing, and improving information literacy instruction (Ratteray, 2004) and can select the right assessment tool(s) for their institution’s own particular needs (Hernon, 2004). Outcomes assessment offers a valuable framework for measuring the effectiveness of instructional efforts.

However, not all colleges and universities require that students receive information literacy instruction. Even those who do often relegate instruction to no more than a one-hour workshop. The fact remains that students who are unaware of a deficit in their information literacy skills are unlikely to seek skill remediation on their own or to engage with instruction when forced to take it. Competency theory provides a framework for understanding the disconnection demonstrated in the information literacy literature between actual skill attainment and self-assessments of performance. Competency theory suggests that individuals with low-level skills in a particular domain tend to overestimate their own skill level and, moreover, have trouble recognizing proficiency in others (Kruger & Dunning, 1999).

This project uses student scores on the Information Literacy Test (ILT) (James Madison University [JMU], n.d.), responses on two short surveys, and student scores on the Library Anxiety Scale (LAS) (Bostick, 1993) to provide a look at the relationship between a standardized measurement of student information literacy skills and students’ estimates of their information seeking skills. It also examines the extent to which skill level may be associated with library anxiety.

2. Problem statement

Much research and practice have focused on attaining information literacy competence through instructional interventions and assessments. However, these efforts largely reflect the point of view of the information literate: professional librarians and instructors. Generally speaking, instructional efforts have not been informed by students’ views of information literacy and its attainment. Less is known about how students with non-proficient information seeking skills view themselves along these dimensions.

This initial investigation is important because the relationship between these variables has not been addressed by empirical research to date. Competency theory suggests that information literacy skills may be associated with students’ ability to self-assess their skill set; students who operate at a low skill level may be at a disadvantage in terms of being able to recognize their skill deficit (Kruger & Dunning, 1999).

Research testing the theory of library anxiety supports the implications of competency theory because it has documented an association between high-performing students (in terms of academic achievement and a high level of self-motivation) and the experience of library anxiety (Jiao, Onwuegbuzie, & Lichtenstein, 1996; Onwuegbuzie & Jiao, 2004). However, these studies do not directly measure student information literacy skills correlated with experiencing library anxiety (Gross, 2005). This research, therefore, will be useful for testing and/or verifying both competency and library anxiety theory.
The following research questions are addressed in investigating this problem:

1. Based on a test of information seeking skills, what level of information literacy skills do low-performing and high-performing incoming freshmen (based on high school GPA and SAT/ACT scores) bring with them to higher education?
2. Is there an association between scores on an information literacy skills test and students’ estimates of their information literacy skills?
3. Do students with non-proficient information literacy skills demonstrate inflated estimates of their performance on an information literacy skills test?
4. Do students with non-proficient information literacy skills adjust their self-estimates of performance in response to information literacy skills testing?
5. Is there a relationship between student scores on a test of information literacy and their scores on a scale that measures library anxiety?
6. Is there a relationship between student scores on a test of information literacy and their scores on any of the Library Anxiety Scale sub-scores?

3. Relevant literature

Research has shown that students receive inconsistent information literacy skill instruction in the K-12 environment, that students enter institutions of higher learning with a wide range of information literacy skills, and that low-level information literacy skills are common among entering freshmen and low-performing students (Jiao & Onwuegbuzie, 1998; Massey-Burzio, 1998; Maughan, 2001; Seiden, Szymborski, & Norelli, 1998; Valentine, 1999). A recent study conducted by the Educational Testing Service reported that only 13% of 3,000 college students and 800 high school students tested were information literate (Foster, 2006). Research also shows that many students are not achieving these skills prior to earning a 4-year degree (Coupe, 1993; Greer, Weston, & Alm, 1991; Maughan, 2001), and that lesser performing students do not recognize that they lack these skills (Holman, 2000; Maughan, 2001).

Both anecdotal data from librarians and empirical evidence from research suggest that students demonstrate inflated views of their information literacy skills (Freeman, 2004; Ivanitskaya, Laus, & Casey, 2004). For example, Geffert and Christensen (1998) found no correlation between “student’s test scores and their levels of self-confidence, comfort in libraries, or self-assessment of library skills” (p. 279). Interestingly, this study also provided evidence that students with higher level skills tend to underestimate their skills, while students with lower level skills overestimate their performance. These findings are based on six questions designed to test information literacy and student’s self-reports of how comfortable they felt using various information resources. Geffert and Christensen recognized that their study was limited by the difficulty inherent in measuring competency in information literacy skills. They offered no theory to explain their findings.

A long-term study focused on assessing student information literacy skills at the University of California, Berkeley, assessed the information literacy skills of graduating seniors in 1994,
1995, and 1999 using a 36-question survey (Maughan, 2001). Self-assessments of information literacy were compared to skills demonstrated in response to the survey questions. The researchers concluded that “students think they know more about accessing information and conducting library research than they are able to demonstrate when put to the test” (p. 71). Similar to the Geffert and Christensen (1998) study, the Berkeley study was limited by its assessment tool, which the authors described as focused only on “the most fundamental and easiest-to-measure information competencies” (p. 85). They did not advance any theory to explain these findings.

Holman (2000) designed a study to compare computer-assisted instruction and a traditional classroom intervention for teaching information literacy skills. She noted that for some students, neither type of intervention improved skills. Further, despite failing grades on the post-test, most students reported feeling confident to perform information seeking tasks. In her conclusion Holman called for more research looking at the intersection between information literacy instruction, self-confidence, and library use.

3.1. Competency theory

Accepted theory in information studies documents that information seeking typically begins with a sense of uncertainty (Collins, Mellon, & Young, 1987; Kuhlthau, 1993). However, competency theory would predict that students with a high level of information literacy skills are more likely to question their ability to perform. Competency theory, developed in the domain of psychology, suggests that people who lack competence tend not only to be unaware of their lack of ability, but to overestimate what they can do. They actually display more confidence than skilled individuals (Kruger & Dunning, 1999). Studies of competence suggest that individuals with low skill levels overestimate their abilities because their lack of skill hinders their ability to assess their own performance. Conversely, highly skilled students tend to underestimate their performance, assuming that they are less skilled than they actually are. However, individuals with strong skills can use social comparison to regulate this miscalibration, while individuals who lack these skills cannot. One manifestation of this is the inability of people with poor skill sets to recognize expertise in others. This may mean that students who lack information literacy skills do not realize it and therefore are unlikely to seek remediation.

In addition, while the library community has identified the skill set a student needs to be considered information literate (Association of College and Research Libraries, 2000), the common approach to skill provision is didactic and informed by professional models, not the perceptions and habits of low-skilled students. There are calls in the library literature to acknowledge the searching strategies students use as a way of moving them towards more sophisticated skills (Seamans, 2002).

Competency theory suggests that low-skilled students are unlikely to self-identify in either a classroom or library context. They lack the meta-cognitive skills needed to recognize the relevance of the teacher’s or library’s outreach efforts to their personal context. Freeman’s (2004) study of the relationship between student views of their library skills and their
opinions of library instruction found that “a positive self assessment of one’s library skills generally will have a negative effect on one’s opinion of library instruction” (p. 45). Understanding the extent to which competency theory applies in this domain is crucial to the design of resources, services, systems, and other interventions that speak to the needs of these students in ways that they can hear.

3.2. The theory of library anxiety

Studies of competence predict that students with low-level information literacy skills will proceed confidently, unaware that they do not possess the level of skills they think they do. Interestingly, the effect of confidence in completing research assignments has not been widely reported in the literature of library and information studies. Rather, researchers have found that individuals cope with strong feelings of uncertainty, especially during the initiation of a project. This finding led to the development of library anxiety theory. The experience of library anxiety has been an active area of research in the field since the 1980s (Collins et al., 1987; Jiao & Onwuegbuzie, 1998; Kuhlthau, 1993; Mellon, 1986). Library anxiety theory describes students as so uncomfortable in the academic library that this discomfort impairs their ability to engage in information seeking tasks. Students who suffer library anxiety tend to think that they lack skills that others have. Rather than seeking help, they try to hide their lack of skill from instructors and peers.

Bostick identified five barriers to library use that further clarify the nature of library anxiety. These barriers include fear of library staff, an affective sense of incompetence, feeling uncomfortable in the library, lack of knowledge about the library, and discomfort using library equipment (copiers, computers, etc.) (Onwuegbuzie, Jiao, & Bostick, 2004).

Studies of library anxiety have looked at variables that may be associated with skill level, such as the number of library classes a student has attended and how frequently he uses the library (Jiao & Onwuegbuzie, 1997, 1998; Onwuegbuzie & Jiao, 2004). None of these studies has directly measured information literacy skill, and so it is not possible to comment on the relationship between skill levels and the experience of uncertainty in information seeking or the library anxiety response. Are people who experience library anxiety more likely to have a high level of information literacy? A second strength of the study reported here is that it tests library anxiety theory as well as competence theory in seeking a deeper understanding of the information literacy skills of students.

4. Procedures

This study uses objective tests to measure the information literacy skills of incoming freshmen and the extent to which they experience library anxiety. In addition, the study used two short surveys to collect demographic information, self-assessments of skills, and information about exposure to information literacy skills instruction.
4.1. Data collection instruments

Information literacy skills were measured using the Information Literacy Test (ILT) developed at JMU (n.d.). Both the SAILS test developed at Kent State University and the ICT developed by ETS were considered for use in this project. However, at the time of data collection, neither of these tests offered scores at the individual level; the SAILS test still does not (Project SAILS, 2007). Moreover, the ICT test provides a combined measure of information and communication technology skills. Therefore, it is not strictly a measure of information literacy as defined in the field of library and information science. The ICT, for example, involves such activities as downloading a videoplayer, creating a graph, developing presentation slides, and preparing a text message for a cell phone (ICT Literacy Assessment, 2007).

All three tests have been validated and tested for reliability (Cameron, Wise, & Lottridge, 2007). Although developed for in-house use, the ILT is not specific to resources or instruction at James Madison University. In fact, the test has been adopted for use at other schools, including the Virginia Community College System, Northwest Missouri State University, Kent State University, Christopher Newport University, Manchester Metropolitan University (United Kingdom), and Hong Kong University of Science and Technology (S.L. Wise, personal communication, March 29, 2007). The ILT presents subjects with 65 multiple choice items designed around four of the five ACRL information literacy standards, which

1. determines the nature and extent of the information needed;
2. accesses needed information effectively and efficiently;
3. evaluates information and its sources critically and incorporates selected information into his or her knowledge base system; and
4. understands many of the economic, legal, and social issues surrounding the use of information and accesses and uses information ethically and legally. (JMU, n.d., paragraph 2)

The ACRL standard “uses information effectively to accomplish a specific purpose” is not addressed by this test (JMU, n.d., paragraph 2). Table 1 provides interpretation of ILT scores. This table is used to categorize participant scores as non-proficient (<39), proficient (39–53), or advanced (54 or higher). Scores are based on 60 questions out of the 65 presented, as 5 questions are routinely added to the ILT for test development purposes.

Library anxiety was measured using the Library Anxiety Scale (LAS) developed by Bostick (1993) to provide a quantitative test of Mellon’s (1986) theory of library anxiety. The Library Anxiety Scale asks respondents to rate 43 statements using a Likert-type scale with ratings from 1 (strongly disagree) to 5 (strongly agree). In addition to producing a total score, the Library Anxiety Scale can also be scored to produce five subscales, identified as Barriers with Staff, Affective Barriers, Comfort with the Library, Knowledge of the Library, and Mechanical Barriers. The Library Anxiety Scale and scoring protocols are available in Library Anxiety: Theory, Research, and Applications (Onwuegbuzie et al., 2004).

The two surveys the authors developed and used to collect demographic data and data on students’ self-assessments are provided in Appendices A and B.
For testing purposes, the researchers developed two Blackboard sites that contained a video greeting and instructions from the researchers, a link to the ILT test, the pre- and post-ILT surveys, and the LAS. One site presented the ILT test before the LAS; the other presented the LAS before the ILT. Half the subjects were randomly assigned to one site and half to the other. Participants made appointments to show up at the testing center. Data were collected over the course of 2 weeks in a proctored environment. The average time to complete all the tests was 53.9 minutes.

4.2. Participants

Study participants were specific subjects representing the top and the bottom 25% of the incoming class (based on high school GPA and SAT/ACT scores) at Florida State University who were participating in summer session. They were contacted via email and asked to participate in this study. Participants were chosen from the top and bottom 25% of their class because theory and research suggests that these students are the most likely to demonstrate miscalibrations between skill level and self-estimates of performance (Kruger & Dunning, 1999).

A minimum of 60 students were sought, and 58 responded. Of these, 7 were under the age of 18 and could not be included in the study. While equal numbers of high- and low-performing students were sought, fewer low-performing students opted to participate in this study. No data are available to explain why this was so. Are low-performing students more reluctant than high-performing students to place themselves in a testing situation? Were these low-performing students avoiding distractions as they started their college careers? Are different incentives needed to attract this population? These questions may relate directly to the

<table>
<thead>
<tr>
<th>Proficiency level</th>
<th>Performance standard</th>
<th>Descriptors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proficient</td>
<td>39 (65%)</td>
<td>The student who is proficient is able to</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Describe how libraries are organized</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Define major library services</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Choose the appropriate type of reference source for a particular information need</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Identify common types of citations</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Employ basic database search strategies</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Locate a variety of sources in a library or online</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Discriminate between scholarly and popular publications</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Legally and ethically use information</td>
</tr>
<tr>
<td>Advanced</td>
<td>54 (90%)</td>
<td>The student who is advanced is able to attain the criteria for proficient and</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Modify and improve database search strategies to retrieve better results</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Employ sophisticated database search strategies</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Interpret information in a variety of sources</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Evaluate information in terms of purpose, authority, and reliability</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Understand ethical, legal, and socioeconomic issues relating to information access and use</td>
</tr>
</tbody>
</table>

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question of how to best design and market interventions that will build information literacy skills for those with low levels of proficiency.

5. Findings

All data were coded and analyzed using SPSS. For all tests alpha was set at \( p=0.05 \). Findings for each research question are presented below.

5.1. Demographic data

Participants were incoming freshmen who represented either the top 25% or bottom 25% of their class based on high school GPA and ACT (or adjusted SAT) scores. There were 51 participants in the study, of whom 33 were in the top quartile and 18 were in the bottom quartile. Table 2 summarizes the demographic data for the study participants.

5.2. Information literacy skill levels

An important consideration in measuring information literacy is how motivated participants will be to take the test seriously, given that the outcome of the testing has no bearing on their lives. Several strategies were included in the research design to minimize and then assess the possibility that low scores on the ILT might be due to a lack of effort rather than a lack of skill. For example, while all subjects were given the incentive of a gift certificate for the university

<table>
<thead>
<tr>
<th>Table 2</th>
<th>Top quartile</th>
<th>Bottom quartile</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age and gender freq.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18 years</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>24 (72.7%)</td>
<td>13 (72.2%)</td>
<td>37 (72.5%)</td>
</tr>
<tr>
<td>Male</td>
<td>9 (27.5%)</td>
<td>3 (16.7%)</td>
<td>12 (23.5%)</td>
</tr>
<tr>
<td>19 years</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Male</td>
<td>0</td>
<td>2 (11.1%)</td>
<td>2 (3.9%)</td>
</tr>
<tr>
<td>Race/ethnicity freq.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>27 (81.8%)</td>
<td>10 (55.6%)</td>
<td>37 (72.5%)</td>
</tr>
<tr>
<td>Hispanic</td>
<td>4 (12.1%)</td>
<td>2 (11.1%)</td>
<td>6 (11.8%)</td>
</tr>
<tr>
<td>Black</td>
<td>1 (3%)</td>
<td>4 (22.2%)</td>
<td>5 (9.8%)</td>
</tr>
<tr>
<td>Asian</td>
<td>1 (3%)</td>
<td>0</td>
<td>1 (2%)</td>
</tr>
<tr>
<td>Multi-race/ethnicity</td>
<td>0</td>
<td>1 (5.6%)</td>
<td>1 (2%)</td>
</tr>
<tr>
<td>No response</td>
<td>0</td>
<td>1 (5.6%)</td>
<td>1 (2%)</td>
</tr>
<tr>
<td>Mean high school GPA</td>
<td>3.97</td>
<td>3.04</td>
<td>3.639</td>
</tr>
<tr>
<td>Mean ACT/adjusted SAT</td>
<td>26.94</td>
<td>21.39</td>
<td>24.98</td>
</tr>
</tbody>
</table>
bookstore, they were also advised that those who scored in the top 15% of all participants would be included in a drawing for an additional 4 gift certificates.

Another strategy used to ensure motivation was to ask all participants to view a short video before beginning the testing. The video introduced the researchers, explained the importance of the study, and encouraged participants to do their best. Lastly, a response time effort analysis was performed on this data set at the Center for Assessment and Research at JMU. The data are consistent with times that suggest all participants were engaged with the test.1

Scores on the ILT provide the basis for a response to the question, “What level of information literacy skills do low-performing and high-performing incoming freshmen, based on GPA and SAT/ACT scores, bring with them to higher education?” The scoring rubric used for analysis is taken from the ILT manual. It suggests that a score of less than 39 indicates non-proficient skills, scores between 39 and 53 represent proficient skills, and a score of 54 or higher indicates advanced skills.

The mean score on the ILT for all participants was 39.25 (SD=6.81). The mean score for bottom-tier freshmen was 33.94 (SD=6.12). The mean score for top-tier freshmen was 42.15 (SD=5.30). A t-test comparing these two groups, without the assumption of equal variances in a two-tailed test, resulted in t(30.98)=−4.793, p<0.000. This indicated a significant difference in the information literacy skills obtained by these two groups. However, it must be noted that four (22.2%) of the bottom-tier freshmen tested at the proficient level and nine (27.3%) of the top-tier freshmen had non-proficient scores. Only one student in the entire sample (a top-quartile participant) demonstrated attainment of advanced information literacy skills.

In the short survey respondents took before taking the ILT, they were asked, “How have you learned what you know about using the library or how to find information?” They were presented with a list of fixed responses from which they could choose as many as fit their background. The next question on the survey, “Please describe any other ways that you have learned to use the library or to find information,” allowed respondents to identify other information literacy learning experiences they had had that were not covered by the fixed responses.

Because participants could choose as many answers as applied to their background, the total number of responses (152) exceeded the number of participants in the study (n=51). Among respondents, 74.5% (38) responded that they “taught myself,” 45.1% (23) received library instruction in the school library media center, 39.2% (20) were helped by a librarian in a public library, and 41.2% (21) reported being helped by a classmate or friend. Fewer respondents said they were helped by a parent (15 people or 29.4%), received library instruction in the classroom (13 or 25.5%), or received instruction in a college or university library (12 or 23.5%). Ten students (19.6%) said that they received instruction as part of their freshman orientation on campus.

However, top-quartile students differed from bottom-quartile students in that they reported a higher incidence of receiving instruction in information literacy in the school library media center, classroom, and/or public library. Data on the sources students identified as contributing to their skills are displayed in Table 3.

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1 For a discussion of response time effort analysis, see Wise and Kong (2005).
In answer to the question about other ways participants have learned to use the library or to find information, representative responses include instruction as part of campus special programs, from classroom teachers, experience working in a library, and help from a stranger in a library.

5.3. Information skill levels and self-estimates of performance

In order to determine if self-estimates of performance in the domain of information literacy follow the same pattern demonstrated in the literature, participants were asked to estimate their performance on the ILT before and after taking the test. Both pre- and post-tests were used to determine if exposure to the ILT would assist students in making better self-assessments. Participants estimated their performance in terms of the expected percent of questions they would be able to answer correctly, the number of questions they would answer correctly, and how their performance on the ILT would compare to the scores of other incoming freshmen taking the test (in percentages).

This was used to respond to the question, “Is there a relationship between a standardized measurement of information literacy skills and students’ estimates of their information literacy skills?”

5.3.1. Pre-ILT estimates

The mean estimate of performance by percentage is 75.25 ($SD = 11.30$). This is significantly higher than the actual mean percentage of 65.42, one-sample $t(50) = 6.215, p < 0.000$. The mean score of all participants on the ILT is 39.25 ($SD = 6.81$). The mean estimate of the number of questions students expected to answer correctly on the ILT is 49.71 ($SD = 6.86$). This is a significant difference, one-sample $t(50) = 10.876, p < 0.000$. The mean estimate comparing estimates of performance to other incoming freshmen by percentile is 76.86 ($SD = 13.98$). This estimate is also significantly higher than the real mean of 52.9, one-sample $t(50) = 12.238, p < 0.000$. All measures indicate that expected performance is miscalibrated with actual performance.

<table>
<thead>
<tr>
<th>Source</th>
<th>Freq. bottom quar. (percentage of quartile)</th>
<th>Freq. top quar. (percentage of quartile)</th>
<th>Total frequency (percentage of total)</th>
</tr>
</thead>
<tbody>
<tr>
<td>School library media center</td>
<td>6 (33.3%)</td>
<td>17 (51.5%)</td>
<td>23 (45.1%)</td>
</tr>
<tr>
<td>Classroom</td>
<td>3 (16.7%)</td>
<td>10 (30.3%)</td>
<td>13 (25.5%)</td>
</tr>
<tr>
<td>Parent</td>
<td>6 (33.3%)</td>
<td>9 (27.3%)</td>
<td>15 (29.4%)</td>
</tr>
<tr>
<td>Public library</td>
<td>5 (27.8%)</td>
<td>15 (45.5%)</td>
<td>20 (39.2%)</td>
</tr>
<tr>
<td>College/university library</td>
<td>4 (22.2%)</td>
<td>8 (24.2%)</td>
<td>12 (23.5%)</td>
</tr>
<tr>
<td>Classmate/friend</td>
<td>11 (61.1%)</td>
<td>10 (30.3%)</td>
<td>21 (41.2%)</td>
</tr>
<tr>
<td>Myself</td>
<td>14 (77.8%)</td>
<td>24 (72.7%)</td>
<td>38 (74.5%)</td>
</tr>
<tr>
<td>Orientation</td>
<td>4 (22.2%)</td>
<td>6 (18.2%)</td>
<td>10 (19.6%)</td>
</tr>
<tr>
<td>Other</td>
<td>14 (77.8%)</td>
<td>11 (33.3%)</td>
<td>25 (49.0%)</td>
</tr>
</tbody>
</table>
Pearson’s correlation was used \( (n=51, \text{two-tailed test, alpha}=0.05) \) to analyze ILT scores and self-estimates of performance by percentage, by estimated number of correct answers, and by expectations of performance compared to expectations of the performance of others. In all cases these variables were positively correlated, but not to a significant degree. Correlations ranged from 0.177 to 0.248.

5.3.2. Post-ILT estimates

The mean estimate of performance by percentage after taking the ILT is 68.82 \( (SD=10.64) \). This estimate is significantly higher that the actual mean of 65.42\% on sample \( t(50)=2.285, p<0.027 \). The mean score of all participants on the ILT is 39.25 \( (SD=6.81) \). The mean estimate of the number of questions expected to be answered correctly on the ILT after taking the test is 43.88 \( (SD=7.65) \). The difference between these two variables is also significant, one-sample \( t(50)=4.325, p<0.000 \). The mean estimate comparing performance to other incoming freshmen by percentile is 70.20 \( (SD=16.01, n=49) \). This is also a significant difference from the actual mean, one-sample \( t(49)=7.639, p<0.000 \). All measures demonstrate a downward correction in estimates of performance. Nonetheless, all estimates indicate that a miscalibration between performance and estimates of performance persist even after having the experience of taking a skills test.

Researchers used Pearson’s correlation \( (n=51, \text{two-tailed test, alpha}=0.05) \) and performed a bivariate analysis of ILT scores and self-estimates of performance for all three variables. Post-test estimates by percentile were positively correlated with ILT score, but not at a significant level. Post-test estimates of number of correct test items \( (r=0.298, p<0.034) \) and comparison of performance with peers \( (r=0.402, p<0.004) \) were both positively correlated with actual test scores at a significant level.

5.3.3. Low-level information skills and estimates of performance

Competency theory and previous research suggest that miscalibrations between self-estimates of performance and actual performance are greatest among low-skilled individuals. The question, “Do students with low-level information literacy skills demonstrate inflated estimates of their performance on an information literacy skills test?” required isolating and analyzing data from low-skill students. In this sample, 23 (45.1\%) of participants received scores of less than 39, which is the threshold score for proficiency on the ILT. Among the remaining participants, 27 (52.9\%) scored in the proficient range, and only one (2\%) participant received a score in the advanced range (greater than 54). Figs. 1 and 2 graphically demonstrate that the miscalibrations for the non-proficient subjects are in fact greater than those demonstrated by other subjects. Proficient students did a better job of

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\(^2\) One participant chose to answer the question of how many correct answers he/she had on the test with a range of scores rather than a single score. The range provided was 49–60. His response was coded as 49 because this reflected the participant’s most conservative estimate of performance.

\(^3\) There was one missing response to this question.
estimating their performance, and the one advanced student underestimated his or her skill level.

Tables 4–6 display mean scores for actual and estimated performance both pre- and post-testing.

Fig. 1. Actual scores and estimated scores by skill level.

Fig. 2. Actual percentiles and estimated percentiles by skill level.
5.3.4. Low-level information skills and estimates of performance before the ILT

Among non-proficient students, the mean score on the ILT is 33.48 or 55.8% ($SD=4.63$). The mean estimate of performance by percentage before taking the ILT is 72.30 ($SD=12.24$). The mean estimate of the number of questions expected to be answered correctly on the ILT before taking the test is 48 ($SD=7.1$). The mean estimate comparing estimates of performance to other incoming freshmen by percentile before taking the test is 71.09 ($SD=17.38$). All measures demonstrate a miscalibration between estimated and actual performance. One-sample $t$-tests for estimated score, percentage, and peer comparison for pre-test estimates were respectively $t(22)=9.812$, 22.176, and 15.281, $p<0.000$.

5.3.5. Low-level information skills and estimates of performance after the ILT

Do students with low-level information literacy skills adjust self-estimates of performance in response to taking the ILT? All three post-test measures demonstrate a downward correction in estimates of performance. Nonetheless, all estimates demonstrate that a significant miscalibration between actual performance and estimates of performance persists even after having taken a skills test.

Among non-proficient students, the mean score on the ILT is 33.48 ($SD=4.63$) and the mean estimate of the number of questions expected to be answered correctly on the ILT after taking the test is 41.74 ($SD=7.61$). The mean estimate comparing performance to other incoming freshmen by percentile after taking the test was 73 ($SD=11.85$, $n=21$). These estimates of performance are highly inflated, indicating that non-proficient participants not only overestimate their own level of skill attainment, but also believe that they are performing at an above-average level. Non-proficient students, on average, scored at the 15.7 percentile. The mean estimate of performance by percentile after taking the ILT was 66 ($SD=10.78$).

Table 5
ILT mean percentile rank and performance estimates by percentage

<table>
<thead>
<tr>
<th>ILT rating</th>
<th>$n$</th>
<th>Percentile</th>
<th>Mean percentage</th>
<th>Pre-test estimate mean</th>
<th>Post-test estimate mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-proficient</td>
<td>23</td>
<td>15.7</td>
<td>55.8</td>
<td>72.30</td>
<td>66</td>
</tr>
<tr>
<td>Proficient</td>
<td>27</td>
<td>70.6</td>
<td>72.65</td>
<td>77.22</td>
<td>71.19</td>
</tr>
<tr>
<td>Advanced</td>
<td>1</td>
<td>100</td>
<td>91.66</td>
<td>90</td>
<td>70</td>
</tr>
<tr>
<td>All participants</td>
<td>51</td>
<td>50</td>
<td>65.42</td>
<td>75.25</td>
<td>68.82</td>
</tr>
</tbody>
</table>
One-sample $t$-tests for estimated score, percentage, and peer comparison for post-test estimates were respectively $t(22)=5.208$, 22.38, and 11.997, $p<0.000$.

6. Discussion

6.1. Student information skills

As noted above, there is much evidence that many students are information illiterate when they enter institutions of higher education. The findings of this study support this idea because 45% (23) of the students in this sample tested as non-proficient in their information literacy skills. While a significant difference in ILT scores between bottom and top quartiles of incoming freshmen was demonstrated, it is important to note that there were bottom-tier students who were information proficient as well as top-tier students who were non-proficient based on their scores on the ILT. Further, only 1 student out of 51 tested at the advanced level.

Students, regardless of tier, reported similar backgrounds in terms of how they developed their information literacy skills. While they demonstrated a variety of inputs, the most common answer was “taught myself.” Help from a classmate or friend was as prevalent as instruction in the school library media center or public library. Only about a quarter of students reported receiving instruction in a classroom setting or at an academic library. Top-tier students were more likely to report experiencing formal instruction in information literacy skills in the library or classroom.

These findings reflect what the literature has shown: information literacy instruction at the K-12 level is provided inconsistently. The majority of these students perceived themselves to be self-taught in terms of their information literacy skills. While such self-reliance is laudable, it may contribute to allowing students to develop a faulty sense of skill attainment, because skill development is not evaluated against an accepted criteria of competence (such as the ACRL standards). Further, much research on the ability of individuals to self-assess their instructional needs demonstrates that such self-assessments are faulty (Davis et al., 2006; Gravil, Compeau, & Marcolin, 2005).

A number of bottom-tier and non-proficient students indicate that they picked up skills from friends and classmates. This is also in line with the literature on information seeking, which has demonstrated that people go to another person for information first and that young people enjoy sharing the skills they have attained. However, given what is known about the state of

<table>
<thead>
<tr>
<th>ILT rating</th>
<th>$n$</th>
<th>Percentile mean rank</th>
<th>Pre-test estimate mean rank</th>
<th>Post-test estimate mean rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-proficient</td>
<td>23</td>
<td>15.7</td>
<td>71.09</td>
<td>61.82</td>
</tr>
<tr>
<td>Proficient</td>
<td>27</td>
<td>70.6</td>
<td>81.48</td>
<td>76.8</td>
</tr>
<tr>
<td>Advanced</td>
<td>1</td>
<td>100</td>
<td>85</td>
<td>75</td>
</tr>
<tr>
<td>All participants</td>
<td>51</td>
<td>52.9</td>
<td>76.86</td>
<td>70.20</td>
</tr>
</tbody>
</table>

Table 6
ILT mean percentile rank and performance estimates compared to peers
information literacy skills and the findings of this study, how information literate are friends and classmates likely to be? Further, one of the characteristics of low-skilled individuals described by Kruger and Dunning (1999) is that they are unable to assess the skill levels of others. These findings call for increased attention to formal interventions that will ensure that students at all levels obtain information literacy skills in the educational environment.

6.2. Self-estimates of performance

This analysis demonstrates that the pattern of association in which subjects who demonstrate low-level skills hold inflated views of their abilities, as described by Kruger and Dunning (1999), applies to information literacy. Despite the small sample size, the high level of significance \( p<0.000 \) for all self-estimates reinforces this finding.

While it was hoped that selecting subjects from the top and bottom tiers based on GPA and SAT/ACT scores would present subjects at the bottom and top of the information literacy skills continuum, only 1 student out of 51 tested at the advanced level. This subject did demonstrate the pattern of self-estimates reported in previous literature: the extremely competent tend to underestimate their performance. However, this limited subject pool makes further analysis related to expertise in the domain of information literacy impossible here. Further research concerning both those in the non-proficient category and the advanced category is needed.

Subjects performing at a proficient level also follow the pattern of behavior predicted by Kruger and Dunning (1999): They give more realistic estimates of performance and a more accurate self-ranking compared to peers.

Kruger and Dunning’s (1999) assertion that the link between inflated self-assessments and poor performance is a lack of metacognitive skills (not being able to tell the difference between a right and wrong answer) presents an interesting conundrum for those interested in developing effective information literacy instruction. Like Kruger and Dunning, professional wisdom in librarianship would suggest that the “cure” for incompetence is skill building. However, studies such as those performed by Holman (2000), Maughan (2001), and others have found that instruction is not always successful with low-skill individuals. This may be a signal that individuals who are not information literate may need a new, different type of intervention in order to recognize and overcome their skill deficit. Further investigation is needed to determine if this is so and how best to respond to the needs of this subset of the population.

6.3. Information literacy and library anxiety

The purpose of this analysis is to verify competency theory and research testing the theory of library anxiety. Research into library anxiety supports the implications of competency theory—it has documented an association between high-performing students (in terms of academic achievement and a high level of self-motivation) and the experience of library anxiety (Jiao et al., 1996; Onwuegbuzie & Jiao, 2004). In contrast, Kuhlthau’s (1993) Information Search Process (ISP) model of information seeking suggests that a sense of uncertainty is a normal affective state at the start of the research process.
One important concern in the data collection design was that the order in which subjects were presented with a test of information literacy and a test of library anxiety during the same session might artificially affect scores. Would students who had just taken a test of information literacy be more in touch with fears they have around library use? Likewise, would the anticipation of taking an Information Literacy Test inflate library anxiety scores?

Counterbalancing was used to anticipate this potential problem. Half of the subjects took the ILT and then the LAS; the other half took the LAS and then the ILT. Participants were randomly assigned to comparison groups, stratified by their identification as top- or bottom-tier students. For the purposes of this analysis, one case was removed from the data set as an outlier.

To respond to the question, “Is there a relationship between student scores on a standardized test of information literacy and their scores on a scale that measures library anxiety?,” Pearson’s correlation was used ($n=50$, two-tailed test, alpha=0.05). A bivariate analysis of ILT scores and student total scores on the LAS was performed. The results of this correlation are non-significant ($r=-0.18, p=0.21$), indicating only a slight negative relationship between information literacy scores and scores on the LAS.

A second analysis was performed to respond to the research question, “Is there an association between student scores on a standardized test of information literacy and their scores on any of the library anxiety subscale scores?” This data analysis focused on ILT scores and the five subscale scores derived from the LAS. The scale measures five barriers that contribute to the experience of library anxiety: staff, affective, comfort with the library, knowledge of the library, and mechanical barriers.

Table 7 shows that the only subscale that demonstrates a relationship with information literacy skills is knowledge of the library ($r=-0.37, p=0.01$). This relationship is negative, indicating that as information literacy scores rise, anxiety scores related to a lack of knowledge of the library fall.

Competency theory and findings from studies of library anxiety suggest that library anxiety might be more of a problem among high-performing students than among low-performing students because high-performing students are more likely to second-guess their skills. The findings from this study do not support this hypothesis. No correlation was found between performance on the ILT and the experience of library anxiety as measured by the LAS.

### Table 7
Scale and subscale scores ($n=50$)

<table>
<thead>
<tr>
<th>Scale/subscale</th>
<th>$M$</th>
<th>SD</th>
<th>$r$</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td>ILT</td>
<td>39.32</td>
<td>6.86</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LAS total score</td>
<td>96.78</td>
<td>16.89</td>
<td>$-0.18$</td>
<td>0.21</td>
</tr>
<tr>
<td>Barriers with staff</td>
<td>31.48</td>
<td>6.34</td>
<td>$-0.17$</td>
<td>0.24</td>
</tr>
<tr>
<td>Affective barriers</td>
<td>30.46</td>
<td>7.58</td>
<td>$-0.04$</td>
<td>0.79</td>
</tr>
<tr>
<td>Comfort with the library</td>
<td>17.78</td>
<td>3.95</td>
<td>$-0.26$</td>
<td>0.07</td>
</tr>
<tr>
<td>Knowledge of the library</td>
<td>9.28</td>
<td>2.26</td>
<td>$-0.37$</td>
<td>0.01</td>
</tr>
<tr>
<td>Mechanical barriers</td>
<td>7.78</td>
<td>1.69</td>
<td>0.11</td>
<td>0.45</td>
</tr>
</tbody>
</table>
lack of association between performance on the ILT and the affective subscale reinforces this finding; this subscale is designed to measure subjects’ sense of incompetence. However, there was only one score at the advanced level on the ILT. A replication performed with a more balanced sample across the range of scores on the ILT and the LAS would more fully address this question.

The relationship between information literacy and knowledge of the library, the only subscale that demonstrated a correlation, also does not support the idea that knowing less results in an enhanced sense of confidence. This association was very strong, given the small sample size and restricted scores. This may indicate that efforts to build information literacy, as long suggested in the literature, may be effective at stemming library anxiety.

However, knowledge of the library is only one of five barriers measured by the LAS. Level of information literacy may not prevent people from experiencing other barriers, such as perceiving that librarians are not helpful or feeling discomfort using library equipment. Therefore, issues related to barriers not related to knowledge of the library may require their own set of interventions.

7. Limitations

There are several limitations that must be kept in mind in interpreting and applying the findings from this study. First, while proactive steps were taken to ensure that subjects would be motivated to take their participation seriously, the data collected nonetheless relies on honesty, openness, and motivation of respondents. Further, while recruitment was designed to pull in students who seemed likely to represent both low-level and high-level information literacy skills, only one student demonstrated advanced-level information literacy skills. This fact limits the discussion and analysis of high-skill individuals’ performance.

Another limitation is sample size. As a first attempt at theory verification, this study offers some useful insights. However, it is not possible to generalize these findings beyond this sample. The small sample size also limits the analysis of library anxiety in that a full range of scores on the LAS and the ILT were not demonstrated. It must also be noted that norms have not been developed for the LAS (A. Onwuegbuzie, personal communication, July 27, 2006). As LAS scores rise, so does library anxiety. However, because scores have not been categorized, it is not possible to associate a given score with a defined anxiety level, such as low, medium, or high anxiety. This means it is only possible to talk about the library anxiety of subjects in a relative sense. It is not possible to identify subjects who experience so much library anxiety that it actually begins to inhibit their performance.

8. Conclusion

Overall, this research promises to have wide impact in both the theoretical and practical realms. The information gained informs theory, adds to the general base of knowledge concerning student information literacy skills, and presents a new way of thinking about how
to improve student learning in both traditional and distance learning environments. Findings from this work may also be transferable to understanding the development of information literacy skills in other user populations, such as children and seniors. The findings may be applied to encourage higher academic achievement by students, create a more informed citizenry, and increase the number of college graduates who are prepared to enter graduate programs, compete in the marketplace, and become lifelong learners.

This study, in conjunction with several others being undertaken currently, may form the basis for a more all—encompassing investigation with a special emphasis on how to best design, market, and deliver information literacy education for students operating with non-proficient information skills. More research is needed on the types and efficacy of instructional strategies currently used to teach information literacy skills in the K-12 environment and higher education. More research is also needed to develop innovative strategies for providing new kinds of information literacy education. For example, in light of the findings of this study, students with low-level skills may benefit from working collaboratively to create knowledge. It is also hoped that this study will help to open the dialog between librarians, instructors, and users to make the goal of attaining information literacy better understood for all.

**Acknowledgments**

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**Appendix A. Pre-ILT Survey Questions**

1. What is your age?
2. What is your gender (male or female)?
3. Please choose the race category below that best describes you.
   1. White
   2. Black
   3. Asian
   4. American Indian
   5. Hispanic
   6. Native Hawaiian/Other Pacific
   7. Multi-race/Ethnic
4. How have you learned what you know about using the library or how to find information? (You may choose more than one answer.)
   1. library instruction in the school library media center
   2. library instruction in the classroom
   3. helped by a parent
4. helped by librarian in a public library (includes library tour or group instruction)
5. helped by a librarian in a college or university library (includes library tour or group instruction)
6. helped by a classmate or friend
7. taught myself
8. library instruction provided during FSU orientation

5. Please describe any other ways that you have learned to use the library or to find information.
6. Please estimate how well you think you will perform on the Information Literacy Test in terms of the percentage of questions you expect to be able to answer correctly (for example, 100% would be a perfect score; 75% means that you would get 75% of the questions right; etc.). Enter your estimate in the box below.

7. The Information Literacy Test asks you to respond to 65 questions. Please estimate how many of these questions you think you will be able to answer correctly. (For example, do you expect to get a score of 34 out of 65? 54 out of 65? A perfect score of 65 out of 65?) Please enter your estimated score in the box below.

8. Using percentages again, please estimate how you think your performance on the Information Literacy Test will compare to other incoming freshmen taking this test. (For example, an estimate of 80% means that you think 20% of the students will score higher than you.) Enter your estimate in the box below.

Appendix B. Post-ILT Survey Questions

1. Now that you have taken the Information Literacy Test, please estimate how well you think you performed in terms of the percentage of questions you answered correctly (for example, 100% would be a perfect score; 75% means that you got 75% of the questions right, etc.). Enter your estimate in the box below.

2. You responded to 65 questions on the Information Literacy Test. Please estimate how many of these questions you think you were able to answer correctly. (For example, do you think you received a score of 34 out of 65? 54 out of 65? A perfect score of 65 out of 65?) Please enter your estimated score in the box below.

3. Now that you have taken the Information Literacy Test, please estimate, using percentages, how you think your performance on the Information Literacy Test will compare to that of other incoming freshmen taking this test. (For example, an estimate of 80% means that you think 20% of the students will score higher than you.) Enter your estimate in the box below.

References


