In this issue:

Developing the Information Literacy of University Students: Integrating Research into Curricula

Deborah F. Beard
Southeast Missouri State University
Cape Girardeau, MO 63701, USA

Dana Schwieger
Southeast Missouri State University
Cape Girardeau, MO 63701, USA

Ken Surendran
Southeast Missouri State University
Cape Girardeau, MO 63701, USA

Abstract: Program outcomes in professional curricula include preparing students for future careers, graduate work, and life-long learning. Students must be equipped with a variety of skills and capabilities including technical, business, organizational, problem-solving, and interpersonal. Graduates must also possess the ability to face unexpected challenges during their careers, discern between valuable and inaccurate resources, as well as sustain currency in their chosen field. The Internet is one of those mixed resources that has both accurate and false information, requiring judicious use. The authors believe students need to be information literate and be provided with opportunities to develop and strengthen their research skills progressively throughout their academic experience. In this paper, the authors use the Information Literacy Competency Standards for Higher Education to construct a rubric for evaluating information literacy and propose other strategies and activities to promote life-long learning.

Keywords: Information Literacy, Research skills, Life-long learning, Assurance of learning, Assessment

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EDSIG activities include the publication of ISEDJ and JISAR, the organization and execution of the annual ISECON and CONISAR conferences held each fall, the publication of the Journal of Information Systems Education (JISE), and the designation and honoring of an IS Educator of the Year. • The Foundation for Information Technology Education has been the key sponsor of ISECON over the years. • The Association for Information Technology Professionals (AITP) provides the corporate umbrella under which EDSIG operates.

Developing the Information Literacy of University Students: Integrating Research into Curricula

Debbie Beard
dfbeard@semo.edu
Department of Accounting and MIS

Dana Schwieger
dschwieger@semo.edu
Department of Accounting and MIS

Ken Surendran
ksurendran@semo.edu
Department of Computer Science

Southeast Missouri State University
Cape Girardeau, MO 63701, USA

Abstract

Program outcomes in professional curricula include preparing students for future careers, graduate work, and life-long learning. Students must be equipped with a variety of skills and capabilities including technical, business, organizational, problem-solving, and interpersonal. Graduates must also possess the ability to face unexpected challenges during their careers, discern between valuable and inaccurate resources, as well as sustain currency in their chosen field. The Internet is one of those mixed resources that has both accurate and false information, requiring judicious use. The authors believe students need to be information literate and be provided with opportunities to develop and strengthen their research skills progressively throughout their academic experience. In this paper, the authors use the Information Literacy Competency Standards for Higher Education to construct a rubric for evaluating information literacy and propose other strategies and activities to promote life-long learning.

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1. INTRODUCTION

Although the Internet has provided an abundance of information about a wealth of topics immediately accessible within a few clicks of the mouse, the quality of student research is an ongoing concern for faculty in all disciplines. The act of researching topics including searching, collecting, analyzing, and adequately reporting the researcher's findings may be a lost art. Information Systems (IS), Management Information Systems (MIS), Computer Science (CS), Accounting (AC) and other major areas of students need to be able to ask the right questions, locate and gather pertinent and accurate facts and authority, and then communicate their findings and recommendations in a clear and precise format. Students need to be taught to recognize differences in the relevance and reliability of resources to efficiently filter through overwhelming amounts of available data. Despite growing up in a technology-rich environment, many students

lack the information, computing and technology (ICT) literacy skills necessary to navigate, evaluate, and use the overabundance of information available today (Katz, 2007).

The study of information systems in a university environment contains a complex combination of technical, business, organization, and interpersonal skill requirements. A process for demonstrating success in building those skill sets has been pursued as educators respond to calls from professional organizations, accrediting agencies, legislators, and others to demonstrate accountability. In addition, our quest for assurance of learning and continuous improvement requires the setting of benchmarks, the collection and analysis of data, and the gathering of feedback that can highlight demonstrated competencies, actions that should be taken, and the consequences of actions taken. Hence, there is a need to set explicit goals and objectives relating to information literacy and research in our strategic planning, curriculum development, and pedagogy.

Table 1. Skills Sought by Employers

Skill	Value
Communication skills (verbal & written)	4.6
Strong work ethic	4.6
Teamwork skills (works well with others)	4.5
Initiative	4.4
Interpersonal skills (relates well to others)	4.4
Problem-solving skills	4.4
Analytical skills	4.3
Flexibility / adaptability	4.2
Computer skills	4.1
Technical skills	4.1
Detail orientation	4.0
Organizational skills	4.0

Source: Job Outlook 2008 Survey www.naceweb.org

Reports from various professional organizations and individuals have examined the changing demands of information technology and accounting professionals (AECC, 1990;

Albrecht & Sack, 2000; AAA, 1998; AICPA, 1998; Arthur Andersen & Co., 1989; Cheney et al. 1990; Gallivan etal. 2004; IMA, 1999; Lee et al. 1995; Misic 1996; Robert Half Intl, Inc, 2006; Segars & Hendrickson, 2000; Todd et al. 1995; Wade & Parent, 2001/2002; Wynekoop & Walz, 2000). Recently, the Job Outlook 2008 Survey of 276 employers (Koncz & Collins, 2007) examined the qualities that employers look for in prospective employees. Data was collected using a five-point scale ranging from 1 to 5 with "1" indicating that the characteristic was "not important" and "5" indicating that the characteristic was "extremely important" The levels of importance for the characteristics studied are listed in Table 1. Research skills, although not explicitly listed, are essential for problem solving and maintenance of technical skills. Furthermore, research projects can integrate many of these important skills, e.g. communication and computer skills.

According to AACSB Accreditation Standard 15, although universities do not need to provide specific courses addressing the following undergraduate skills, programs need to provide learning experiences addressing both general and management-specific learning goals including:

- Communication abilities,

- Ethical understanding and reasoning abilities,

- Analytic skills,

- Use of information technology,

- Multicultural and diversity understanding, and

- Reflective thinking skills (AACSB, 2006).

Deficiencies in requisite skill sets are not only a concern for potential employers and accrediting bodies such as the Association to Advance Collegiate Schools of Business (AACSB), but present challenges for educators in various disciplines across the nation. Consequently, educators should work cooperatively and collaboratively to identify activities and pedagogy that integrate skills development and assessments of these skills into curricula. The authors believe that many of these skills can be strengthened through the completion of projects and ex-

periences that focus on students demonstrating information literacy.

Regardless of their discipline, students need to be information literate as they access, evaluate, and use information. The authors of this paper provide a model with strategies and activities for developing information literate MIS, CS, and AC majors. The authors review relevant literature relating to information literacy and research skills. Based upon this research, they propose a model for assurance of learning relating to information literacy and research skills. Examples of successful university activities and class projects to promote competency in these important skills are then provided.

2. RELATED LITERATURE: INFORMATION LITERACY AND RESEARCH SKILLS

Various individuals and organizations have studied and promoted information literacy. In their publication, Information Literacy Competency Standards for Higher Education, the Association of College & Research Libraries (ACRL) defined information literacy; explained the relationship between information literacy and information technology, information literacy and higher education, information literacy and pedagogy, and information literacy and assessment; and presented competency standards for higher education. "Information literacy forms the basis for lifelong learning . . . . enables learners to master content and extend their investigations, become more self-directed, and assume greater control over their own learning" (ACRL: 3). The Final Report (1989) of the American Library Association's Presidential Committee on Information Literacy defined an information literate person as follows:

> "one who is able to recognize when information is needed and having the ability to locate, evaluate and use effectively the needed information. Ultimately, information literate people are those who have learned how to learn. They know how to learn because they know how information is organized, how to find information, and how to use information in such a way that others can learn from them. They are people prepared for lifelong learning, because they can always find the information needed for any task or decision at hand" (p. 1).

Breivik and Gee (1989:12) stressed that "information literacy is a survival skill in the information age" and "should help keep one from *drowning in the abundance of information* that floods our lives." Breivik and Gee (1989:24) also noted that information literacy "includes (the teaching of) an integrated set of skills (research strategy and evaluation) and knowledge of tools and resources." Likewise, Bruce (2002:1) described information literacy as ". . . the foundation for learning in our contemporary environment of continuous technological change." Kurbanoglu (2003) stressed the significance of the development of confidence in using information and computer literacy skills and emphasized the importance of practice and feedback in developing this confidence.

Rader (1990) emphasized the importance of information literacy for individual and organizational productivity and, therefore, the need to teach self-education and information resource access strategies and database development and management in a global electronic environment. Burke, Katz, Handy, and Polimeni (2008: 66) stressed that "Accountants need to know what databases and other resources to access, how to extract the relevant data, and how to organize and analyze the data and develop recommendations. Accounting educators are responsible for teaching students the skills that are essential to this research." Burke, et al (2008:68) reported several examples of the integration of the coverage of research skills into the accounting curricula and provided a three-step process for teaching research skills to accounting students. The three steps included finding relevant sources, evaluating the data, and drawing conclusions and reporting findings. These examples can be adapted in other disciplines as well, including CS, IS, MIS, and other disciplines.

Bruce (1997) noted that there were seven categories of information literacy in higher education. These categories included: (1) information technology conception, (2) information source conception, (3) information process conception, (4) information control conception, (5) knowledge construction conception, (6) knowledge extension conception, and (7) the wisdom conception. The categories build upon the process of selecting the appropriate tools for finding information to finally inculcating the information into

the student's own knowledge and applying it wisely to decision-making.

Golian (2000) recommended that the use of Internet resources should integrate the concepts of learning theory and focused on some strengths and shortcomings of using Internet technology in various learning situations. Golian (2000: 140) emphasized that "Information competency is not simply a matter of computer literacy, it is a combination of subject knowledge, information-seeking behaviors, and technology training. Unless students are educated to seek the best and most appropriate information (not just what is easily found), they will simply use these new technologies to find the most convenient information."

In his 1994 article, Hawes noted the move from an industrialized to an information-based society and the increasing need for business schools to address information literacy. Although the awareness was noted prior to 1994, universities have not adequately addressed information literacy needs. Hawes (1994) reported various initiatives taken at business schools to build information literacy skills. Some of these initiatives included the use of a marketing research course, the capstone business policy course, the business writing course, in-class lectures by library specialists, and specific course assignments using library resources. Although Hawes reported some progress in the teaching of information literacy skills, more effort was believed needed.

In an information literacy survey conducted in the Marketing Department at their university in Greece, Korobili and Tilikidou (2005) found that faculty provided little instruction to encourage students to use appropriate research resources effectively. Williamson, Bernath, Wright, and Sullivan (2007) conducted a study of information literacy skills of 15 students at Monash University in Australia. Their study focused upon three aspects including (1) the use of information sources, (2) knowing when sufficient data had been collected, and (3) managing the information that they had collected. Williamson et al. (2007) found that students needed direction, to be provided by both librarians and faculty, in all three aspects of information literacy.

Polack-Wahl and Anewalt (2006) described a research methods course developed at the University of Mary Washington for the undergraduate computer science program. Two of the underlying motivations behind the development of the course were to help students learn to learn and to help them apply their knowledge and skills to solve problems of varying sizes and skill requirements. At first, the course was met with little student interest, however, when coupled with a "hot" programming topic, the students quickly got on board. Throughout the course, students incorporated learning strategies into their approach to coursework.

Feamster and Gray (2008) described an introduction to a graduate research course taught to computer science students at the Ph.D. level at Georgia Tech. One of the primary goals of this course was the immersion of students in high-impact research to teach them integral research skills and increase their marketability. The course consisted of five components addressing research skills, research mechanics, skills for working independently, career development, and an orientation to the field of computer science from both department and field perspectives. The outline of the course could be used at both the graduate as well as undergraduate levels.

At the undergraduate level, the information literacy scope covers a wide breadth of topics. However, research conducted in upper level courses is more focused and in-depth. Thus, in the expansive spectrum of research, from the broad-based view addressed by undergraduate work to the more focused approach represented at graduate levels, information literacy is an essential component to providing contributive research. The information literate individual should be able to determine the extent of information needed, access the needed information effectively and efficiently, evaluate information and its sources critically, incorporate selected information into his/her knowledge base, use information effectively to accomplish a specific purpose, understand the economic, legal, and social issues surrounding the use of information and access, and finally, use information ethically and legally (ACRL: 3). In the next section, the authors present a model that can be used for assurance of learning.

3. ASSESSMENT AND ASSURANCE OF LEARNING

Gorgone, Yaverbaum, and Price (2005) stress that ABET CAC (ABET Inc. Computer Accreditation Commission) places emphasis on outcomes, assessments, continuous improvement, and inclusion of minimum outcomes in accreditation criteria. Gorgone, et al. (2005) noted that program assessment involves setting goals and objectives for the program, undertaking activities that measure success in reaching those goals and objectives, and then implementing necessary changes to improve program quality.

Landry, Pardue, Longenecker, Reynolds, McKell, and White (2006) provide tools based on exit assessments for IS courses. Aasheim, Gowan, and Reichgelt (2007) described the assessment process designed and implemented for an information technology (IT) program with specific emphasis on course-level assessment. Several examples of course-level assessments were provided. White and McCarthy (2007) discussed the use of the Center for Computing Education Research (CCER) IS Assessment Test in the development and implementation of a comprehensive assessment plan on their campus. Stemler and Chamblin (2006) shared their experiences and outlined procedures for developing an assessment strategy to achieve accreditation and to improve their MIS program. Todorova and Mills (2007) recommended a four stage approach to the evaluation and development of assessment portfolios for IS education that utilize diverse methods for assessment.

Other oversight and accrediting bodies have been encouraged to develop similar assessment concerns for their fields of study (Black & Duhon, 2003). The AACSB is one such institution that has also developed new accreditation standards focusing upon assurance of learning (Black & Duhon, 2003). The intent of the Assurance of Learning Standards emphasized by the AACSB (2006) is to provide information that will assist each school in evaluating how well they have accomplished the learning goals at the core of program activities. Learning goals need to be routinely assessed and systematically evaluated. The results of the findings should be distributed to faculty to assist them as they seek continuous improvement. Martell (2007) stressed the change in focus of the revised AACSB standards on assurance of learning and provided examples on how assessment results can be used to improve curricula. She also provided insight into problems some schools have in meeting the assurance of learning standards. In the following section, the authors discuss a model for the assessment process in which the necessary feedback elements are considered.

A Model for the Assessment Process

Curricula models and assessment activities are important components of the continuous improvement process in education (McGinnis & Slauson, 2003). The integration of "research skills" and "information literacy" into teaching methodologies to address the requirements of employers and engage today's learner in the learning process should proceed in a strategic and well-organized manner as modeled in Figure 1.
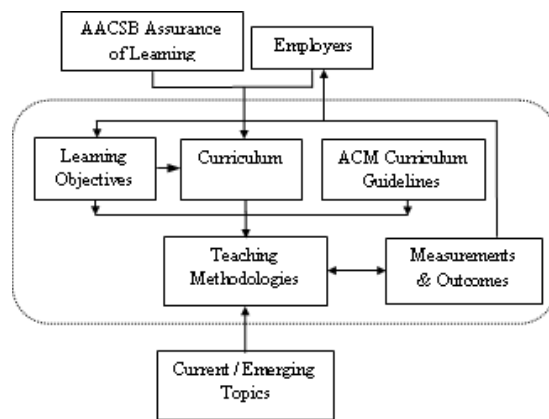
Figure 1. Integration of Research and Information Literacy Skills Model

Accreditation standards, employer expectations, current/emerging topics, and other curriculum guidelines should be considered in identifying learning objectives. For example, identification and specification of the goals relating to requisite "soft skills" requirements, such as information literacy and other research skills, should be identified and learning objectives developed in light of external requirements (accrediting bodies and employers), university and program specific learning goals, and emerging industry issues. Curricula should be developed and appropriate teaching methodologies chosen to develop these skills. Measurements should be taken and learning outcomes should be examined to highlight areas of success and areas of deficiency re-

quiring additional attention. Changes may then be necessary in learning objectives, curriculum, and teaching methodologies. Employers may also be interested in observing results as well as providing input on enhancements that can be made to the learning process. Closing the assessment loop by demonstrating the use of the results for continuous improvement is expected and important.

Evaluation of Achievements

Strategies for achieving learning objectives include various pedagogy-related activities and methods focusing upon research design, data collection and synthesis, and information dissemination. This step may require refinement of the objectives and adjustment of the curricula if effective methods and activities cannot be identified or integrated into the curricula in a beneficial and effective manner. Regular measurements of knowledge, skills, and attitudes should be taken to determine student competencies and resultant compiled outcomes of the activities and methods. Evaluation of student performance associated with the measures and outcomes, activities and methods, and goals and objectives of the learning process should be developed, reported, and utilized to suggest appropriate actions to be taken to demonstrate a focus on continual quality improvement. In the next several sections, the authors identify available resources, programs, and activities that can be integrated into the learning and assessment process to develop information literacy and promote student scholarly activity.

4. SUPPORT ACTIVITIES IN ACADEMIA FOR INFORMATION LITERACY AND RESEARCH SKILLS DEVELOPMENT

Faculty do not have to assume sole responsibility for developing information literacy and research skills. There are many auxiliary resources provided to students that support and encourage their scholarly activity. The authors' library, a critical component of a successful information literacy program, has utilized technology to provide valuable resources and strategies for research. For example, websites are structured around various research topics. Links to appropriate titles provide background information, facts and figures, search engines to search indexes, abstracts, and databases for journal, magazine, and newspaper articles online. Links to books, videos, government documents, persons of interest relating to the topic, professional organizations, and other web searching tools are readily available. In addition, library personnel have developed SEARCHPATH, a tutorial to teach students basic library and research skills.

Special Programs

At the authors' university, the Honors Program promotes, among other goals, the advancement of student learning by encouraging the pursuit of research and scholarly activity. The program, which is available to students throughout their entire undergraduate studies, emphasizes analytical thought and insight into the methodologies of various disciplines through research projects beyond the regular classroom requirements. The program also encourages cross-disciplinary synthesis through extended projects.

Student Research Conference

Each spring, a Student Research Conference is held on the authors' campus that promotes and recognizes research by undergraduate and graduate students in all academic disciplines. Students are given the opportunity to present their papers to an audience of faculty and peers. The best papers are then published in the University's student research journal.

Early Research Support Initiative

Faculty and students at the authors' university also participate in the Ronald L. McNair Scholars Program. This undergraduate program, made possible through a U.S. Department of Education grant, supports the scholarly activities of low-income, first generation students or students traditionally underrepresented in graduate education. As these students prepare to complete a resource project under the supervision of a Faculty Mentor and apply for graduate school, workshops and seminars are provided to strengthen student research, presentation, and technical writing skills. Information literacy is integrated into these workshops and seminars. Financial resources are provided to support a summer research internship and student travel to present research at national conferences.

Each of these programs provides the opportunity to not only develop student research skills but also to emphasize the importance of information literacy in conducting this research. Faculty should encourage student participation in these programs and support ongoing information literacy development throughout the educational experience. Faculty should also consider actively participating in these programs as mentors or sponsors and should network with other faculty involved in these programs to share ideas and successes.

5. INFORMATION LITERACY AND RESEARCH SKILLS DEVELOPMENT INITIATIVES IN THE CLASSROOM

Also, at the authors' university, the University Studies or general education program is based upon the following nine objectives:

1. Demonstrate the ability to locate and gather information

2. Demonstrate capabilities for critical thinking, reasoning, and analyzing

3. Demonstrate effective communication skills

4. Demonstrate an understanding of human experiences and the ability to relate them to the present

5. Demonstrate an understanding of various cultures and their interrelationships

6. Demonstrate the ability to integrate the breadth and diversity of knowledge and experience

7. Demonstrate the ability to make informed, intelligent value decisions

8. Demonstrate the ability to make informed, sensitive aesthetic responses

9. Demonstrate the ability to function responsibly in one's natural, social, and political environment (University Studies Handbook, 2005-2006).

Each course in the program must include strategies and activities focusing on these objectives; many of these objectives relate to developing and demonstrating information literacy. For example, Objective No. 1 addresses the ways to search for, find, and retrieve information in a technological society; Objective No. 2 focuses upon evaluating, analyzing, and synthesizing large amounts of information; and Objective No. 6 deals with the correlation and synthesis of disparate knowledge into a coherent, meaningful whole.

In addition to the efforts made for the students at large across campus, CS, MIS, and AC faculty are making strides to integrate research activities and to demonstrate information literacy in the curriculum. The authors have incorporated some research and information literacy projects into their courses. Some of those projects are described in the following sections.

Computer Science Capstone Course Project

As part of their program, all of the Computer Science and Computer Information Systems majors at the authors' institution take an upper level Capstone Experience course. Prior to this course, they take a Software Engineering course in which they learn a few heuristics used in the primary processes (gather requirements, analyze, design) of developing applications under the Object-Oriented paradigm. Thus, they are taken through a narrow path quickly so as to apply these heuristics in the Capstone Course in which the students, working in teams, develop a prototype for meeting a client's application requirements. As the teams are analyzing their chosen application system (with whose domain they are not always familiar), they also learn the system development support – management - processes (project, quality, configuration) before starting the detailed design of their system. This approach (commonly used in many CS and CIS programs) has several positive attributes. However, the fact that there are few other system development approaches and that implementation tools are added every day, clearly indicate the need to get a feel for the enormity of the subject area. Further, this research experience can help the students learn new tools required in implementing their client system.

In this research component, each project team chooses a topic from a list provided by the instructor and makes a 30-minute presentation to the entire class. A sample list of topics is shown in Figure 2. This list is regularly revised to reflect new developments in the field. Even though some of the topics in

the list are briefly discussed in class, the teams are directed to explore further and present the material as if they are teaching a class. The topics are chosen during the first week and the presentations are scheduled during the 8th or 9th week.

Using a two-part performance-based rubric (Appendix 1), the presentations are evaluated by other teams and the instructor. This research driven assessment also helps students in developing their presentation skills.

- Aspect Oriented Programming
- Agile methodology - eXtreme Programming (Highlights)
- CoCoMo – Cost Models
- Service Oriented Architecture
- Process-Oriented Analysis and Design (the course uses Object Oriented approach)

UML 2.0 – Additional features

Figure 2 - Sample Topic List

In order to establish whether or not research and writing activities have successfully contributed to the educational process, skills must be regularly assessed. Multiple activities with assessments could be given throughout the semester to observe improvements on a project-by-project basis. The overall scores of students can be compared on a semester-by-semester basis. These assessments should not only be invaluable in meeting AACSB Assurance of Learning standards for achieving and maintaining accreditation, but also for providing feedback that can be used in improving student information literacy skills.

Introductory MIS Course Project

Another course in which a research element has been incorporated into the classroom is the junior level management information system course required of all College of Business majors. The professors teaching this course have found that, in order to adequately cover the topics thought to be most beneficial to the students, several secondary MIS topics could not be addressed. One of the methods used to counter this lack of topic coverage is the incorporation of those

topics into course projects. During the e-business module, students are required to learn and build a prototype Web site for a given scenario and client. The scenario client has a specific business need as well as a desire to keep current with MIS related topics. The students are asked to select a topic from those that have not yet been covered during the course and to prepare one Web page that explains the topic, why the topic is important to the client, and examples of how that topic has been or could be used in a business type situation. At the conclusion of the project, students present their Web sites to the class and focus their presentations on the pages covering the MIS topics.

On-going Activities

The authors have incorporated other on-going activities into their courses to develop student research skills and information literacy. These activities should encourage students to go beyond the textbook in problem solving and decision making and in staying current in their field. For example, students could visit professional organization websites associated with their areas of interest and write summaries of articles from respected periodicals, provide oral reports, participate in group discussions based on articles in daily news media, and complete honors projects, cases, and client projects.

Textbook publishers, e.g. Cengage Learning Systems and John Wiley & Sons, Ltd, are increasingly providing on-line resources through their websites to support information literacy. Cengage Learning Systems, for example, provides access to their online suite of research tools, tutorials, demonstrations, research cases, and links to relevant professional research sites and professional organizations. John Wiley & Sons, Ltd. provides readings from authoritative periodicals that address controversial issues, and provides cases that use the Internet and can be used to improve critical-thinking skills. Faculty can use these resources in making assignments and should work with publishers to enhance these tools.

Activities in Accounting

In AC courses at the authors' university, several activities have been undertaken to expand students' perspective of knowledge availability and generation. Similar assign-

ments described below could be designed for CS/IS/MIS students.

Accounting majors have been required to complete research relating to cases using the Financial Accounting Research System (FARS) info base. In addition to evaluating the quality of the completed activities, students were surveyed to obtain their perspective on the value of the project. Analysis of the survey results indicated that students recognized that they would be: 1) able to obtain more accurate and detailed information from FARS than the textbook, 2) better prepared for entry into the accounting profession, and 3) more confident in being able to stay up-to-date in their profession throughout their careers. Students agreed that they had not only strengthened their research and analytical skills but also had expanded their technical knowledge in accounting while completing assignments that provided opportunities for valuable real-world experiences.

The Wall Street Journal's Journal-in-Education program provides some valuable tools in bringing the real world into the classroom and in providing timely information for research. Faculty can receive discipline-specific e-mails from the Wall Street Journal that include summaries of recent articles and discussion questions that can be adapted for research projects. This enables students and faculty alike to maintain currency of common and emerging concepts and technologies and strengthen their information literacy and research skills.

A Rubric for Promoting and Assessing Information Literacy

The Association of College and Research Libraries (ACRL) issued the Information Literacy Competency Standards for Higher Education in 2000. Appendix 2 illustrates an information assessment rubric that the authors developed based upon the ACRL identified standards, performance indicators, and outcomes. The rubric is divided into five sections with goals examining research topic development, data collection, concept development, communication of concepts, and ethical and legal considerations. Each section's goals are further defined by specific objectives.

Faculty may elect to combine or eliminate some of the objectives as well as create

their own. The authors selected "Satisfactory" and "Unsatisfactory" as the measurement of performance relative to each goal; however, the Measurement column may consider individual objectives or provide a collective measurement using other scales of measurement chosen by faculty.

Although the authors have provided one overarching rubric template to address information literacy, the template can be modified for use at the undergraduate and graduate levels. This rubric should be given to students early in the educational process and reviewed as research assignments are made throughout their educational experience. Assessments could then be reviewed over time to provide feedback on the success of curricula and teaching methodologies and to promote continuous improvement of the educational process.

6. IMPLICATIONS FOR FUTURE RESEARCH

Enhancing research and information literacy skills is a growing concern for students facing the vast amount of content available through Internet resources. Web 2.0 is providing a significant contribution to the quantity of material available for students to access, however, the accuracy and reliability is often questionable. Future research could develop a scale for evaluating, assessing acceptability, and ranking Web 2.0 resources. A survey could be developed and distributed to employers of recent graduates to examine the research skills needed by college graduates to fulfill their work-related roles.

The authors touched on a few of the activities that they have integrated into their courses to enhance student research and literacy skills. Further research could be conducted on the effectiveness of activities employed by faculty at other universities and in other disciplines to encourage and instill quality research methodologies.

7. CONCLUSION

The increasing number of web-based resources has spurred the need for information discernment among college graduates. Ensuring that graduates achieve a satisfactory level of information literacy is an important issue that demands increased attention na-

tionwide and across disciplines. Research has indicated that students need more than just a sound foundation of technical skills to be successful in the workplace. With the continuously changing technological landscape, it is important for students to develop and hone their research, writing, and information literacy skills to stay current with industry changes throughout their academic and work careers.

In this paper, the authors developed an assessment model and scoring rubric to guide CS/CIS/MIS/AC and other programs in the integration of information literacy objectives and methodologies into their curriculum. Using the Association of College and Research Libraries, 2000 Information Literacy Competency Standards for Higher Education, the authors proposed a grading rubric template that can be modified to guide students and faculty in the development of stronger information literacy skills at both the undergraduate and graduate levels. Faculty can customize the template to emphasize various steps of the research process. The authors also provided illustrations of some of the projects and tools that they have incorporated into their programs. These projects should help students build a solid foundation of research and information literacy skills that will better equip them to face changes and emerging issues in their chosen field.

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APPENDIX 1.
GRADING RUBRIC

A. Content (Criteria)   **Max: 25 Points:**   **Points awarded:**

Base your ratings using applicable factors listed below

    1.   Scope of research stated clearly

    2.   Relevance to Software Engineering established

    3.   Demonstrated inquiry / research skill

    4.   Stated the underlying principles

    5.   Had logically organized the material

    6.   Helped in enhancing your learning

    7.   Completeness (achieved the set objectives)

    8.   Provided references

    9.   Gave practical tips

Rationale / Observations:

B. Effectiveness (of presentation)   **Max: 15 Points**   **Points awarded:**

Base your rating on the following quality issues

    1.   Quality (to suit purpose) of the presentation

    2.   Organization of the presentation

    3.   Cogency

    4.   Clarity

    5.   Focus

    6.   Responsiveness to the audience

APPENDIX 2.
INFORMATION LITERACY RUBRIC

Goal	Objective	Measurement
Research Topic Development		
Defines and articulates the need for information	• Research topic identification • Thesis statement and questions • Key concepts and terms identified • Production of new information	Satisfactory Unsatisfactory
Resource selection	• Identifies valuable and reliable re-sources • Directs paper toward a particular au-dience • Distinguishes between primary and sec-ondary resources • Development of information from raw data	Satisfactory Unsatisfactory
Considers costs and bene-fits of data acquisition	• Uses expanded resources • Defines a realistic timeline and plan	Satisfactory Unsatisfactory
Reevaluates information needed	• Clarifies / refines question	Satisfactory Unsatisfactory
Data Collection		
Efficiently gathers informa-tion	• Selects appropriate investigative methods	Satisfactory Unsatisfactory
Constructs and applies ef-fective search strategies	• Appropriately developed research plan • Effective search strategy	Satisfactory Unsatisfactory
Retrieves information using a variety of resources	• Use of search engine, in-person collec-tion, survey, observation, interviews	Satisfactory Unsatisfactory
Refines search strategy as needed	• Assesses quantity, quality, and relev-ance of search results • Identifies gaps information retrieved	Satisfactory Unsatisfactory
Extracts records and man-ages sources	• Appropriately and completely cites sources	Satisfactory Unsatisfactory

Concept Development		
Summarizes main ideas	• Reads text and selects main ideas • Reformulates ideas into own ideas	Satisfactory Unsatisfactory
Applies criteria to evaluating information and its sources	• Examines and compares information from various sources in order to evaluate reliability, validity, accuracy, authority, timeliness, and point of view or bias • Understand the impact of concepts upon data interpretation	Satisfactory Unsatisfactory
Synthesizes main ideas to construct new concepts	• Recognizes interrelationships between concepts and combines • Extends initial synthesis and constructs new hypotheses • Utilizes technology to study interactions	Satisfactory Unsatisfactory
Compares and differentiates between new and prior knowledge	• Determines whether information satisfies research needs • Determines whether information contradicts or verifies other information • Draws conclusions based upon information gathered • Tests theories with discipline appropriate techniques • Selects information that provides evidence for the topic	Satisfactory Unsatisfactory
Determines new knowledge impact on value system	• Appropriately incorporates differing viewpoints	Satisfactory Unsatisfactory
Validates understanding and interpretation of information	• Participates in classroom sponsored discussion • Seeks expert opinion through interviews, surveys, listservs, etc.	Satisfactory Unsatisfactory
Evaluates appropriateness of initial inquiry	• Determines if original information need has been satisfied • Reviews search strategy and incorporates additional concepts • Reviews and expands information retrieval resources	Satisfactory Unsatisfactory
Communication of Concept		
Applies new and prior information to the planning and creation of a product or performance	• Organizes material to support new product or performance • Integrates new and prior knowledge to support new product	Satisfactory Unsatisfactory

Revises development process for new product or performance	• Maintains a log of activities • Reflects on past success, failures, and strategies	Satisfactory Unsatisfactory
Communicates product or performance effectively to others	• Chooses an appropriate communication medium to communicate product/performance to audience • Incorporates principles of design and communication • Communicates clearly and with style	Satisfactory Unsatisfactory
Ethical and Legal Considerations		
Understands many of the ethical, legal and socio-economic issues surrounding information and information technology	• Demonstrates an understanding of intellectual property, copyright, and fair use of copyrighted material	Satisfactory Unsatisfactory
Follows laws, regulations, institutional policies, and etiquette related to the access and use of information resources	• Demonstrates an understanding of what constitutes plagiarism and attributing work to others • Demonstrates an understanding of institutional policies regarding human subjects	Satisfactory Unsatisfactory
Acknowledges the use of information sources in communicating the product or performance	• Uses appropriate documentation style for complete citations • Posts permission granted notices as appropriate	Satisfactory Unsatisfactory

Adapted from Source: The Association of College and Research Libraries, Information Literacy Competency Standards for Higher Education, American Library Association, 2000, Chicago, IL.

The authors suggest securing a copy of the publication and visiting the ACRL website

(http://www.ala.org/ala/acrl/) for additional information.

AUTHOR BIOGRAPHIES

Debbie Beard is a professor of Accounting in the Donald L. Harrison College of Business at Southeast Missouri State University in Cape Girardeau. She holds a PhD in Business Administration with a major in accounting from the University of Arkansas – Fayetteville. She is a Certified Management Accountant. Her current research interests include experiential learning, information security, accounting and MIS curricula restructuring, financial literacy, and ethical codes of conduct.

Dana Schwieger is an associate professor of Management Information Systems in the Donald L. Harrison College of Business at Southeast Missouri State University in Cape Girardeau. She holds a PhD in Management Information Systems from Southern Illinois University – Carbondale. She was selected for the Boeing Welliver Faculty Fellowship. Her current research interests include adaptive structuration theory, health management information systems, MIS curricula restructuring and e-business strategy.

Ken Surendran is a professor in the Department of Computer Science at Southeast Missouri State University. His research interests include software engineering, security management education and object technology. He has a BE in electrical engineering from the university of Madras, India, an M. Tech in electrical engineering from the Indian Institute of Technology and a PhD in applied analysis from the State University of New York at Stony Brook. He is a senior member of the IEEE and a member of the ACM.