

Information Literacy: Skills for Life

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Introduction

The amount of information available to our students is increasing rapidly every day and they can be easily overwhelmed with the variety and complexity of it. In addition, because they are so adept at using computers, many students over-estimate their abilities to search for, organize, and utilize information. These students believe that they already have the ability to sift out false information; that they are experts at searching the Web; and that the large numbers of people that use the Web will make detection of falsehoods more likely (Thompson 2003, Profeta and Kendrick 2002, Davis Herring 2001, Calvert 1999, and Tolppanen 1999). Manuel (2002) reports that 28% of freshman at California State University agreed that a “central internet authority reviewed all Web information for its accuracy.” Furthermore, many students also have the mistaken belief that the Web will provide all the information they may need in the course of their college career. Investigating their college library’s resources, whether print or electronic, never occurs to them. To them, it’s all on the Web, it’s all worthwhile, and it’s all free.

These findings indicate that students require training to become “information literate”. The Association of College and Research Libraries (ACRL) (2000) defines an information literate person as someone who can:

- Determine the extent of information needed
- Access the needed information effectively and efficiently
- Evaluate information and its sources critically
- Incorporate selected information into one’s 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 use information ethically and legally

Information literacy is a broad skill that is applicable to any discipline, any career, and in anyone’s life. The American Association of School Librarians and Association for Educational Communications and Technology (1998) note that “‘information literacy’—the ability to find and use information— is the keystone of lifelong learning.” Likewise, The American Library Association (1989) states that “ultimately, information literate people are those who have learned how to learn”. Students that have acquired this skill will be more confident learners because they will be able to find and use the information they need to solve novel problems. In addition, these

students will have the ability to stay current in their fields of study by effectively searching and using new literature.

Instructional modules for use in the Department of Civil and Environmental Engineering (CEE) were developed by faculty in the CEE Department with librarians from Falvey Memorial Library at Villanova University to help students become information literate. These modules, as well as a plan to evaluate the effectiveness of this program, based on ACRL outcomes, are described in this paper. Research indicates that a successful information literacy program must be introduced early in the student's university education and be reinforced often, with assignments of increasing complexity. Consequently, six modules, which are placed throughout the students' time in our department (Sophomore through Senior year), were developed and will be described. These modules build upon one another and are discipline/course integrated.

Student Outcomes

In the mid 1990's, the Accreditation Board for Engineering and Technology (ABET) adopted a new set of criteria for the evaluation of engineering programs in the United States. These new criteria formalized the concepts of continuous curriculum improvement and outcomes-based education in engineering. Since the adoption of these new criteria, engineering programs across the US, including Villanova, have been re-evaluating their programs to determine if they meet the criteria. This program will help our department satisfy several criteria while motivating our students about their field. Globally, our graduates will possess (ABET 2002):

- a recognition of the need for, and an ability to engage in life-long learning;
- a knowledge of contemporary issues; and
- an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Although satisfying ABET criteria is important to our engineering program, the mission of any university, college, or department is to graduate students who are able, confident learners who can apply their knowledge in a variety of situations; in other words, students who are information literate.

The outcomes, which are based on those developed by ACRL (2000) for each year of study are described below:

By the end of the sophomore year, the students should be able to:

1. explore general information sources to increase familiarity with a topic
2. identify key concepts and terms that describe the information need
3. define a realistic overall plan and timeline to acquire the needed information
4. read text, select main ideas, and restate textual concepts in their own words
5. identify verbatim material that can then be appropriately quoted
6. evaluate a website for authority, reliability, credibility, purpose, viewpoint, and suitability
7. reflect on past successes, failures, and alternative strategies by maintaining a log of information seeking and evaluating activities
8. communicate clearly and with a style that supports the purposes of the intended audience
9. demonstrate an understanding of intellectual property, copyright, and fair use of copyrighted material

10. select an appropriate documentation style and use it consistently to cite sources
11. confer with instructors and participate in class discussions to identify a research topic, or other information needed
12. define or modify the information need to achieve a manageable focus
13. know how information is formally and informally produced, organized, and disseminated
14. determine the availability of needed information and make decisions on broadening the information seeking process beyond local resources
15. select controlled vocabulary specific to the discipline or information retrieval source
16. construct and implement a search strategy using appropriate commands for the various information retrieval system selected
17. integrate new and prior information in a manner that supports the purposes of the product

By the end of the junior year, the students should be able to:

18. develop a thesis statement and formulate questions based on the information needed
19. select efficient and effective approaches for accessing the information needed
20. assess the quantity, quality, and relevance of the search results to determine if additional information is required or if the search strategy should be revised
21. create a system for organizing the information
22. recognize that existing information can be combined with original thought, experimentation, and/or analysis to produce new information

By the end of the senior year, the students should be able to:

23. identify the purpose, audience, value, and differences of potential resources in a variety of formats
24. examine and compare information from various sources to evaluate reliability, validity, accuracy, authority, timeliness, and point-of-view bias
25. extend initial synthesis, when possible, at a higher level of abstraction to construct new hypotheses that may require additional information
26. draw conclusions based upon information gathered

Project Plan

The major issues facing any educator when developing new instructional modules are when and how to teach the material and how to assess what has been done. These issues are addressed in this project plan.

Place in Curriculum

Information literacy skills can be taught in a for-credit library course, or through various assignments integrated throughout the curriculum. The literature supports the latter approach. Dupuis (1997) states that “most librarians agreed that broad information literacy skills are best taught within the academic curricula.” Likewise, Davidson (2001) and Adams and Morris (1985) found that students describe for-credit library courses as their least preferred method of obtaining library instruction. The ACRL and the literature on the topic recommend that students have many opportunities integrated throughout the curriculum for seeking, evaluating, and managing information gathered from multiple sources and that the assignments be discipline-specific (Catts and Appleton 1999; ACRL 2000; Nerz and Weiner 2001; Popescu and Popescu 2003). This is

not a new idea: Knapp (1956) recommended that “competence in the use of the library... should be integrated into the curriculum.” In addition, Davidson et al. (2002) report that librarians recommend teaching information literacy in lower division courses. Like all skills, it must be repeatedly used and reinforced.

During the 1998-99 to 2002-2003 academic years, a two-semester program of introductory information literacy skills, called Quest, was administered to all first year students as part of their Core Humanities seminar. After assessment of the program, including focus group studies conducted by Villanova’s Office of Planning, Training, and Institutional Research (Hewlett 2002), the decision was made to redirect the library’s efforts toward integrating information literacy instruction into the students’ areas of study. “Link[ing] information literacy to ongoing coursework and real-life experiences appropriate to program and course level” has been identified as a best practice in this field by ACRL (2003). Villanova has already initiated programs for first year nursing and biology students and is, therefore, continuing the evolution by developing a similar program for engineering students.

Learning Issues

Today’s students view technology favorably and are adept with its use. However, they are not critically evaluating the information they gather. The literature indicates that when assignments are properly constructed and when learning is active and collective, their information literacy skills can improve dramatically.

Typically, students respond well to hands-on computer laboratories in which they search various databases and retrieve electronic information. McGuigan (2001) notes that the Web is often the first source students explore when researching a topic. Davis (2003) also reports that students are using fewer scholarly references, but that this trend can be reversed with properly constructed assignments.

Active and peer learning are strategies often employed to teach a variety of topics. The effectiveness of these strategies is especially important because Manuel (2002) reports that the students at California State University viewed the “words of caution said by the instructor about the Internet as trashing of the technology...by someone professionally threatened by the Internet.” Manuel (2002) found that the assignments and directions needed to be primarily visual rather than textual. Peer learning is another effective strategy in use today because “teachers report that ... today’s kids get along less well with teachers, but better with one another” (Howe and Strauss 2000).

Our Plan

A successful information literacy program must:

- be introduced early in the student’s university education
- be reinforced often, with assignments of increasing complexity
- use active and peer learning techniques

Curriculum

A series of instructional modules will be incorporated into courses throughout the three years the students are taking classes within the Civil and Environmental Engineering (CEE) curricula at Villanova to achieve the outcomes described previously (Table 1). The development of the modules will be a collaborative effort between the instructors teaching the courses and the authors of this paper. One module from sophomore year is presented as an example.

Table 1. Courses with Information Literacy Modules

<i>Year</i>	<i>Course</i>	<i>Assignment</i>	<i>Implementation</i>
Sophomore	Geology for Engineers (GLY 2805)	Term paper on issue or issues dealing with geology, environmental geology, or engineering geology	Fall 2004
	Environmental Engineering Science (CEE 2311)	Research paper on a Superfund site	Spring 2005
Junior	Soil Mechanics Laboratory (CEE 3901)	Case study of a civil engineering failure	Spring 2006
	Transportation Engineering (CEE 3211)	Term paper on and analysis of a contemporary issue in transportation engineering	Spring 2006
Senior	Foundation Design (CEE 4801)	Evaluation of the resources available on a geotechnical engineering project	Fall 2005
	CEE Professional Practice (CEE 4601)	Term paper on an issue related to civil engineering practice	Fall 2005

Example Module: GLY 2805

The module used in Geology for Engineering (GLY 2805) has been developed and was implemented in Fall 2004. This is provided as an example to show how the other modules will be developed and the types of activities that will be associated with each module. The goals of this module are to meet the outcomes listed above for sophomore year.

Development Process

The instructor of the course has had his students write a term paper in this class for many years. This term paper focuses on an issue or issues dealing with geology, environmental geology or engineering geology. The students write the paper in the context of addressing their fellow civil engineering students. The author can assume the reader has a basic knowledge of physical geology, but they should define any advanced terminology and explain advanced concepts. The instructor provides the students with a list of potential topics, which include researching a topic dealing with an area of study covered in the course, such as “Geology of Glacier National Park”, or researching a contemporary issue, such as “Sinking Neighborhoods in Philadelphia”.

Description of Module

The students will attain the outcomes listed previously through formal instruction from library personnel and the instructor, as well as self-guided research. The activities associated with this module are summarized in Table 2. The website evaluation sheets the students use during week two will be based on evaluation tools used by the students in other Villanova information literacy

programs and other sources (Fogg et al. 2002, Beck 2004, and University of California at Berkeley 2004). The goal of the library session is to introduce the students some of the technical databases available and to the types of resources available at Falvey. This library session will provide the foundation for the library sessions planned for CEE 2311 and CEE 3211.

Next year, the students will evaluate one another's papers in week 14. The students will be provided with a rubric to assist them with the evaluation of the paper. This rubric will relate to outcomes 4, 5, 8, 10, 17 described previously. An example rubric is provided after this section.

Table 2. Summary of GLY 2805 Module

<i>Week</i>	<i>Where</i>	<i>Activities</i>	<i>Outcome</i>	<i>Deliverable</i>
1	In class	The student will receive the term paper assignment with an explanation of the assignment from the instructor. The instructor describes the documentation style used by the American Society of Engineers (ASCE) and provides an example page. The instructor will also tell them that they need to maintain a journal of their research activities.	10, 11	Student selects topic.
2	In/Out of class	The student is provided with evaluation criteria for websites (approximately 10 minutes of class, presented by library personnel). Each student explores sources that are available to the general public (i.e. Web sources). Student makes entries into search journal.	1, 2, 3, 6, 7	Student completes worksheet evaluating a website, develops preliminary list of key words used to describe the topic, and submits a plan/timeline to perform the required research.
3	In library	Student creates Boolean search statement. Student uses appropriate databases. Student obtains sources from the library and inter-library loan. Student makes entries into search journal. (One 75 minute period)	4, 10, 12, 13, 14, 15, 16	Student records proper citation of selected articles. Student evaluates and summarizes a selected article. Student describes differences between Google and subject-specific database.
5	Out of class	Student continues performing research on selected topic and making entries in journal.	6, 10, 17	Student submits outline, reference list, and introduction.
12	Out of class	Student continues performing research on selected topic and making entries in journal.	4, 5, 8, 10, 17	Student submits term paper.
13	Out of class	Student summarizes how they performed their research, what was successful and unsuccessful and what they would do differently next time.	7	Student submits search journal with summary sheet.
14	Out of class	Student reads and critiques another student's term paper following a set of evaluation criteria.	4, 5, 8, 10, 17	Student submits critique.

Evaluation of Module

Assessing student learning is always a challenging process. There has been some debate about the ability to measure a complex skill-set like information literacy. However, Catts and Appleton (1999) state that information literacy skills are measurable.

Student work will be the primary tool used to assess the information literacy program. The CEE department has an assessment protocol in place that requires professors to collect student work for assessment. Consequently, CEE professors are accustomed to collecting student work and assessing it with rubrics. Student work in the classes identified in Table 1 will be collected. Rubrics will be developed based on the outcomes described previously. Each outcome will have 4 levels: Mastered, Proficient, Limited, and Insufficient. The work will be assessed by Falvey Library staff and the CEE faculty member teaching the course. Our goal will be to have 80% of our students performing at, or above, the Proficient level. An example rubric for outcome 6 for sophomore year is provided in Table 3.

Table 3. Example Rubric for Sophomore Year: Outcome 6

<i>Outcome</i>	<i>Mastered</i>	<i>Proficient</i>	<i>Limited</i>	<i>Insufficient</i>
Uses at least 3 of the following criteria to evaluate website for authority, reliability, and credibility: 1) author's credentials; 2) author's affiliation; 3) presence of scholarly references; 4) data presented in the form of tables, graphs, charts; and 5) dates of creation and update	Uses at least 3 criteria and adds evaluative comments	Uses 3 criteria	Uses 2 criteria	Uses 1 criterion or does not evaluate website for this characteristic
Uses at least 3 of the following criteria to evaluate website for purpose, viewpoint, and suitability: 1) intent of the website (e.g., to inform, persuade, present opinions, report research, or sell a product); 2) intended audience; 3) several viewpoints presented or at least acknowledged, if topic covered is open to debate; and 4) source of at least some of the information needed by student	Uses at least 3 criteria and adds evaluative comments	Uses 3 criteria	Uses 2 criteria	Uses 1 criterion or does not evaluate website for this characteristic

Surveys will be used as a secondary tool to provide attitudinal data. Every year we administer two exit surveys to our seniors. One is the EBI survey, which is purchased by the university, and the other is a survey developed "in-house". Although the EBI survey does not have questions relating specifically to information literacy, there are questions regarding life-long learning, written communication, oral communication, and modern engineering tools. The in-house survey will be modified to include questions relating to information literacy.

Conclusions

Although the Boyer Commission did not use the words "information literacy", their report clearly supports the skills we will develop in our students as a result of this program (Boyer 1998). The Boyer Commission stressed the importance of inquiry-based learning. This type of learning is only possible if students can effectively navigate the enormous sea of information available to them.

A plan for the development of instructional materials and assignments has been described. Currently, we are implementing this plan. These modules will:

- be fully integrated into the CEE curriculum
- increase in complexity during the three years
- be hands-on assignments that stress active and peer-learning
- be evaluated based on ACRL outcomes
- enable our students to become confident, life-long learners; and
- weave the concept of research into undergraduate education.

This plan will be constantly evaluated and enhanced as necessary, but we feel that this is an important step in ensuring that our students have the ability to use these skills in all aspects of their lives.

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