QUOTES FROM REFERENCES USED IN the PROPOSED STANDARDS

MSCHE: Middle States Commission on Higher Education
http://www.msache.org/

Middle States Commission on Higher Education, *Standards of Accreditation*. 2002. Philadelphia, Pennsylvania.

Avoidance of obsolescence

Self-instruction and distance learning programs are available to help students reach one of the principal goals of professional education that is vital to avoidance of obsolescence, namely, the ability to learn without the help of an on-campus teacher.

Standard 12

Page 37
"...institution's curricula are designed so that students acquire and demonstrate college-level proficiency in general education and essential skills, including oral and written communication, scientific and quantitative reasoning, technological competency and information literacy"

Page 38
"general education requirements assuring that, upon degree completion, students are proficient in oral and written communication, scientific and quantitative reasoning, technological capabilities appropriate to the discipline, and information literacy, which includes critical analysis and reasoning"

NCA-HLC: North Central Association of Schools and Colleges – Higher Learning Commission
http://www.ncahigherlearningcommission.org/

North Central Association of Schools and Colleges – Higher Learning Commission. *Restructured Expectations: A Transitional Workbook.* Available at http://www.ncahigherlearningcommission.org/restructuring/03Workbook.pdf

Criterion Three: Student Learning and Effective Teaching

Criterion 3 - Core Component 3d
The organization's learning resources support student learning and effective teaching.

Criterion Four: Acquisition, Discovery, and Application of Knowledge
The organization promotes a life of learning for its faculty, administration, staff, and students by fostering and supporting inquiry, creativity, practice, and social responsibility in ways consistent with its mission.

Criterion 4 - Core Component 4a
The organization demonstrates, through the actions of its board, administrators, students, faculty, and staff, that it values a life of learning.

Examples of Evidence
- The organization's planning and pattern of financial allocation demonstrate that it values and promotes a life of learning for its students, faculty, and staff.

Criterion 4 - Core Component 4b
The organization demonstrates that acquisition of a breadth of knowledge and skills and the exercise of intellectual inquiry are integral to its educational programs.

Examples of Evidence
- Learning outcomes demonstrate that graduates have achieved breadth of knowledge and skills and the capacity to exercise intellectual inquiry.
- Learning outcomes demonstrate effective preparation for continued learning.

Criterion 4 - Core Component 4c
The organization assesses the usefulness of its curricula to students who will live and work in a global, diverse, and technological society.

Examples of Evidence
- Faculty expects students to master the knowledge and skills necessary for independent learning in programs of applied practice.

Criterion 4 - Core Component 4d
The organization provides support to ensure that faculty, students, and staff acquire, discover, and apply knowledge responsibly.

Examples of Evidence
- The organization creates, disseminates, and enforces clear policies on practices involving intellectual property rights.

NWCCU: Northwest Commission on Colleges and Universities
http://www.nwccu.org/

NWCCU Accreditation Standards
Available at
http://www.nwccu.org/Standards%20and%20Policies/Accreditation%20Standards/Accreditation%20Standards.htm

Education Program and Its Effectiveness

Standard 2.A – General Requirements

2.A.8 Faculty, in partnership with library and information resources personnel, ensure that the use of library and information resources is integrated into the learning process.

Standard 2.C – Undergraduate Program

Baccalaureate and academic or transfer associate degree programs include a substantial core of general education instruction with identifiable outcomes and require competence in (a) written and oral communication, (b) quantitative reasoning, (c) critical analysis and logical thinking, and (d) literacy in the discourse or technology appropriate to the program of study.

Standard 2.D – Graduate Program

The objective of a research-oriented graduate degree program is to develop scholars — that is, students with skills necessary to discover or acquire, organize, and disseminate new knowledge. The objective of the professional graduate degree is to develop in students their competence in interpreting, organizing, and communicating knowledge and to develop the analytical and performance skills needed for the conduct and advancement of professional practice.

Standard 2.E – Graduate Faculty and Related Resources

2.E.2 The institution demonstrates a continuing commitment of resources to initiate graduate programs and to ensure that the graduate programs maintain pace with the expansion of knowledge and technology.

Standard 2.G – Continuing Education and Special Learning Activities

The changing nature of the demands placed upon individuals in today's society requires many of them to engage in life-long education.

Policy 2.6 Distance Delivery of Courses, Certificate, and Degree Programs

Requirements
Approval and Purpose

e. The institution ensures that the technology used is appropriate to the nature and objectives of the programs.

Library and Information Resources

j. The institution ensures that students have access to and can effectively use appropriate library resources.

k. The institution monitors whether students make appropriate use of learning resources.

l. The institution provides laboratories, facilities, and equipment appropriate to the courses or programs.

SACS: Commission on Colleges of the Southern Association of Colleges and Schools
http://www.sacscoc.org/

Criteria for Accreditation:
Commission on Colleges of the Southern Association of Colleges and Schools
Approved by the College Delegate Assembly December 1984
Modified: December 1997

5.1.2 Services
Page 53
"Basic library services **must** include an orientation program designed to teach new users how to access bibliographic information and other learning resources."

Page 54
"Emphasis should be places on the variety of contemporary technologies used for accessing learning resources. Libraries and learning resource centers **must** provide students with opportunities to learn how to access information in different formats so that they can continue life-long learning. Librarians must work cooperatively with faculty members and other information providers in assisting students to use resource materials effectively. Libraries and learning resource centers should provide point-of-use instruction, personal assistance in conducting library research, and traditional reference services. This should be consistent with the goal of helping students develop information literacy – the ability to locate, evaluate, and use information to become independent life-long learners."

5.3 Information Technology Resources and Systems
Page 57-8
Although the diversity of educational programs and goals will be a major determining factor in the selection of information technology resources by an institution, there **must** be a reasonable infusion of information technology in to the curricula so the students exit with the fundamental knowledge and basic ability to use these resources in everyday life and in future occupations. Institutions **must** provide the means by which students may acquire basic competencies in the use of computers and related information technology resources."

WASC: Western Association of Schools and Colleges

http://www.wascweb.org/

Western Association of Schools and Colleges, *WASC Handbook of Accreditation*. 2001. Alameda, California.

Page 20

Standard 2
Achieving Educational Objectives Through Core Functions

Teaching and Learning:
Criteria for Review

2.2. All degrees—undergraduate and graduate—awarded by the institution are clearly defined in terms of entry-level requirements and in terms of levels of student achievement necessary for graduation that represent more than simply an accumulation of courses or credits.

- Baccalaureate programs engage students in an integrated course of study of sufficient breadth and depth to prepare them for work, citizenship, and a fulfilling life. These programs also ensure the development of core learning abilities and competencies including, but not limited to, college-level written and oral communication; college-level quantitative skills; information literacy; and the habit of critical analysis of data and argument. In addition, baccalaureate programs actively foster an understanding of diversity; civic responsibility; the ability to work with others; and the capability to engage in lifelong learning.

Page 21

- Graduate programs are consistent with the purpose and character of their institutions; are in keeping with the expectations of their respective disciplines and professions; and are described through nomenclature that is appropriate to the several levels of graduate and professional degrees offered. Graduate curricula are visibly structured to include active involvement with the literature of the field and ongoing student engagement in research and/or appropriate high-level professional practice and training experiences.

Page 22
Teaching and Learning:
Questions for Institutional Engagement

3. To what extent does the institution provide an environment that is actively conducive to study and learning, where library, information resources, and co-curricular programs actively support student learning?

Page 23
Scholarship and Creative Activity:
Questions for Institutional Engagement

4. In what ways does the institution seek to foster among its students a research-oriented culture of inquiry—especially at the graduate level—that is consonant with its character and purposes?

Page 26

Standard 3
Developing and Applying Resources and Organizational Structures to Ensure Sustainability

Fiscal, Physical, and Information Resources
Criteria for Review

3.6. The institution holds, or provides access to, information resources sufficient in scope, quality, currency, and kind to support its academic offerings and the scholarship of its members. For on-campus students and students enrolled at a distance, physical and information resources, services, and information technology facilities are sufficient in scope and kind to support and maintain the level and kind of education offered. These resources, services and facilities are consistent with the institution's purposes, and are appropriate, sufficient, and sustainable.

3.7. The institution's information technology resources are sufficiently coordinated and supported to fulfill its educational purposes and to provide key academic and administrative functions.

Fiscal, Physical, and Information Resources
Questions for Institutional Engagement

Page 27
5. How does the institution ensure that its members develop the critical information literacy skills needed to locate, evaluate, and responsibly use information? How does it utilize the special skills of information professionals to support teaching, learning, and information technology planning?

NEASC-CIHE: New England Association of Schools and Colleges - Commission on Institutions of Higher Education
http://www.neasc.org/

Standards for Accreditation
Available at http://www.neasc.org/cihe/stancihe.htm

Undergraduate Degree Programs

4.18
Through the major or area of concentration, the student develops an understanding of the complex structure of knowledge germane to an area of inquiry and its interrelatedness to other areas of inquiry.

4.19
Graduates successfully completing an undergraduate program demonstrate competence in written and oral communication in English; the ability for scientific and quantitative reasoning, for critical analysis and logical thinking; and the capability for continuing learning. They also demonstrate knowledge and understanding of scientific, historical, and social phenomena, and a knowledge and appreciation of the aesthetic and ethical dimensions of humankind. In addition, graduates demonstrate an in-depth understanding of an area of knowledge or practice and of its interrelatedness with other areas.

Graduate Degree Programs

4.22
Research-oriented doctoral programs and disciplinary master's degree programs are designed to prepare students for scholarly careers; they emphasize the acquisition, organization, utilization, and dissemination of knowledge. Doctoral degree programs afford the student substantial mastery of the subject matter, theory, literature, and methodology of a significant field of study. They include a sequential development of research skills leading to the attainment of an independent research capacity.

4.23
They seek to develop the capacity to interpret, organize, and communicate knowledge, and to develop those analytical and professional skills needed to practice in and advance the profession. Instruction in relevant research methodology is provided, directed toward the appropriate application of its results as a regular part of professional practice.

EHAC: National Environmental Health Science and Protection Accreditation Council
http://www.ehacoffice.org/

Available at http://www.ehacoffice.org/process/ps_under.php

VII. Accreditation Criteria p.6

E. Library

Current environmental health science and protection periodicals and reference materials and access to the Internet should be available in the library for faculty and students in the environmental health science and protection program.

VIII. Baccalaureate Environmental Health Science and Protection Degree--
Curriculum Criteria p.6

B. The four-year curriculum should include the following general and specific objectives.

General Objectives:

1. Promote critical thinking.

2. Provide for the development of the skills, technical knowledge and attributes necessary for graduates to function as members of a health team in the public or private sector.

3. Inspire students to continue their education throughout life and to fully appreciate their professional obligations.

CHEM

American Chemical Society (ACS), Committee on Professional Training, 2003, *Undergraduate Professional Education in Chemistry: Guidelines and Evaluation Procedures*. Columbus, Ohio, American Chemical Society. Available at: http://www.chemistry.org/portal/a/c/s/1/acsdisplay.html?DOC=education\cpt\guidelines.html

Section 1.1
Page 5
"A strength of chemistry as general education as well as professional training is that problem-solving skills are emphasized and developed."

Section 1.4
Page 10

Laboratory work in Chemistry

"It should give the students hands-on experience with chemistry and the self-confidence to:

- Communicate effectively through oral and written reports
- Work effectively in small groups and teams"

Page 11

Research

"Undergraduate research can integrate the components of the core curriculum into a unified picture and help undergraduates acquire a spirit of inquiry, independence, sound judgment and persistence."

Page 14

Professional Ethics

"Openness about discoveries and independent verifiability of experiments reinforce good ethical practice in the field. Presenting ethical principles should be an intentional part of teaching chemistry."

ABET: Criteria for Accrediting Engineering Programs http://www.abet.org/criteria.html

CAL POLY: Introductory Competencies in Specific Disciplines http://www.lib.calpoly.edu/infocomp/specific.html

#10 "Judge the product and the process."
EL: Engineering Libraries

"Model for a Web-Based Information Literacy Course: Design, Conversion and Experiences." Reynolds, Leslie J. *Science & Technology Libraries* Vol. 19, No. 3/4, 2001, pp 165-178.

"DESIGN OF THE COURSE: CIRCULAR MODEL"

"We wanted the modular course to bring together abstract concepts and concrete examples. We decided that the course model should mimic the real world and how professionals create information. Evaluation of the original linear course model and its reorganization brought to light Subramanyan's model for the evolution of science and technical information. It was decided to hang the course modules off the points on his circle.

"Following some editing and manipulation of Subramanyan's circle, a progression for the course was developed. Figure 2 shows that in this circle, the evolution of information creation flows clockwise, from its generation as a result of research and development activities through its dissemination in primary literature, its surrogation in indexing and abstracting services and its eventual integration and compaction in reviews, textbooks and encyclopedias. The consumption of information moves in counter-clockwise fashion. We identified "evaluation" as the central theme and placed it in the center of the circle to reflect its importance and relevance to the entire information seeking process." (p 168)

"Industry Expectations of the New Engineer." Rodrigues, Ronald. *Science & Technology Libraries* Vol. 19, No. 3/4, 2001, pp 179-188.

"INTRODUCTION"
"…half that time [20.6 hours a week] is spent gathering and looking for the information. The remaining half is spent reviewing and analyzing it." p. 181.

"EXPECTATIONS"

"Corporations expect their newly hired engineers or scientists to be able to "hit the ground running." Commercial laboratories often issue laboratory notebooks to new engineers on the first day of work. Laboratory notebooks are legally admissible records of the engineer's research which are used to document or establish the date of conception of an invention, or to document the reduction to the practice of an invention. Possessing fundamental bibliographic skills in both technical and business research serves the engineer to more efficiently defend the company's intellectual property.

"Making project deadlines contributes to a company's bottom line, i.e., profitability. By gaining new ideas and information for engineers active in developing new products or upgrading existing ones, improving processes, doing root cause analysis of equipment-failure problems, integrating different kinds of technology into their products and processes, looking for new suppliers or components, investigating new uses for their products, and checking on their competitors. In order to efficiently meet these expectations, engineers would greatly benefit by knowing how to quickly locate references that meet their needs. They should be aware of all options available to them, whether funded by their company or available through a university or information broker. Far too many engineers are completely unaware of the information resources that their companies have to offer.

"Information needs in a corporate environment cover a wide range of topics. In addition to finding specific data such as ranges of measurement or physical properties, engineers may encounter any of the following areas for research:

- Find out if an experiment has already been done, to avoid needless repetition.
- Find people who are the recognized experts in their field, as demonstrated by the frequency with which they are cited by other authors.
- Locate consultants or organizations that can answer complex questions.
- Find trends in venture capital spending.
- Find contract and other revenue opportunities from various governmental sources.
- Find licensable technologies.

- Identify others who have been working on a technology of interest. It is becoming increasing important to monitor competitors and their marketing strategies and product offering and developments. Many large companies ask their engineers to be mindful of emerging startups for possible acquisition.
- Locate and create patents and other intellectual property. This is an extremely important activity in today's corporations. The number of patent applications continues to increase dramatically.
- Stay in touch with changing technology and product life cycles from infancy to success by using tools that provide bibliometric analysis. It is possible to learn a great deal about a company by analyzing its published papers and/or patent portfolio.

"The infancy of technological products is often marked by a peak in patents and technical reports, its commercial emergence by a peak in conference papers, and its maturity by a peak in journal articles, all measurable in many commercial databases. Online databases provide the trained engineer with cost-effective power search capabilities and features such as Boolean searching, proximity operators and relevance ranking. "Alerting" and "table of content" services provide the engineer with new material of specific interest and may be sent directly to his or her e-mail, dramatically cutting the time spend on reviewing hardcopy journals and reports." p181-183.

"THE ROAD TO ENGINEERING LIBRARY LITERACY"

"Engineering students, in preparations for efficiently managing information during their careers, should be departing the university for industry with more than just an accumulation of textbooks and course notes to take with them. It would be of great value for them to also possess the following proficiencies:

1. A basic knowledge of how a typical engineering library is organized, as well as familiarity with general and engineering-specific reference books.
2. A working knowledge of the nature and usefulness of a wide range of technical journals relevant to the field. However, now matter how wide this range is, the wise engineer will realize that, with approximately 40,000 journal titles in current circulation and the number still increasing, it is not possible to be familiar with all those that may be needed.
3. An awareness of the professional associations that support their engineering specialty, as well as other associations that may be worth joining in the future, or at least be worth monitoring for their journals and conference papers.
4. The rudiments of searching relevant online sources provided through the university library. They should learn about the design and content of these databases, not overlooking non-technical ones that provide information about their competitors, suppliers, products, management techniques, and other matters that engineers and engineering managers often become involved in. A recognition of the pitfalls involved in searching the "open internet" versus the commercial online databases – the World Wide Web is far from bringing the world's information sources together into one easily searchable pool. The Internet adds many new disconnected pools of information, each with its own rules of access and structure. Engineers should always be conscious of the time it takes to complete tasks on the Internet, and repeat the tasks using other information resources to become familiar with the advantages and disadvantages of different approaches. It is important to cross-check information from the Internet against other basic references." (p183-184)

"VALUE AND COST"

"… In gathering information, an engineer should continually strive to balance the costs of obtaining the information against the value of the information, in order to maximize financial return.

"Engineers should be trained to recognize those factors that affect this balance …" p. 185

"KNOWING WHERE TO LOOK"

"… Engineers who do a lot of online searching may choose to combine the end-user and information professional roles and work alone,[10] but a partnership between an engineer and an information professional, such as a corporate librarian, is often most effective.[11] In addition to being able to conduct online searches proficiently, information professionals will know which questions are best answered by an online search and which by other means. However, the reality is that far too many engineers do not take advantage of the information resources available to them. Often the fundamentals of information literacy are woefully inadequate." (p 187)

"CONCLUSION"

"In today's complex global marketplace, being able to navigate the ever growing mountain of technical and business information is becoming more of a challenge. Engineers that use information well, not only have a competitive advantage over those that don't, they avoid the cost of being misinformed which can be devastating.

The transition from student to working engineer can be less traumatic when the principles above are fully appreciated. Demonstrated bibliographic research competency will help shore up the engineers, confidence that, in not only having the skills to cut time obtaining information, they will have more time to apply the knowledge when and where it counts." (p 187-188)

"**The Implementation of Information Technology."** Schmarzwalder, Robert. *Science & Technology Libraries* Vol. 19, No. 3/4, 2001, pp 189-205.

"The corporate client base typically places a heavy premium on obtaining results that have been analyzed, summarized, and reported in brief. Require response time is typically short (days) to very short (hours) and there may be major financial consequences to incorrect or incomplete information. Internal information typically carries some degree of confidentiality and there is often segmentation within the ranks of the company regarding who is permitted access to which information . Internal information typically fulfills between 40% and 70% of the information requests to corporate information centers,[3] reflecting the extensive research and development activities of corporations in the engineering, scientific, and pharmaceutical industries." (p 195)

"Through the use of current awareness services, such as Ford Motor Company's RLIS Select product, … data mining, and text visualization technologies, libraries have been able to expand their horizons into public affairs and competitive intelligence functions. Involving information professionals in these areas results in the availability of a highly relevant stream of information to decision makers and allows them to focus their activities on core business needs – as opposed to information gathering. Moreover, advanced information technologies, such as data mining and visualization, move beyond retrieval and allow the information professional to identify trends and patterns within large sets of complex textual data. This often provides an entirely new capacity to corporations that can be applied to a wide variety of information streams. The role of corporate libraries in performing these types of analyses is emerging as an area of potential value." (p 196)

ASEE/Engineering Libraries Division
DRAFT
Information Competencies for Engineering

What skills and knowledge do we expect all engineering graduates to have? Students must be prepared to engage in life-long learning to keep abreast of changes in technology and new investigative tools for doing research. The processes of knowledge retrieval and expert decision-making are important to modern engineering problem-solving.

A vital component of the learning process is the ability to find information on a new topic or problem, analyze it, and integrate the new information with what is known. This ability comes from developing information competencies, or information "literacy". Awareness of the broad range of engineering information resources available and their relative value for particular needs, the knowledge of how to use them, and the motivation to use them routinely, will characterize the "information literate engineer", one prepared for life-long learning.

The Internet and the World Wide Web are research tools that have ushered in an era of easy access to information. Most of it is "unfiltered" as to quality and accuracy, unlike academic library resources, which are carefully reviewed before selection. Students need to develop methods for evaluating the reliability and bias of the information found on the web.

This document details the skills in which an information-literate engineering student should be proficient. Key areas are:

- problem definition,
- development of an efficient and systematic method of finding information,
- awareness of major information resources in engineering,
- critical analysis of information,
- accurate documentation of sources,
- presentation skills: organizing and communicating information to others
- awareness of the social, legal, and ethical uses of information (copyright, plagiarism)

<u>Competencies</u>

1. Students analyze and define their information need.
2. Students select and use appropriate information sources.
   Outcomes:
   a. Engineers should develop skills in identifying and using information resources such as conference papers, preprints, technical reports, patents, journals articles, standards and specifications, government information, maps, and books, in both print and electronic format.
   b. They should use reference tools such as encyclopedias, dictionaries, and handbooks specific to engineering or to the discipline in which they are doing research.
   c. Engineers should know which is the appropriate resource to use for each problem-solving situation.
3. Students search library catalogs effectively, to determine book and periodical locations and to access electronic resources.
   Outcomes:
   a. Students can locate periodical titles and determine what is available at the library.
   b. Students can initiate document delivery/interlibrary loan requests to obtain items not held locally in print or electronic format.

4. Students can find information on the Internet and evaluate its reliability and authenticity.
5. Students understand citation searching and determine when it might be useful.
6. Students select appropriate information databases to find research or data on their chosen topic and find how to search the database in an effective way.

Outcomes:
   a. Students develop effective search strategies and modify them as needed.
   b. Students chose appropriate subject categories and search terms.
   c. Students know how to broaden or narrow search results.
   d. Students evaluate references and select the most appropriate ones.

e. Students recognize the type of resource cited and understand the components of a citation.
f. Students understand the difference between scholarly and popular information sources and can determine this from a citation.

7. Students locate and retrieve cited sources.

Outcomes:

a. Students can determine how to obtain the items they retrieve in a search.
b. Students can interpret standard library descriptions of holdings and can access electronic resources via the Internet.

8. Students analyze and evaluate information obtained.

Outcomes:

a. Students assess the authority, reliability and validity of information retrieved.
b. Students use multiple information sources for problem-solving and decision-making.
c. Students examine conflicting information from several sources and reconcile the differences.
d. Students make decisions based on evidence, when available, rather than on opinion. Students recognize the difference between the two.

9. Students use current awareness services to keep abreast of research and emerging knowledge in respective subject areas.
10. Students understand the basic structure of a scientific paper: abstract, introduction, materials and methods, results, discussion, assignment of keywords or indexing terms.
11. Students use effective and appropriate tools for the presentation of information.
12. Students understand the global, ethical, legal, and socio-political issues of access, use, and management of information.

SUMMARY:

Electronic methods of information access are gradually predominating over traditional print formats. As more electronic resources are developed, students need a set of skills to select the most appropriate resources from among library and public web sites. In today's research-based environment, the ability to obtain, synthesize, and use information efficiently will be of crucial importance to both undergraduate and graduate students in engineering throughout their career.

The development of information literacy skills should be integrated with academic courses and class assignments within each respective discipline. It is ideally based on close cooperation between faculty and librarians, so that basic through advanced skills can be taught at the appropriate time in the curriculum. When students graduate with a mental model of how to systematically find information in any field, they will be prepared for life-long learning.