Information Use Skills in the Engineering Program Accreditation Criteria of Four Countries

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The need for 21st century information skills in engineering practice, combined with the importance for engineering programs of meeting accreditation requirements, suggests that it may be worthwhile to explore the potential for closer alignment between librarians and their work with information literacy competencies to assist in meeting accreditation standards and graduating students with high-level information skills. This article explores whether and how information use skills are reflected in engineering program accreditation standards of four countries: Canada, the United States, the United Kingdom, and Australia. Results indicate that there is significant overlap between the information use skills required of students by engineering accreditation processes and librarians’ efforts to develop information literacy competencies in students, despite differences in terms used to describe these skills. Increased collaboration between engineering faculty and librarians has the potential to raise student information literacy levels and fulfil the information use-related requirements of accreditation processes.

Keywords: engineering accreditation; information literacy; information use skills

Introduction

Accreditation of academic programs, including engineering, is an important process that serves several functions. It provides a measure of quality assurance to ensure that students are paying for an educational experience that will adequately prepare them for the workforce. It also provides a level of standardization among multiple programs within the same jurisdiction; while most accrediting bodies avoid being too prescriptive, they do provide insight into the skill and knowledge levels expected of those graduating from an accredited program. Accreditation of postsecondary educational programs also contributes to public confidence in the products and services offered education institutions (Eaton 2009). Finally, in a healthily functioning accreditation environment, accreditation is viewed as a cyclic process that provides opportunities for continual
improvement of the program.

Accreditation has become increasingly important in modern times as a result of the proliferation of postsecondary institutions and courses (both physical and virtual) whose quality is difficult to assess. An increasingly mobile workforce, expecting their credentials to be efficiently assessed (and ideally recognized) in multiple jurisdictions, has also been a driving force behind the emphasis on programmatic accreditation. Accreditation of professions like engineering that are heavily dependent on technology also ensures that students are learning current practices and technologies and graduate meeting the latest industry standards.

Despite its importance, the postsecondary accreditation landscape is quite complicated. Some countries have established national or regional postsecondary institutional accreditation requirements, mandating that each university must meet institution-wide accreditation standards. These blanket accreditation processes are supplemented by programmatic accreditation that assesses specific programs, most often for professions like engineering, medicine, nursing, social work, etc. Institution-wide processes are necessarily general in nature but, depending on requirements, can provide a valuable starting point on which programmatic accreditation can build. Institutional accreditation often requires data collection, long-term planning, and the development of procedural expertise (with writing self-study documents, preparing for site visits, etc.) that is valuable to the programmatic accreditation process. Despite this, however, the programmatic accreditation process typically requires significant specialized attention and is a rigorous and time-consuming process.

As mentioned, engineering is one program that is typically subject to a separate, programmatic accreditation process. There are numerous accreditation bodies around the world that accredit engineering programs, with most of these being national in
scope. There has been some movement towards recognition of accreditation standards across national borders (most notably the European Network for Accreditation of Engineering Education’s EUR-ACE program) but this level of coordination is still the exception rather than the norm. Adding to the complexity of the accreditation environment is the need for standards to continually evolve; engineering is a dynamic profession that has been greatly impacted by technology. Accreditation standards must keep pace with this development to ensure that students are prepared to meet the demands of the modern engineering workplace after graduation.

One of the developments impacting engineering and reflected in recent versions of accreditation standards has been the exponential increase in the volume of information available to professionals and the resulting need for information use skills, defined here as the ability to skillfully find and use information for specific purposes. Research into time spent on information tasks has found that engineers spend a great deal of their work day engaged in information-related work. Allard, Levine, and Tenopir (2009) studied US and Indian engineers in the workplace and found that they spent one quarter of their time on information-related tasks (broadly divided into software tools, Internet use, and reading), while Robinson’s results suggested that over 55% of engineers’ workday was spent on the acquisition and provision of knowledge (2010). Information use is not only an important factor in engineers’ use of time, but also serves as an important source of inspiration in their work (Makri and Warwick 2010). Clearly, sophisticated information use skills are essential to engineers, their employers, and universities preparing students for future careers in engineering.

Librarians, too, have recognized the importance of developing skills to use information effectively throughout the lifespan, from elementary/secondary school, through post-secondary education, and beyond for purposes of both personal and
professional lifelong learning. The library profession has adopted the term “information literacy” to refer to this skill set, defining the term as the ability to “recognize when information is needed and have the ability to locate, evaluate, and use effectively the needed information” (American Library Association 1989). This simple definition perhaps belies the complex range of skills and knowledge that the term information literacy has come to represent to the library profession. A much more developed and comprehensive articulation of these abilities is laid out in the publication Information Literacy Competency Standards for Higher Education, developed by the Association of College and Research Libraries division of the American Library Association. Five broad competencies are outlined in the document:

1. The information literate student determines the nature and extent of the information needed.
2. The information literate student accesses needed information effectively and efficiently.
3. The information literate student evaluates information and its sources critically and incorporates selected information into his or her knowledge base and value system.
4. The information literate student, individually or as a member of a group, uses information effectively to accomplish a specific purpose.
5. The information literate student understands many of the economic, legal, and social issues surrounding the use of information and accesses and uses information ethically and legally. (Association of College and Research Libraries 2000)

Each competency is further delineated by comprehensive performance indicators and learning outcomes. Although the standards are American in origin, they are generally
considered consistent (Gullikson 2006, p. 584) with similar documents originating in other countries, especially The SCONUL Seven Pillars of Information Literacy: Core Model (UK) and the Australian and New Zealand Information Literacy Framework.

Several national/regional accreditation bodies, most notably The Middle States Commission on Higher Education (US), have incorporated the main points of Information Literacy Competency Standards for Higher Education into their institutional accreditation requirements (Saunders 2007). This has opened the door to high levels of cooperation between librarians and teaching faculty, prompting the development of rigorous information literacy programs at accredited institutions. There are numerous examples of accredited institutions where information use skill development is planned, embedded throughout the curriculum, and taught and assessed collaboratively by librarians and subject faculty (for example, New Jersey Institute of Technology 2009, University of Massachusetts Amherst n.d.).

Despite the success resulting from this high level of collaboration when required by institutional accrediting bodies, the Information Literacy Competency Standards for Higher Education and partnerships with librarians are not overtly referred to in most programmatic accreditation guidelines. Saunders, however, suggests that this is not indicative of a lack of importance assigned to information skills in programmatic accreditation, but rather notes that although these accreditation agencies “are not explicit in their expectations for information literacy learning outcomes,” with, “careful reading and extrapolation, it is possible to draw clear connections between specialized standards and ACRL competency areas” (2011, p. 66). A few previous studies have considered programmatic accreditation standards from other fields of study in relation to the ACRL Information Literacy Competency Standards for Higher Education, most notably Ruediger and Jung (2007). With respect to engineering, Milne and Thomas
(2008) draw comparisons between the *Australian and New Zealand Information Literacy Framework* and Engineers Australia’s accreditation standards when discussing incorporation of information skills into a specific first year course. Murphy and Saleh (2009) write about the implications for information literacy program development of connections between Canadian engineering accreditation criteria and the lifelong learning standard in a different set of standards, ACRL’s *Information Literacy Standards for Science and Engineering/Technology*. Oxnam’s brief 2003 article draws comparisons between an earlier version of the US engineering accreditation standards and the ACRL *Information Literacy Competency Standards for Higher Education*. The present study builds on the work of these pioneers by considering the most recent engineering accreditation standards from four jurisdictions in order to identify trends, map to specific ACRL information literacy competencies, and present the findings in a manner and venue that may have a real impact on institutions preparing for accreditation.

This purpose of this article, then, is to explore whether and how information skills are reflected in engineering program accreditation standards. Its goals are twofold:

1. Map the connections between requirements outlined in engineering accreditation standards of four countries: Canada, the United States, the United Kingdom, and Australia, and the Association of College and Research Libraries’ Information Literacy Competency Standards for Higher Education.

2. Raise awareness of the potential for librarian/faculty collaboration in meeting engineering accreditation standards.

The need for 21st century information skills in engineering practice, combined with the importance for engineering programs of meeting accreditation requirements, suggests that it may be worthwhile to explore the potential for closer alignment between
librarians and their work with information literacy competencies to assist in meeting accreditation standards and graduating students with high level information skills.

Methodology

The present study is a content analysis of the accreditation standards for engineering programs. It analyses four major English language engineering standards. The following countries/documents were included in the analysis:

- Australia: *Accreditation criteria guidelines*, by Engineers Australia Accreditation Board
- Canada: *Accreditation criteria and procedures*, by the Canadian Engineering Accreditation Board
- UK: *The accreditation of higher education programmes: UK standard for professional engineering competence*, by Engineering Council
- US: *Criteria for accrediting engineering programs: effective for reviews during the 2012-2013 accreditation cycle*, by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology

Clearly, these are not the only English language standards in use for such purposes around the world, but they do represent accreditation standards used by a large number of programs. Additionally, these four countries are signatories of *The Washington Accord*, indicating that their engineering program accreditation requirements are substantially equivalent to those of the Accord’s fifteen full and five provision member nations (International Engineering Alliance n.d.).

The most current version of each accreditation document as of December 2012 was included in the analysis. Each document was available for free in its entirety on the web site of the accrediting agency. In some cases, these accreditation documents made
reference to further, related documents that are to be consulted during self-study preparation and site visits, but this study focused exclusively on the primary accreditation document, viewing these as the most likely to be referred to and therefore the most influential in the accreditation process. Engineering faculty and librarians may wish to include these additional documents in developing a detailed plan for their specific institution. The analysis included only accreditation criteria related to undergraduate or first degrees; criteria for graduate students, even when included in the documents under review, were not considered. Similarly, the analysis focused on general, overarching requirements, and did not include additional requirements articulated by sub-disciplines, as in the US accreditation document.

The content analysis started with a broad sweep of the accreditation documents, looking for the term “information literacy,” along with other broadly equivalent language that describes facility with using information. The goal was to identify terms used to describe this concept within the engineering profession, as well as to note any regional variations in language use.

Once this search for broad, equivalent terms was complete, the focus shifted from the word count-type approach characteristic of quantitative content analysis to a richer, qualitative content analysis in which “the researcher looks at documents more holistically” and “analyzes meanings of words and phrases” (Saunders 2011, p. 75). The analysis was “deductive category application,” wherein, “categories are predetermined along with clear definitions” (Saunders 2011, p. 75); in essence, the five standards outlined by the ACRL Information Literacy Competency Standards for Higher Education served as the categories by which the accreditation documents were analyzed. Each accreditation standard document was carefully studied and passages
Results

The analysis revealed that information skill development is included to varying degrees in each of the four accreditation documents under consideration. Only the Australian document uses the term “information literacy” in describing this skill set; the term does not appear in any of the other accreditation documents. Australia is, in fact, the only country studied whose engineering accreditation standards apply an umbrella term to describe information skills, and then go on to elaborate in a separate section devoted to the topic. Further references to these skills are also found in other sections of the document, but not elaborated to the extent that they are in the section devoted to information literacy. The accreditation documents from Canada, the United States, and the United Kingdom have references to specific skills scattered throughout, but don’t gather them under a single term. It is clear, though, that information skill development is an important part of the accreditation process in each of the countries under study, regardless of terminology used. The fact that, even in the Australian document with its discrete section on information literacy, reference to information use skills is scattered throughout the accreditation standards suggests that this skill set is a pervasive part of many aspects of engineering education and practice.

Each of the four national accreditation documents reviewed addresses at least one performance indicator for each information literacy competency (with one exception, discussed later). Of all the documents reviewed, the Australian accreditation criteria align most clearly with the ACRL Information Literacy Competency Standards for Higher Education, addressing 15 of the 22 performance indicators at least once, and in several cases multiple times. This clearly indicates that the Australian engineering
accreditation body and the library profession share similar goals with respect to student information skill development, although undoubtedly the level of detail around student competencies in the Australian document, which although not the longest in terms of page numbers devotes the most text to competencies, provides more points for comparison than some of the other accreditation standards.

The UK accreditation standards, while not as detailed as those of Australia, also include many of the information use skills outlined in the ACRL Information Literacy Competency Standards for Higher Education. Unlike Australia, there is no section in the accreditation document devoted specifically to these competencies; rather, they are distributed throughout various sections of the document. Again, this suggests that such skills are viewed as a pervasive part of engineering practice rather than an isolated skill set.

The Canadian and American accreditation documents are much briefer than those of Australia and the United Kingdom. The United States has a comprehensive institutional accreditation process, administered through six regional accreditation bodies, which may to some degree account for the brevity of their document. These regional accreditation bodies have institution-wide requirements for general student outcomes, so inclusion of these in accreditation guidelines for specific disciplines may be regarded as redundant, since engineering programs are typically offered under the auspices of a regionally-accredited university. The accreditation criteria of each of the six regions address information literacy to varying degrees (Saunders 2007) with one, the Middle States Association of College and Schools, going so far as to adopt the five ACRL information literacy competency standards verbatim (Middle States Association 2006). Thus, while the US engineering accreditation criteria do address four of the five
standards, their relative brevity in doing so may be partially due to institutional accreditation requirements.

The Canadian engineering accreditation document, although lengthy as it covers not only student outcomes but also accreditation procedures, lays out “graduate attributes” very broadly and briefly. The document does include content that maps to each of the five information literacy standards but brevity of the student outcomes section results in relatively few mentions and no elaboration. Unlike many other countries, Canada does not have a comprehensive national or regional process for accrediting postsecondary institutions, so these requirements stand alone unless complemented by institution-specific policies. On a national level, then, the differences in how the four documents treat information use skills is not so much in intent and substance, but in the degree of detail and this is a reflection of the characteristics of the documents as whole.

Closer analysis of the attention paid to the content of each of the five information literacy competency standards in the accreditation documents provides further insight into emerging themes and national variations. Standard one of the ACRL *Information Literacy Competency Standards for Higher Education* requires that students be able to determine the nature and extent of their information need. This competency is addressed to some extent by each of the four accreditation documents reviewed. All four speak to the importance of recognizing when information is needed and formulating answerable questions. This ability is articulated in the accreditation documents in broad terms, suggesting that the need for information may relate to traditional information sources (journal articles, standards, patents, etc.) but need not be limited to these sources. The second performance indicator, requiring knowledge of
types of potential information sources, is addressed by the UK and Australian standards. This seems particularly pertinent given the modern information environment’s proliferation of sources.

<insert Table 2>

Standard two focuses on the ability to access needed information effectively and efficiently. This is the information skill most traditionally associated with libraries and their instructional programs although, as the *Information Literacy Competency Standards for Higher Education* in their entirety reveal, it is only one of several abilities required of an information literate individual. Performance indicator one, which requires the selection of appropriate investigate methods, is addressed in all but the Canadian accreditation document, with particularly heavy emphasis in the Australian accreditation criteria. The UK document uses the term “information retrieval skills” which, while perhaps closest to performance indicator three’s ability to retrieve documents from online and other sources, is in fact fairly broad and encompasses several of the performance indicators falling under this standard.

<insert Table 3>

Standard three, which focuses on the critical evaluation of information and its integration into one’s knowledge base, is the standard whose performance indicators are most frequently reflected in the accreditation documents. This is hardly surprising, given the overwhelming emphasis in the educational literature about the need to develop critical thinking skills in students (McPeck 1981, Paul 1989, Flores et al. 2010, among many others). While evaluating information is not synonymous with critical thinking, it is a manifestation of the capacity for critical thought (Gibson 1995). What is curious however is that, in the only instance of one of the four accreditation documents failing to align with the five standards, the American accreditation document addresses
neither evaluation of information, nor the broader concept of critical thinking. The Canadian document connects with the importance of synthesizing information to solve problems rather than the evaluation-related performance indicators. Only the Australian and British accreditation requirements refer to the need to evaluate information, with the Australian document speaking broadly about the importance of the ability to evaluate information, and the British document more specifically highlighting evaluation of “current research” and “advanced scholarship,” the implied focus of ACRL Standard three.

<insert Table 4>

Standard four addresses the ability to apply and use information to meet specific needs. The UK and Australian standards connect directly with the first performance indicator’s requirement that students should be able to apply information retrieved for the purposes of creating and communicating knowledge. The Australian accreditation criteria go a step further and add an attitudinal component, requiring that students “develop a propensity” for this practice; in essence they seek a disposition towards inquiry. Each of the four accreditation documents engages with performance indicator three, which requires students to communicate their work with others. The accreditation documents expand considerably on the ACRL’s broad statement by including requirements for communication in all mediums, including written and oral presentations (Canada and Australia), the ability to communicate to all audiences, both professional and general (UK), and the need for technological competence to facilitate this communication (Australia).

<insert Table 5>

Standard five deals with the need to understand the economic, legal, and social issues surrounding the use of information and to use information ethically and legally.
All four of the accreditation criteria reviewed connect with this standard through general statements about the importance of ethical and professional practice. In some respects, it is surprising that the accreditation standards do not further elaborate on this in the context of information use, given the high number of plagiarism cases plaguing academia and the workplace (McCabe and Trevino 1996, Nonis and Swift 2001). However, the concept of integrity is at least present in all four documents and it perhaps makes sense that it receives more attention in the ACRL *Information Literacy Competency Standards for Higher Education* than the accreditation documents, given the exclusive information skills focus of the ACRL standards.

One seeming disconnect that emerges between the ACRL *Information Literacy Competency Standards for Higher Education* and all four accreditation documents is the issue of lifelong learning. Each accreditation document clearly identifies this as a priority, and seems to view it as both a skill set and as an attitude or inclination towards continuous learning and professional growth. This concept is not articulated as part of the five ACRL information literacy competencies; this seems a strange omission, given the focus on an information cycle of obtaining and using new information. A blanket statement preceding the standards states that, “Information literacy is a key component of, and contributor to, lifelong learning,” suggesting that ACRL views lifelong learning as a larger concept rather than a constituent part of information literacy that would be appropriate for inclusion in a standard. Yet, instilling a recognition of the ongoing, lifelong need to seek out information seems not unimportant in the context of the rest of the information literacy standards. A lesser known, and much less frequently cited, attempt to modify the information literacy standards for engineering and science fields, *Information Literacy Standards for Science and Engineering/Technology*, did attempt to rectify this omission. This document differs little from the *Information Literacy*
“Competency Standards for Higher Education” except in standard five, which states that, “information literacy is an ongoing process and an important component of lifelong learning and recognizes the need to keep current regarding new developments in his or her field” (ALA/ACRL/STS Task Force 2006). Perhaps future versions of the Information Literacy Competency Standards for Higher Education will more overtly address this in order to better align with accreditation documents in engineering and other fields, and to ensure that students will continue to learn throughout their professional lives.

**Conclusion**

Meyer and Land write that, “Language itself, as used within any academic discipline, can be another source of conceptual troublesomeness . . . . The discursive practices of a given community may render previously ‘familiar’ concepts strange and subsequently conceptually difficult” (2006, p. 14). This observation seems to hold true for conceptions of information use skills held by the engineering and library & information science professions. There is little evidence in the literature of either profession to suggest that cooperation is occurring in efforts to meet and report on information use skills in order to meet accreditation requirements. And yet, as this study has shown, despite differences in language and terminology (Meyer and Land’s “discursive practices”), the ACRL Information Literacy Competency Standards for Higher Education and the four engineering accreditation documents reviewed reveal a shared purpose and recognition of the importance of information use skills that is independent of the terminology used to describe them.

The accreditation of an engineering program is undoubtedly primarily the responsibility of the Dean (or equivalent) and the engineering faculty members, as they are most intimately acquainted with the nature of the program under study. The
accreditation documents themselves, though, do suggest (and in some cases mandate) that others are to be consulted during preparation of the self-study report and are to meet with the site visit team. Librarians are already often included in this process, but are typically asked to provide information about inputs—collection size, budgets, etc.—rather than their contribution to outputs like student learning outcomes. This request for input measures seems inconsistent with the spirit of the rest of the accreditation process which, in recent years, has shifted to focus on outcome measures. It is also at odds with the library profession’s emphasis on student outcomes, as evidenced in the ACRL *Information Literacy Competency Standards for Higher Education*. Reorienting the librarian’s involvement in the engineering accreditation process and the cycle of forward planning that should emerge from accreditation has the potential to strengthen student outcomes in information use skills.

The present study was intended as an initial exploration of the overlap in aspirations between engineering accreditation documents and library and information science’s concept of information literacy. There are many potential avenues for future study that could enrich and build on this work. A logical next step would be to analyze the self-study documents prepared by engineering units seeking accreditation to better understand how they are meeting and reporting on information skill development requirements, as well as to identify related gaps or shortfalls; such a study could employ a methodology similar to that used by Saunders (2011) in her analysis of the institutional self-study documents prepared for the US regional accreditation process. It would also be useful to survey both engineering employers and faculty members to gauge their responses to the information use skills outlined in their national accreditation requirements and the ACRL *Information Literacy Competency Standards for Higher Education*. There is also a need for further study of recently graduated
engineers in the workplace, in order to understand how they fare in meeting the
information demands of their daily work, and whether there are ways that university can
better prepare them to meet these. Finally, as partnerships between engineering
programs and librarians develop with the goal of meeting accreditation requirements,
these should be reported so as to provide models for wider adoption.

Smith (2002) wrote that “more than anything, [accreditation] is a means for
organizing a conversation among the faculty and other professionals responsible for an
academic program” (p. 31). Ultimately, it is hoped that this paper starts a conversation
among engineering faculty and librarians that leads to cooperation and enhanced
information use skills among engineering students.

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Table 1. Standard one: Determines the nature and extent of the information needed.

Table 2. Standard two: Accesses needed information effectively and efficiently.

Table 3. Standard three: Evaluates information and its sources critically and incorporates selected information into his or her knowledge base and value system.

Table 4. Standard four: Individually or as a member of a group, uses information effectively to accomplish a specific purpose.

Table 5. Standard five: Understands many of the economic, legal, and social issues surrounding the use of information and accesses and uses information ethically and legally.