Work in Progress - Lifelong Learning and Information Retrieval Practices in Materials Science and Engineering

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Abstract - This paper describes an exploratory case-study of information retrieval practices in one specific discipline, materials science and engineering. In particular, we examine how do the information retrieval practices of practicing professionals compare to those of undergraduate seniors? The preliminary findings provide provisional insights into the concrete retrieval skills students have and need, and suggest teaching practices (particularly in design courses) faculty can employ to help students build such skills.

Index Terms – Lifelong learning, information literacy

INTRODUCTION

Shuman et al. have identified broad attributes associated with lifelong learning, which include the ability to “identify, retrieve, and organize information”[1]. As both the available information and the means to retrieve it proliferate exponentially in the knowledge economy, students and faculty alike need to increasingly attend to explicit strategies associated with this process.

While several studies of information literacy and lifelong learning have addressed the needs of engineering professionals briefly [2-10], few have provided detailed examinations of the kinds of learning today’s global engineers require, or the methods available and useful for developing that learning. To address this gap, the present study provides a preliminary exploration of the information retrieval strategies of professionals and students to identify key gaps and needs, and suggest teaching opportunities.

METHOD

To identify current information retrieval practices in materials science and engineering, this exploratory qualitative included interviews with three practicing professionals and interviews with three capstone design students. Additional data includes information retrieval strategies evidenced in capstone design project proposals and reports. Interviews were transcribed and are being analyzed to identify key themes. Design documents are being examined to identify sources of information.

PRELIMINARY FINDINGS

Professional Interviews

Each of the professionals developed similar methods of acquiring and analyzing information, though they varied in terms of which methods they relied on most heavily. Reading was, not surprisingly, a primary mode of learning. Reading materials included books and trade/research journals, as well as, government calls for papers and related research resources. Interview subjects read both on paper and online; the decision to read online or rely on print media typically balanced between higher comfort of the user interface (books) and ease accessing to up-to-date information (internet).

Importantly, however, the professionals interviewed also relied heavily on personal contacts, including employees, colleagues, and experts in other organization. In general, the professionals reported lower use of internet tools because they were able to supplement online information retrieval with an extensive network of interpersonal contacts. The professionals often found it more efficient to ask colleagues adept at internet search and retrieval to locate and report on information rather than spend time searching themselves. These professionals showed no aversion to or lack of familiarity with internet search tools such as Google, but rather, found searches less effective uses of their time. In addition, professionals often needed information that was secured behind institutional passwords; in such cases, relying on personal contacts and professional networks is critical to locating necessary information.

Finally, the professionals interviewed also cited ongoing workshops and short courses offered by or paid for by their organizations. Such short courses typically focused on professional (e.g. management, team dynamics) rather than technical issues.

Student Interviews

What was noticeable about the students was not so much what they were doing, but what else they wanted. All the students interviewed were highly driven, but all felt they faced particular impediments to fully realizing their potential in the design project they were involved in. Most often, they desired either a particular laboratory skill they
had not learned in school or a more in-depth understanding of a critical concept. The skills each student desired, however, varied significantly based on the projects they were engaged in. They needed to gain facility with highly specialized skills as well as understand a broad set of technical areas applicable to their chosen field.

The interview subjects participate in a curriculum that includes eight required laboratory courses. Most students also have summer internship(s) and/or co-op opportunities that help supplement classroom lectures. Still, most these are short-term experiences that offer little in the way of specialization. For many students, the senior design project, spanning two semesters, is the biggest and most open-ended project they will work on during their time as an undergraduate.

Those interviewed found their capstone projects both enlightening and frustrating – enlightening because of the connections between classroom learning and project execution; frustrating because of the amount of information they felt they lacked, in terms of both academic knowledge and experimental/laboratory skills. The interviewees all wished for more time to work on the intricacies of their project and learn more about the work at hand.

When searching for new information, students tended to rely on general internet sites, online and, to a lesser extent, offline library resources, as well as direct guidance from their advisors. Often students found reading professional papers one of the most frustrating parts of their work because the papers seemed to speak to a more advanced audience than individuals with an undergraduate engineering degree. They relied heavily on their advisors and graduate students; far less frequently, they sought advice from outside experts.

More generally, the students spoke about domains of learning they believed they would need to pursue in the future. In part because of a significant professional development program focused on leadership, communication, collaboration, and globalization, all the students noted the need for interpersonal writing, speaking, and presenting skills that will be of use when working with groups of people with varying backgrounds. However, they did not identify the need for foreign languages, finance, intellectual property law or any other number of potentially helpful skills they were not exposed to in the curriculum.

**SUGGESTIONS FOR TEACHING PRACTICES**

Many universities now include information literacy as a critical component of the curriculum, and students in K-12 are already learning skills about locating and evaluating online resources. Project-centered and problem-based learning experiences are ideally suited to helping students develop and use the kinds of information retrieval skills necessary in the workplace.

The interviews with practicing professionals, however, suggest that today’s engineers also need to be adept at developing and using professional networks. Rather than trusting that all information is available online (as today’s digital natives often believe), these students also need to learn to develop interpersonal skills and the ability to locate and engage experts across a wide range of fields to supplement print and online information.

Approaches to teaching that emphasize lifelong learning can, of course, be challenging for both students and faculty. Ambiguity in the curriculum can be unsettling. Lifelong learners will have to learn to make decisions that are based on incomplete and inaccurate information that is layered with politics. Yet as information proliferates exponentially and workplaces change with increasing rapidity, individuals are increasingly responsible for managing lifelong learning skills. To do so effectively, students need to become self-directed learners with help, support and guidance from coaches, mentors, colleagues and fellow networkers.

**REFERENCES**


