Observations on the Use of Library Information Systems by Chemical Engineering Undergraduates

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Chemical engineering is an increasingly multidisciplinary field. For example: the very fact that chemical engineering is clearly central in nanotechnology developments requires future chemical engineers to be adept with acquiring new knowledge. The National Research Council in their report "Beyond the Molecular Frontier: Challenges for Chemistry and Chemical Engineers" has discussed future challenges for our field. In order for graduates of our chemical engineering programs to be successful in these and all the other ever-changing arenas of chemical engineering, they must be able to learn about related fields expeditiously. Understanding libraries, and academic libraries in particular, is essential to student success in this endeavor. As noted in Tenopir and King's (2004) book, *Communication Patterns of Engineers*, engineers seek information primarily through formal and informal personal communications. For this method of information seeking to be successful, *someone* must have, or know where to quickly find, the desired information. How much more desirable will be the engineer that knows how to find the *right* information needed to move a project forward? In academia, we assume students at the MS and PhD level generally have developed the ability to utilize library resources. We are focusing on undergraduates in this discussion as we fundamentally believe that with the changing demand on the engineering workforce and the advent of the internet, more emphasis needs to be placed on the utilization of library resources at a lower academic level.

Libraries are increasingly complex systems serving as gateways to myriad pieces and types of information that can be useful to undergraduate chemical engineering students, if they understand how to navigate those systems. For example, The Valley Library at Oregon State University contains 1.4 million volumes, 14,000 serials (some in print and some electronically available) and more than 500,000 maps and government documents. In addition we subscribe to over 140 different databases providing a wide variety of content on numerous subjects. Two of these databases, SciFinder Scholar and Engineering Index (Compendex), are particularly useful for chemical engineering students. SciFinder Scholar provides integrated electronic searching of Chemical Abstracts (CA), the CAS Registry file and CASReact. CA contains more than 23 million abstracts of journal articles, patents, and more from 1907 to present. CAS

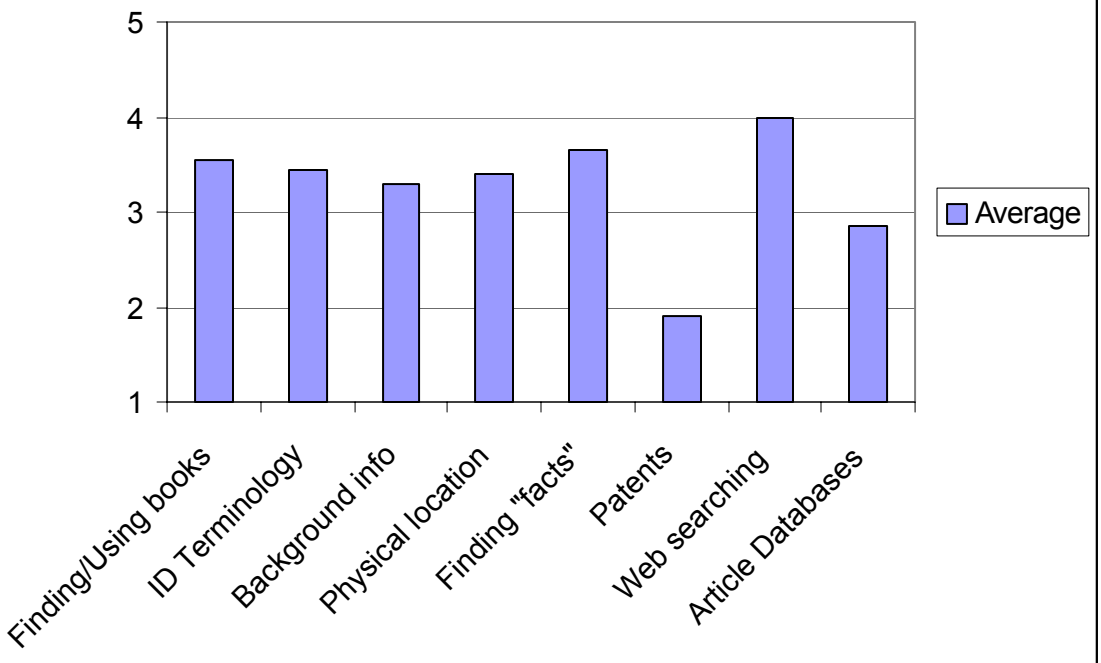
Registry contains more than 23 million substance records and 46 million sequences. CASReact contains information for over 8 million single- and multi-step reactions derived from journals and patents. Engineering Index covers all areas of engineering and contains 7.5 million records referencing 5,000 engineering journals and conference materials dating from 1969. And this does not even touch the information available on the World Wide Web, some of which might be true!

Finding the best information to solve an engineering problem involves a recursive process of *data mining* and *refining*, that is, finding the relevant information available and then extracting the really useful bits and eliminating the less desirable results. This process requires knowledge of information systems as well as knowledge of chemical engineering. *Relevance* and *usefulness* can only be determined from within the context of the information needed and knowledge of the discipline into which it fits.

We decided to introduce students to this mining and refining process in CHE 415 Chemical Engineering Laboratory, a senior writing intensive course. In this course, students are assigned several chemical engineering problems that they must solve. Each of these problems requires students to identify methods and data available in the literature and to apply this information to solving the current problem. Early in the course, we gave the students a short assessment prior to their attendance at an instruction session in the library. This assessment was designed to gauge their familiarity with basic library systems and whether they had ever used some resources we considered important for them to know. Students were asked to rate their fluency on a scale of 1 = no experience to 5 = expert with each of the following basic systems:

- Using the library catalog to find books
- Identifying appropriate terminology for effective searches
- Finding background information
- Physically locating materials
- Finding chemical facts, e.g. property information, spectra, reaction data, etc.
- Finding patents
- Finding useful information using Web search engines
- Using article databases to identify relevant journal articles

Figure 1: Student Assessment of Fluency
1 = No experience; 5 = Expert



Our results for this "pre-instruction test" indicated the students considered themselves least fluent with finding patents (mean = 1.9) and using article databases (mean 2.85). With few exceptions, even those students who considered themselves fluent in using article databases could not name the databases they had used. It was also clear that students did not understand the distinctions between the library's various search systems, even if they considered themselves fairly skilled.

In addition, they were asked which they had used and what they found among the following:

- *Kirk Othmer Encyclopedia of Chemical Technology*
- *Beilstein* and/or *Gmelin*
- *CASSI* (Chemical Abstracts Serial Source Index)
- *Perry's Handbook of Chemical Engineering*
- *CRC Handbook of Chemistry and Physics*

Table 1: Student Use of Key Resources

Name of Resource	Student Awareness
Kirk Othmer Encyclopedia of Chemical Technology	Never used
Beilstein and/or *Gmelin*	Never used

CASSI (Chemical Abstracts Serial Source Index)	Never used
Perry's Handbook of Chemical Engineering	95% had used
CRC Handbook of Chemistry and Physics	45% had used

Of the important resources we wanted them to know, none of the students had knowingly used *Kirk Othmer*, *Beilstein*/*Gmelin* or *CASSI*. Only 45% of the students had used (or remembered using) the *CRC Handbook of Chemistry and Physics*. Thankfully, nearly all students had used and were familiar with *Perry's Handbook*.

Following the instruction session in the library, several students commented about how they wished they had had a similar presentation the previous quarter as part of CHE 414. Our plans are to provide this presentation in the coming year as part of CHE 414. The goal is to make finding information from the literature a useful part of the project rather than a barrier to creative thinking and problem solving.

We would like to find out if our suspicions from this small pilot population about resources familiar to students are confirmed at other chemical engineering departments. To expand our population of undergraduates, we are providing you with a packet* with a similar questionnaire to the one used by our students and ask you to administer it to your senior chemical engineering students. Send us your results and we will compile them and report to all who participate in the study.

*If you are interested in receiving a packet to use with your students, contact either of the presenters at the above addresses.

References:

Tenopir, Carol and Donald W. King, 2004, *Communication Patterns of Engineers*, Hoboken, NJ : John Wiley.

"SciFinder Scholar Content at a Glance," http://www.cas.org/SCIFINDER/SCHOLAR/ataglance.html. Document viewed 2 September 2004.

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