Survey of Library Services at *Engineering News Record*'s Top 500 Design Firms: Implications for Engineering Education

John B. Napp
University Libraries, The University of Toledo

ABSTRACT

This paper reports on the findings of a national survey of the library services available at *Engineering News Record*'s Top 500 Designs Firms. In mid-October 2002 a survey was mailed to all 500 firms. The survey was in two parts. One part was to be completed by a principal in the firm. The second part was to be completed by the degreed librarian (holding a Masters in Library Science or its equivalent) if the firm employed one. The return rate was 21.8% (n=109). The findings indicated that 74.4% of responding design firms do not employ a degreed librarian. In 79% of those firms engineers get information on their own. This situation, along with other results to be presented, seems to suggest that information literacy instruction should be included in the engineering curriculum.

Keywords: Information literacy, libraries

I. INTRODUCTION AND BACKGROUND

There is considerable literature on engineering libraries and librarianship in the academic setting. There is also considerable literature on the information-seeking behavior of engineers. No study, to date, has looked in detail at librarians in consulting engineering firms.

Leckie and Fullerton surveyed science and engineering faculty at two large Canadian universities for their perceptions of student information literacy skills [1]. The authors also questioned their subjects about their own pedagogical practices regarding those skills. The authors point out that faculty recognize the need and value of such instruction and offer ideas for providing it.

Ward surveyed 27 "Principal Engineers" at Ricardo Consulting Engineers in Shoreham-by-the Sea in West Sussex, England [2]. While the author discusses the ways in which engineers at one firm obtain information, the role of the librarian is not dealt with in detail. The engineers used a combination of a homegrown database, networking with internal peers, and departmental and corporate library resources. This survey was undertaken in 1996-1997 prior to Internet access at the firm, so information-gathering behavior may be substantially different today.

Hertzum and Pejtersen interviewed engineers at two Danish product development firms [3]. They found that the engineers used published documents as well as "networks of informed people" to meet their information needs.

Rodrigues explored the expectations the corporate world has of new engineers [4]. The author found that new engineers are expected to be able to locate and manage information resources on their own. He further states that the skills needed to do these tasks are best learned as part of the engineering education.

Brown and Krumholz sought to measure library/information literacy among students in a senior-level geomicrobiology class [5]. The authors had the students read and discuss articles the students located through a literature search. The students improved their library skills over the course of the study by using a wider variety of library resources. They also were able to evaluate information sources more effectively.

Schwarzwalder examined how technology has changed the corporate engineering library [6]. The Internet has changed the way information is delivered and sought. Intranets have changed the way engineers communicate, and also have provided new ways of delivering information from librarians to engineers. This article does not discuss the types of information engineers seek or whether firms have degreed librarians.

Smalley, an academic librarian in California, took temporary jobs in the Silicon Valley to determine information literacy needs in the workplace [7]. The observations she made which are most relevant to the current study are "Employees know that they need good information…" and "…Information Age skills are critical to success – not only in making a life, but also in making a living."

There is a final classification of literature that should be considered. There are numerous guides and directories to information sources for engineers. Lord wrote a recent example of this type of publication [8]. As an introduction to engineering resources it serves well. However, as with many books in the sciences, such books are out of date almost the moment they are published. Internet resources move or disappear, and new resources come out and supersede what is listed in guidebooks. Another problem with resources of this type is that they are only a listing of what is available. Knowing which resource is best for which type of question necessitates being information literate.

II. METHODOLOGY

For the purposes of this study, the term "degreed librarian" refers to a person with a Masters in Library Science (MLS) or its equivalent. This is the usual minimum qualification for librarians in the United States and Canada. Some degreed librarians have an additional Masters degree in a subject area. Engineering librarians, especially those in academic settings, may have a degree in engineering in addition to their library degree. A librarian could provide quality services without such a degree. For this study only degreed librarians were asked to participate since having the degree provides a common background in terms of training. It was hoped that requiring the degree would eliminate from the study those who only have library duties as a part of their job, while primarily being responsible for non-library work.

A "principal" is often an owner of the firm. They are always in senior management positions and are in charge of projects. For this study, it was specified that a principal complete a survey since a person in such a position would be more likely to have knowledge about the firm as a whole than would a junior engineer.

Two survey instruments were developed: one for principals and one for librarians (see Appendix). The instructions directed the principals to complete their survey, and if they employed a degreed librarian, that person was to complete the other survey. Principals were asked eleven questions and librarians were asked seven. It was felt that a longer survey, while perhaps providing more detailed information, might also be seen as

too long by busy executives, thus negatively affecting the return rate. Therefore the surveys were limited to the front and back of one sheet.   Two questions appeared on both surveys: "What type of information is most often needed"/"What type of information are you most often asked to find?" and "What database(s) does your firm subscribe to?" The survey was pre-tested at a local consulting engineering firm that was not part of the sample group.

A mailing list of the *Engineering News Record* (*ENR*) Top 500 Design Firms was purchased with funding from the College of Engineering of The University of Toledo. This group was used for the study because the most profitable firms in the United States would be most likely to have a full complement of services such as a library staffed by a Masters degreed librarian. The list was also chosen for its manageable size and to speed up the preparation of the mailing.

The surveys were sent by U.S. Mail to the heads of all 500 firms on the mailing list. The purchased list did not include e-mail addresses. Firms are included on the *ENR* Top 500 Design Firms list based upon revenue for design services performed in millions of dollars. This could be considered the engineering equivalent of the *Fortune* 500 List.

The return rate was 21.8% or 109 responses. To determine the reasons for non-participation, in order to rule out a problem with the survey instrument, follow-up telephone calls to a random sample of the firms were made. Some firms had a policy of not participating in surveys unless they directly related to engineering, while others reported being extremely busy. The response rate for principals was calculated based on the 109 responses received from the survey for principals.   The response rate for librarians was calculated based on the 35 responses received from the survey for librarians (see Appendix).

III. SURVEY RESULTS

The firms ranged in size from 95-35,000 employees, including the employees at all the offices of firms with more than one location. Respondents were allowed to self-define the term "library".   Indicating that they had a library were 81.6% of the respondents.

Of all the respondents 25.6% have a librarian and 20.1% have a librarian with an MLS. In 11.9% of all the firms responding their librarian was required to have an MLS. Only 3.6% of respondents outsource library research.

The size of the firm correlated positively with whether or not it had a degreed librarian. However, there was a firm with 100 employees with a degreed librarian and one with 7,000 employees that did not have one. A firm with 3,500 employees volunteered that they employed four degreed librarians. Firms with degreed librarians ranged in size from 100–23,000 employees, while those without librarians ranged in size from 250–7,000 employees. The average number of employees at a firm with a degreed librarian was 2,115. The average number of employees at a firm without a librarian was 801. Firms with non-degreed librarians averaged 549 employees. The average for firms with a degreed librarian may be somewhat inflated because there was one firm with 23,000 employees. Most firms in this group had fewer than 1,000 employees.

Principals who said they did not have a librarian because their firm did not need one were compared with those who said that new engineers could not find needed information without assistance. An overlap of 20.1% was found between the two groups.

Some principals went into more detail about why they didn't have a librarian. Five examples are listed here:
1. "Five offices negate value of librarian."
2. "Cannot find one."
3. "Our library is Web-driven – we use IT staff & technical writers to populate it and keep it evergreen."
4. "You don't understand our business – we do not have a need for any extensive research. We do application engineering and cutting edge work."
5. "Multi-task roles by administrative support staff fills this need."

Principals who indicated that there was not a librarian on-site were asked how needed information is obtained. Engineers search for information on their own in 79% of firms without librarians. A secretary or other non-engineer has research as part of their work assignment in 44.4% of those firms. In 30.8% of those firms, local college, university or public libraries are utilized (figure 1).The surveys asked which databases were available at the firms. At 86.2% of the firms, no databases were available. Dialog was available at 7.3% of the firms, LexisNexis was available at 9.2% of the firms, and STN was available at .09% (figure 2). The percentages add up to more than 100% because some firms subscribe to more than one database. Technically one of these "databases" is an aggregator, one is a platform, and the other is a database. To make those distinctions to an audience consisting primarily of non-librarians seemed unnecessarily cumbersome. These databases were chosen for this survey based upon the author's experience and discussions with librarians in corporate engineering settings. Compendex and Inspec are widely used in academic libraries but they are limited to engineering and science. Often the information needs of engineering firms are for materials outside of the scope of those databases. Compendex or INSPEC alone would not meet the needs of a firm, requiring them to subscribe to another database. By contrast, Dialog (the most popular database in this study), provides access to engineering, business and science information.

Figure 1. How information is obtained in firms without a librarian

Figure 2. Databases available
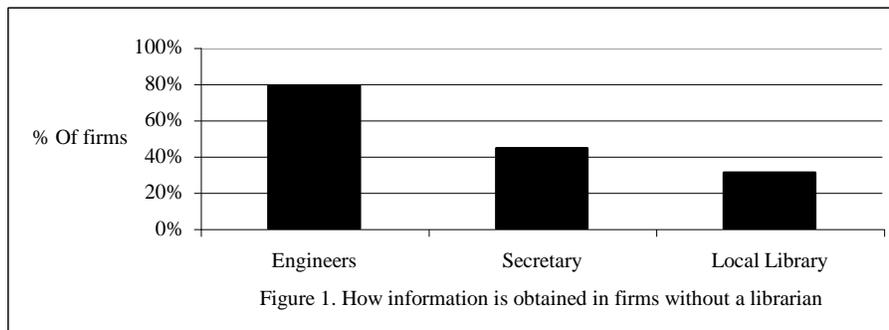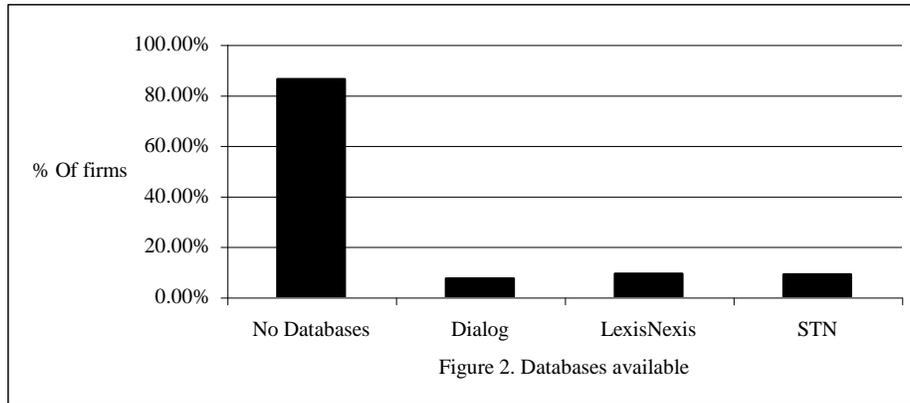
IV. DISCUSSION

The Association of College and Research Libraries defines information literacy as:

> … a set of abilities requiring individuals to 'recognize when information is needed and have the ability to locate, evaluate, and use effectively the needed information [9].

Even with the limited information resources available to engineers at many firms, newly hired engineers should be able to assess that they need information and then seek it out from appropriate sources. The author is not suggesting that students upon graduation should know how to locate every type of information they are likely to need as engineers. One proposal would be for engineering faculty and librarians to agree upon a desired level of competency.

Of the firms responding to this survey, 86.2% did not subscribe to any databases. Engineers at these firms need to be more creative in locating information than engineers at the 13.8% of firms with some database access. There was no librarian of any type at 74.4% of firms in this study. This was a study of only the most profitable design firms in the United States. It is likely that a study of design firms in general would show a smaller percentage of firms that employ a librarian. Of the firms without a librarian, 30.8% made use of local libraries. Using area resources is an economical solution for firms without librarians or for those without database access. However, engineers at firms without database access are more likely to be successful in locating what they need if they have well-developed information literacy skills.

Engineering students are taught how to control costs in the design process. Employers will expect them to be able to do this, as will clients. Part of controlling the costs of a design project is controlling the cost of finding needed information. If low information literacy skills cause an engineer to take a long time to locate needed information, the client is charged unnecessarily.

The Rodrigues article makes the point that the best time for new engineers to learn needed information literacy skills is while they are still in college [4]. During the college experience, students have access to libraries with more electronic and print resources than are available in engineering firms. They also have the opportunity to

receive instruction in the use of these resources from librarians. This study confirms his conclusion that new engineers are expected to be able to locate and use information on their own. If, as students, these new engineers were exposed to the breadth of information resources available, they would be more likely to know where to look for needed information. If students become employed by firms with limited access to research tools, knowing about a variety of resources would increase their likelihood of finding needed information.

The Smalley article reported on a study of Silicon Valley workers [7]. Her research found that knowing how to locate and use information is valued in the workplace. The current study supports that observation.

Nerz and Weiner co-authored an article titled *Information Competencies: A Strategic Approach* [10]. This was the inspiration for an assignment the author developed that asks students to imagine they are in an engineering firm as the leader of a design team. The course instructor could vary the project being designed from class to class or within a class. They are told that the first step in the design project will involve gathering information on the subject of their project. The students are given an example of a Pathfinder for general engineering resources and are asked to develop one for their project. Such an assignment has two benefits. It helps the students become familiar with library resources that they can use in their studies as well as in their careers. It also subtly gives the message that as working engineers they will need to use library skills and resources beyond Yahoo and Google. This assignment is also easily adaptable to different engineering disciplines and courses.

There are other methods for teaching engineering students the value of information literacy skills. One involves engineering faculty working together with librarians to develop course-specific assignments or curriculum-based instruction [11][12][13][14]. In curriculum-based instruction, information literacy is taught throughout the undergraduate program. Ideally, the instruction fits seamlessly, so the student is unaware that the skills are being taught. The skills are merely a part of what is being learned in their courses along with thermodynamics, technical writing, etc.

Information literacy and the accreditation of engineering programs is another issue to be considered. While not mentioned specifically in the ABET Engineering Criteria, two sections of Criteria 3 are suggestive of information literacy skills.

The ABET Engineering Criteria for 2003-2004 require students to be willing and able to engage in lifelong learning [15]. According to Criterion 3, section (i) students will need information literacy skills to locate and use the resources for lifelong learning. The skills they will need to have can be best learned while they are still in college. As students, they have the opportunity to become information literate as part of their engineering coursework. They have access to more sources than they will have at consulting engineering firms. They also have access to librarians who can assist them in becoming more information literate.

It will also be important for librarians and teaching faculty to help students learn how they can locate information using the limited tools they will likely have available on the job. Compendex, Dialog and Inspec are excellent tools, but unless they are working in a community with a college or public library with those resources, it is unlikely that their firm will have access to them.

In ABET Engineering Criteria 3, section (k), engineering graduates are also required to use "…the techniques, skills, and modern engineering tools necessary for engineering practice." This requirement could include the ability to locate and utilize needed information. The challenge will be to convince engineering students that, as working engineers, they will be expected to have those skills and in fact will need them to succeed in their careers.

The 20.1% overlap of firms without degreed librarians and those where principals felt new engineers cannot find needed information without assistance was an unexpected finding. One possible explanation is that senior engineers provide assistance to the new engineers in those firms. Without further study it is impossible to know the actual reason or reasons for what appears to be an inconsistency.

V. CONCLUSIONS

1. Most consulting engineering firms do not have librarians. In this study, out of 109 firms responding there were only 25.6% with a librarian. While larger firms tend to be more likely to have librarians, this is not always the case.
2. The firms that do have a librarian do not always employ a degreed librarian. In this study, 20.1% of firms responding employed a librarian with a Masters of Library Science degree or its equivalent.
3. The person serving in the role of librarian may have primary job assignments outside of the library making them less available for research assistance than engineers might find desirable. This person might be the receptionist or a technician and have little or no training in librarianship. Some of the librarians who lack a formal degree may have many years of experience and may be skilled at locating information, but that would be highly variable. The author did not ask about the full-time or part-time status of the librarians in the survey, but a few did indicate that they worked part-time. This would certainly limit their availability and would require more self-sufficiency among engineers.
4. Many principals in such firms believe that new engineers can find needed information on their own. This means that the new engineer will be expected to be able to locate and use needed information on their own.
5. The databases engineering students may be used to having access to are generally not available at engineering firms. Of firms responding, 86.2% have no database access. Engineering students need to learn how to search for information using the limited resources that most firms will have available. They can also learn to make use of the resources local academic and public libraries provide.

The information resources available to most engineers working in consulting design firms are quite limited. There is also an expectation at many of these firms that new engineers will be able to find needed information on their own. One way for students to acquire the high level of competency necessary to do this is for information literacy instruction to be integrated into the engineering curriculum.

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APPENDIX

These are the survey questions that were used in this study. In the mailings that were sent to firms each survey was printed on the front and back of one sheet of paper. The responses received for each choice are provided here as well.

> **To be completed by a Principal in the firm.**

1.   Does your firm have a library?

    89 - Yes   11 - No

2.   Does your firm have a degreed (Masters of Library Science or equivalent) librarian on-site (someone for whom this is their primary job)?

    28 - Yes (If yes, proceed to question 7)   72 - No

3.   Is the reason you do not have a librarian on-site…

    12 - Financial   55 - Because our firm does not need one

    13 - Other

4.   If you do not have a librarian on-site, do you outsource library-type research?

    4 - Yes   96 - No

5.   If you do not have a librarian on-site and are not outsourcing those function, how is needed information obtained?

    64 - Engineers get what they need on their own

    36 - A secretary of other non-engineer has research as part of their work assignment

    25 - Local college, university, or public libraries are utilized

6.   If you do not have a librarian on-site, is there a catalog or database of what research material is owned by the firm to assist in accessing the materials?

    54 - Yes   46 - No

7.   What type of information is most often needed in your firm? (Check all that apply)

    98 - Regulations (OSHA, EPA, or state rules) 97 - Standards 45 - Laws

    21 - Patents or other technical data   57 - Journal articles

    49 - Company information   20 - Other

8.   What database(s) does your firm subscribe to? (Check all that apply)

    8 - Dialog   10 - LexisNexis   1 - STN

9.   Do you believe newly hired engineers are able to find needed information without assistance?

    47 - Yes   52 - No

10.   How many employees are at your location (including Principals)?

    10-2,000

11.   How many employees are in your firm at all locations total (including Principals)?

    95-35,000

To be completed by the librarian.

1.   Do you have an MLS (Master in Library Science) degree or its equivalent?

22 - Yes   13 - No

2.   Was an MLS required for your current position?

13 - Yes   22 - No

3.   What database(s) does your firm subscribe to? (Check all that apply)

11 - Dialog   7 - LexisNexis   7 - STN

4.   What type of information are you asked to find most often?

26 - Regulations (EPA or state rules)   29 - Standards   16 - Laws

7 - Patents or other technical data   27 - Journal articles

16 - Company information   15 - Other

5.   Is most of the research material available to engineers at your firm in electronic or print format?

3 - Electronic   4 - Print   27 - Both

6.   Do you provide services to more than one office? (Check all that apply)

1 – No   9 - Yes, to office(s) in this state

28 - Yes, to office(s) in multiple states

10 - Yes, to offices in other countries

7. In your position as librarian, indicate the percentage of a typical week devoted to each category: (must add up to 100%)

16.4% Cataloging

14.7% Reference

15.2% Web searching

6.8% Database searching

17% Administrative responsibilities

10% Shelving, filing loose-leaf materials

7.6% Non-library duties

9.7% Other *
*This corresponds to the number of respondents who had duties outside of the library as their primary job responsibility.

AUTHOR BIOGRAPHY

John Napp is Assistant Professor of Library Administration and Engineering Librarian at The University of Toledo. Previously he was the librarian for an environmental engineering firm in Toledo, Ohio. His research interests include engineering librarianship, and library instruction.

Address: 1024 Carlson Library, The University of Toledo, Toledo, OH 43606-3399; telephone: 419-530-2492; e-mail: john.napp@utoledo.edu

Figure 1. How information is obtained in firms without a librarian

Figure 2. Databases available