A Longitudinal Survey of the Information Seeking and Use Habits of Some Engineers

Maurita Peterson Holland and Christina Kelleher Powell

From 1978 to 1990 the College of Engineering at the University of Michigan offered "Technical Communications 490: Information Resources for Engineers" to seniors working on research projects. A follow-up study was conducted in 1993 to assess the impact of this course. Questionnaires were sent to 60 students who had taken the class and 60 students with similar characteristics who had not; the return rate for both groups was 50 percent. Although both groups of former students were very similar in their use of information resources on the job, those who had taken the Technical Communications course identified more specific resources available to them. They also rated formal sources of information, such as college and public libraries, more highly than did the respondents who had not taken the class, and spent an average of ten hours more per month searching for information and reading information. These data lead us to conclude that there is a relationship between the former students' use of information resources and their having taken Technical Communications 490. This study also revealed that many engineers have access to the tools needed for electronic information retrieval, and that while few receive formal instruction in their use, there is widespread interest in learning more.

The question of educating students in the use of information resources is no longer debated by most academic librarians. Well-established programs that run the gamut from orientation tours to discipline-integrated instruction, and from HyperCard help stacks to Mosaic homepages, are available on many college campuses. Literature abounds on every aspect of instruction within reference service. However, very little work has been done to investigate the impact of information instruction on the information-seeking habits of graduates after they have left the campus and have moved into the labor force.[1] Such a longitudinal study is reported here.

BACKGROUND

During the period 1978–90 students in the College of Engineering at the University of Michigan were offered Technical Communication 490: Information Resources for Engineers. Approximately 250 students completed the 1 to 3 credit

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course during the 12-year period. The senior-level course, available only to students who had a specific information research need such as a term paper or faculty-directed project, covered problem analysis, development of the information research plan, use of manual and online systems and services, evaluation of information, nature of the engineering literature, and organization of personal files and databases.

In order to learn what impact the course may have had on the students who took it, a survey was designed and tested on 30 graduates who were 8–12 years past graduation. After this pretest, the survey was administered to the remaining group of students who had taken the course during this period. We also sent the survey to a set of former students who had not taken the course, but who had similar characteristics. The matching points were gender, grade point average, departmental major, and national origin. Sixty surveys were sent out in each group; 31 course takers and 29 noncourse takers returned the survey.

SURVEY DATA

Career

The descriptions that the graduates gave of their current job titles could be divided into three broad categories: practicing engineers, managers of technical processes, and "other" (see table 1). For course takers, "other" included 2 CEOs/company presidents, 2 sales/marketing specialists, a research specialist, a commodities trader, and an attorney. Noncourse takers reported "other" to include 2 company presidents, a sales/marketing specialist, an investment banker, a Naval aviator, an assistant professor, and a financial analyst. A number of respondents in both categories also reported degrees beyond the bachelor of science in engineering degree (see table 2). Overall, the course takers and noncourse takers showed very similar characteristics in their career choices, progress, and attitudes.

The respondents were also asked to rank a number of factors that might contribute to building a successful career,

TABLE 1
CURRENT JOB TITLE

	Course Takers $N = 31$	Noncourse Takers $N = 29$
Working engineers	13	13
Managers	11	9
Other	7	7

TABLE 2
DEGREES EARNED BEYOND BSE

	Course Takers $N = 9$	Noncourse Takers $N = 13$
MBA	5	4
MS	3	9
JD	1	–

TABLE 3
FACTORS THAT CONTRIBUTE TO CAREER SUCCESS

	Course Takers $N = 31$	Noncourse Takers $N = 29$
Hard work	14	17
People skills	11	9
Knowing the right technical information	5	7
Keeping up-to-date about engineering	2	3
Knowing how to use the latest equipment	1	1

(Numbers do not add to 31 and 29 respectively because some responded with tied rankings.)

with choices provided in three categories: people skills (knowing the right people, relating well to people, ability to work with all types and personalities), data knowledge (knowing the right technical information, keeping up-to-date about engineering, knowing how to use the newest equipment/hardware/resources), and work ethic (meeting deadlines or successfully completing assigned projects, doing more and better work than others, accomplishing job objectives). Table 3 shows which factors were given highest ranking. Lowest ranked by members of both groups was knowing how to use the newest equipment, hardware, and re-

sources. In both groups, the responses of those who described themselves as engineers mirrored the responses of the group as a whole.

Electronic Access

Since the engineering curriculum at Michigan is heavily workstation-based and since the Technical Communications course emphasized online information access, our survey focused on the graduates' use of computers and information technology. The respondents provided data on their use of computer applications on the job (see table 4). Only one member of each group reported that he did not use a computer on the job, a person in sales/marketing and an engineer respectively.

Access to online information systems on the job was also examined. Respondents were asked whether their company provided access to such systems, which systems were available, and whether they used online information themselves (see table 5). Respondents who had taken the course showed awareness of a wide range of systems available to them at work. They cited company databases (maintenance system, job cost reporting, technical memory), Compuserve, NASA Recon, DTIC DROLS, NASA COSMIC, University of California library system (MELVYL), the Internet, CAS, PIRA and several other technical and business databases, Access EPA, Dialog, STN, TelTech, Lexis/Nexis, and Prodigy. Noncourse takers were less aware of systems availability at their companies and listed fewer files; their lists included bulletin boards, Compuserve, General Motors MATSPEC, Prodigy, Dialog, and the Internet.

TABLE 4
COMPUTER APPLICATIONS USED AT WORK

	Course Takers $N = 30$	Noncourse Takers $N = 28$
Word processing	29	27
Data processing	26	24
E-mail	14	15
CAD/CAM	10	5

TABLE 5
ACCESS TO ONLINE INFORMATION SYSTEMS AT WORK

	Course Takers $N = 30$		Noncourse Takers $N = 29$	
	Yes	No	Yes	No
Company access	17	13	11	15*
Use personally	9	22	10	19

(*Two made no reply and one was unsure.)

The ability to access online information systems at work and the number of services available that were named by the members of each group were analyzed for statistical significance.[2] Although there was no significant difference in company access to online services ($p = .199$), the difference in the number of systems that the former students identified as available at their workplace, as compared with those listed by the group who had not taken the class, was much more pronounced. While not significant at the .05 level ($p = .063$), the marked difference between two groups who have the same level of access suggests that the former students are better informed about the resources available to them. The usage of these systems, however, did not differ much from group to group.

In addition, respondents were asked about the formats in which they receive information at work (paper, electronic, or graphic/image) and the formats in which they would prefer to receive information. Two-thirds of the respondents in both categories now receive information in electronic form; two-thirds of the respondents also indicated that they would prefer to receive less paper in the future.

Information Sources

How the respondents access and receive information was also surveyed; their use of print and electronic resources, their interaction with human information providers, and the time spent on such activities are reported here.The engineering graduates were asked whether or not they maintained a personal library

TABLE 6
INFORMATION SOURCES USED AT WORK

	Course Takers $N = 31$				Noncourse Takers $N = 29$			
Personal professional library or file on the job			26				23	
	High	Med.	Low	No Response	High	Med.	Low	No Response
Own library	16	10	–	4	14	7	2	6
Word of mouth	21	5	1	4	14	5	2	8
Bulletin boards	4	1	8	17	2	6	11	10
Info utilities	2	1	10	17	4	2	11	12
E-mail	6	2	8	14	8	7	9	9
Fax	6	12	5	6	8	7	5	9
Nearby college library	9	9	4	8	4	6	10	9
Public library	8	9	4	9	1	8	12	8

at work and to rank various information sources they used on the job. While both groups demonstrated the preference for their own personal libraries and word of mouth (which has been documented in other works on engineers and information transfer), those who had taken the Technical Communications course rated formal information sources such as college and public libraries much more highly than those who had not taken the class (see table 6).[3] These differences were analyzed and found to be statistically significant; for the ranking of the usefulness of college libraries, $p = .029$, and for public libraries, $p = .009$.

The publications that the respondents reported they read to gain background information for their work were also examined. While no statistically significant difference was noted, the data did show that the majority of members of both groups read professional literature and technical material (see table 7). The course takers cited more specific titles and a somewhat wider range of sources.

The rankings given by the respondents to people in various groups, inside and outside their company, as sources they used to gain information that is directly related to the performance of their current jobs are shown in table 8. Once again, there was no statistical difference between those who had taken the course and those who had not. Personal knowledge and members of the immediate working group were most highly regarded as sources of information by all respondents. Those who had not taken the Technical Communications course rated company librarians, consultants, or sales representatives less highly than did those who had, but not at a significant level. Other outsiders, such as competitors and other informal contacts (from professional societies or old school friends), were ranked the same by both groups.

TABLE 7
PUBLICATIONS READ TO GAIN INFORMATION RELATED TO CAREER

	Course Takers $N = 25$	Noncourse Takers $N = 25$
Professional society publications	16	12
Business publications	4	8
Computing magazines	3	4
Engineering/automotive/defense/federal publications	18	13

TABLE 8
RANKING OF PEOPLE AS INFORMATION SOURCES

	Course Takers $N = 25$				Noncourse Takers $N = 25$			
	High	Med.	Low	No Response	High	Med.	Low	No Response
Personal knowledge	30	1	–	–	28	–	–	1
Immediate working group	23	7	–	1	23	4	–	2
Personal experimentation	8	14	5	3	10	10	6	3
Others in department	10	17	2	2	11	16	1	1
Others in company outside department	13	7	4	7	10	10	7	2
Competitors	7	12	8	4	9	10	5	5
Informal professional contacts outside company	10	15	3	3	9	10	6	4
Paid consultants to company	11	6	9	5	3	11	13	2
Vendors and sales representatives	13	9	6	3	7	10	10	2
Company librarian/information managers	8	7	9	7	4	9	11	5

TABLE 9
ACQUAINTANCE WITH SPECIFIC KNOWLEDGEABLE PEOPLE

	Course Takers $N = 31$		Noncourse Takers $N = 29$	
	Yes	No	Yes	No
Inside firm	20	11	22	7
Outside firm	15	16	10	19

TABLE 10
FREQUENCY OF COMMUNICATION WITH PEOPLE OUTSIDE OF FIRM

	Course Takers $N = 31$	Noncourse Takers $N = 29$
Regularly	23	15
Occasionally	4	7
Seldom	4	6
Never	0	2

Respondents were asked whether they know specific individuals, inside and outside their firms, who are knowledgeable about information resources (see table 9). The frequency of their communications with others in their field, but outside their firm, is shown in table 10. Although more course takers reported that they know individuals outside their firms whom they regard as knowledgeable sources of information, the difference between the groups was negligible. The frequency of contact with outsiders, however, was far greater for those in the group of former Technical Communications students. While the difference was not statistically significant at .05 ($p = .069$), it does seem to be worthy of note, especially as most other differences between the groups were far less significant ($p > .15$).

The average number of hours per month the graduates reported they spent looking for information, reading information, and giving information to others is shown in table 11. Among those

who had taken the Technical Communications course, estimates for hours spent seeking information ranged between 5 hours and 80 hours per month, with a mean of 22.1 hours. Among those who had not, estimates ranged between 0 and 40 hours per month, with a mean of 12 hours per month spent seeking information. The difference between the two groups' time spent searching for information was significant, with $p = .014$.

There was also a marked difference in the hours spent reading information. For the course takers, estimates again ranged between 5 hours and 80 hours per month, with a mean of 32.7 hours per month spent reading information, while the noncourse takers' estimates ranged between 1 hour and 96 hours per month, with a mean of 22.9 hours. This difference was also significant, with $p = .026$. The members of the two groups varied little, however, in the amount of time they spent giving information to others. Course takers' estimates ranged between 0 hours and 80 hours per month, with a mean of 21.9 hours per month spent giving information to others. For noncourse takers, estimates ranged between 1 hour and 100 hours per month, with a mean of 18.1 hours per month. The difference between the groups was not statistically significant in this instance.

Respondents were asked about the number and type of information resources (databases, books, inhouse technical reports, etc.) that they had created during the past three years. Although inhouse tech reports and other inhouse reports, economic and business data files, computer programs and standards were mentioned as types of material created, in fact only about 50 percent of the respondents in either group reported creating products of any type.

Additional Data Supporting Future Information Access

Respondents were asked about their use of computers beyond the workplace and also about their interest in learning more about information access. Their responses would indicate that they have both an interest in knowing more about a wide range of sources and that they have technology in place at home for such access. They also gave considerable support to any plan which would provide formal instruction in information resource use for engineering students and practitioners.

TABLE 11
TIME SPENT WITH INFORMATION RESOURCES

	Hours/Month	
	Course Takers $N = 31$	Noncourse Takers $N = 29$
Searching for information	22.1	12
Reading	32.7	22.9
Giving information to others	21.9	18.1

TABLE 12
USE OF COMMUNICATION SOFTWARE AT HOME

	Course Takers $N = 10$	Noncourse Takers $N = 14$
Prodigy/Compuserve	6	7
Bulletin boards	6	5
Dial-in to company mainframe	3	10
Dialog	2	1
Freenet/OPACs	1	–
Unspecified	5	–

Two-thirds of both groups used personal computers at home. Table 12 shows the number of those who also used communications software from home and the type of services with which they connected. While there was no statistical significance in their use of communications software for information access, the course takers used a more diverse group of information resources than the noncourse takers.

Respondents were asked what information they most wanted to learn about: access to information via personal computers or workstations, specific engineering information that would help on the job, or business or other nonengi-

TABLE 13
INFORMATION TOPICS OF INTEREST

	Course Takers $N = 29$	Noncourse Takers $N = 27$
Access to information via computer	19 yes	16 yes
Engineering information	21 yes	20 yes
Business information	18 yes	12 yes

neering information (see table 13). While the difference in responses is not statistically significant, the responses from both groups show considerable interest in learning new skills which would expand their information access capacity.

Finally, the engineering graduates were asked whether they had received any formal training in information retrieval, and to describe it if they had. In addition to the formal instruction received as undergraduates, 2 course takers noted other training, 1 from vendors (Dialog, TelTech, Chemical Abstracts) and 1 from a public library. Only 2 noncourse takers had received any formal instruction, 1 at General Motors and the other from Dialog.

Approximately 75 percent of the respondents in both categories were supportive of information access being integrated into engineering classes, or taught either as a part of continuing education or of orientation/on-the-job training. About half of the respondents also supported a separate undergraduate class in information access.

KEY RESULTS

More than ten years after graduation, half of all the engineers in our survey find themselves working in positions no longer classified as "engineer"; they have become managers or moved into other careers in business, law, or academia. They are, however, unified in their belief that hard work in completing projects on time is of primary importance in moving their career forward.[4] Almost all of them use computers, most of them for word and data processing, and two-thirds of them have computers at home where about half of them use communications software to access bulletin board and electronic information services.

The engineers who took the information resources course show similar information gathering preferences to those who did not—and to engineers generally. That is, they prefer word of mouth and their own library of information when they seek information. However, course takers showed more interest in using nearby college and public libraries. They also demonstrated a knowledge of a broader range of electronically available sources and services, and they read a wider range of both professional society-produced and engineering-related technical literature.

While we find little evidence to support course takers being more likely to approach a company librarian or information manager than others, we do see that they are more likely to rely on sources of information outside their companies such as paid consultants, vendors, and colleagues. Furthermore, course takers spent 50 percent more time than their noncourse-taking colleagues finding and using information.

Finally, both groups were almost unanimous in wanting to learn about accessing information both related and unrelated to their jobs. In fact, since only 2 in each respondent group had received any information access-related training during their professional careers, it is obvious that if there is no formal training in college, it is unlikely to occur later. And, they were united in thinking that such instruction should be incorporated into courses taught in college and should also be part of continuing education or on-the-job training.

COMMENTS FROM THE RESPONDENTS

Some of the students who had taken the class appended comments to the survey. One noted that "online research is the [way the] real world does things. It's the only way to [do] research" and an-

other noted, "[I] believe you cannot emphasize the importance of acquiring information access skills enough all throughout school, even after school and into every workday situations. It really does give you an edge in personal and professional lives."

One of the noncourse takers stated: "While I earned two degrees at U-M, I did not use the facilities and resources available to me. My twelve years of work have shown me that I made a mistake and should have." Two others offered suggestions to make information more accessible and useful to engineers:

> I believe that 95 percent of all engineers do not use technical information because it is not easily available. It would do no good if it sat in a library in Ann Arbor. It needs to be easily accessible through a PC at one's desk. In today's competitive market, one does not have time to visit a library.
>
> The type of information I need varies considerably from one assignment to the next. I do not know ahead of time what information I require. Therefore, access to a general information source is critical. Ease and timeliness of retrieval are also important.

CONCLUSION

This work provides perspective on what impact instruction in information access and use had on a group of engineers. It also gives insight in how various individuals and organizations might most effectively reach and educate engineers both while they are in college and throughout their careers. It may well also provide both the framework for longitudinal study of information use in other disciplines and the indication of widespread need for training in information use throughout professional careers. We believe that there may be applications of the information presented in this work for information professionals in a variety of settings.

Academic information professionals should consider that engineering students need instruction and electronic access to information resources. Along with playing the role of educator, academic librarians must also build unified interfaces which promote ease of access so that all students will be able to use a diverse set of data and information resources in a simple and straightforward way. Information management faculty should note that engineers use computers for electronic access both at home and at work. The engineers want proactive instruction in the use of information access across a broad range of resources.

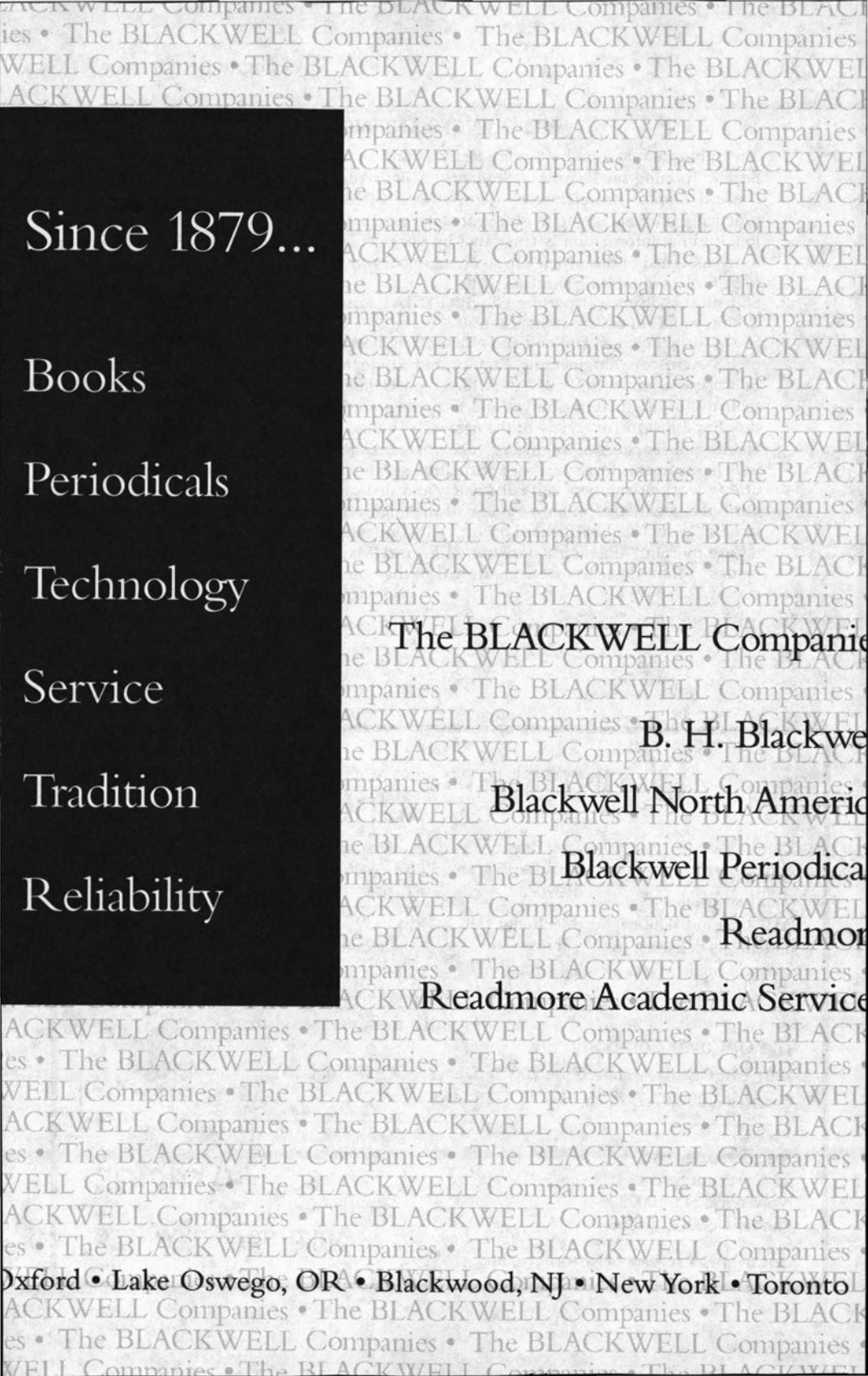
Engineering colleges can play an important role in promoting the use of technical information. Engineers are generally able to receive information resource access training only while they are in school. Those surveyed have given a strong mandate for information access and resource use being integrated into existing engineering courses. Corporate librarians and information managers should realize that engineers may be very interested in learning about electronic access to information and expect that some instruction should be available. While they show little enthusiasm for approaching a librarian for information, their strong desire to solve problems for themselves carries over to their interest in learning electronic information access. Engineers tend to gravitate toward careers in business and management as they mature, and they read business newspapers and magazines. Interestingly, while they say they would like to learn more about computers, few reported reading computer-related magazines.

Professional societies are positioned to play a major role in the delivery of technical and career development training. Engineers read and trust these publications most to solve their technical information needs and to keep them up-to-date.

Finally, academic librarians and corporate counterparts should consider collaborating to develop a continuum of service for newly graduated professionals in all fields. By providing electronic systems and training which encourages and extends the information seeking and use patterns established in college, this powerful collaboration should result in creating active, lifelong information seekers and users.

REFERENCES AND NOTES

1. The only example found is Naomi R. Ikeda and Diane G. Schwartz, "Impact of End-User Search Training on Pharmacy Students: A Four-Year Follow-Up Study," *Bulletin of the Medical Library Association* 80 (Apr. 1992): 124–30 which reports data collected from practicing pharmacists up to four years after graduation. We would note that searching for longitudinal information is frustrated by very general indexing terms. For example, the terms assigned to this article are so broad (*bibliographic instruction, end-user searching*) as to be useless in locating similar articles.
2. Statistical analysis was performed with SYSTAT software for the Macintosh, using Mann-Whitney and chi-square statistical tests.
3. See Maurita Peterson Holland and others, "Engineers as Information Processors: A Survey of US Aerospace Engineering Faculty and Students," *European Journal of Engineering Education* 16, no. 4 (1991): 317–36, which reports data from 275 faculty and 640 students on their use of information sources and technology and the influence of instruction on their use. For a historic overview of the area, see Thomas E. Pinelli, "The Information-Seeking Habits and Practices of Engineers," *Science & Technology Libraries* 11 (Spring 1991): 5–25, which documents forty years of information-seeking behavior among engineers.
4. Strong work-orientation, self-sufficiency, and dedication to task are some of the primary attributes mentioned in an overview of the engineers' personal and professional characteristics as reported by Richard Schott, "The Professions and Government: Engineering as a Case in Point," *Public Administration Review* (Mar./Apr. 1978): 126–32. The "cluster of values" Schott describes were confirmed in the homogenous pattern of responses in this survey.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