

Dimensions and Use of the Scholarly Information Environment:

Introduction to a Data Set Assembled by the Digital
Library Federation and Outsell, Inc.

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November 2002

Digital Library Federation
Council on Library and Information Resources
Washington, D.C.

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First Digital Library Federation electronic edition, September 2008

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Originally published in trade paperback in the United States by the
Digital Library Federation and the Council on Library and Information Resources, Washington, D.C., 2002

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Digital Library Federation ISBN-13: 978-1-933645-20-9

www.diglib.org

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Preface

We know from anecdotal evidence that users' expectations of libraries are changing as they find more information directly from the Web. Anecdotal evidence, though, is hardly enough for developing persuasive plans for new library services. The Digital Library Federation (DLF) and Council on Library and Information Resources (CLIR) commissioned Outsell, Inc., to conduct a large-scale study of undergraduates, graduate students, and faculty members from academic institutions ranging from the small liberal arts college to the largest research university. Our hope was that a picture of user behavior would emerge.

This report presents a summary of the findings and 158 selected data tables; it should be viewed as an entry to a much larger data set. The full set of 659 data tables provided by Outsell will be mounted on the Web later this year. We encourage readers to make use of these tables and ask that you share with us your analyses of the data. In addition, CLIR will deposit the raw data with the Inter-University Consortium for Political and Social Research.

CLIR and DLF expect to commission additional work based on the data. We welcome proposals from readers with an interest in performing more detailed studies.

Deanna B. Marcum
President, CLIR

NARRATIVE

INTRODUCTION

Academic and research libraries face numerous challenges in managing their information resources in the digital age. Like many other organizations, the Digital Library Federation (DLF) has become concerned about changing patterns of information use for teaching, learning, and research and about the implications of these patterns for libraries and library directors, who require reliable information for strategic planning. In collaboration with the Council on Library and Information Resources (CLIR) and Outsell, Inc., the DLF has initiated a planning and research process to understand how library use is changing and to support future investigation and analysis. The survey conducted by Outsell and described herein is only one of several activities under way or recently completed. Related projects include

- A survey by DLF Distinguished Fellow Denise Troll Covey of methods applied by leading research libraries to assess the use and usability of online collections and services (Troll Covey 2002)
- A survey by former DLF Director Daniel Greenstein and Indiana University Dean of Libraries Suzanne Thorin of the policy, organizational, and financial environments in which leading research libraries are developing their digital libraries (Greenstein and Thorin 2002)
- A study by Charles McClure and colleagues into methods of assessing quality in digital reference services (McClure et al. 2002)

Outsell developed the survey questionnaire with guidance from the DLF advisory group on user studies. Interviews began in fall 2001 and continued over two and one-half months. The primary goal of the survey questionnaire was to collect data on the relevance of existing and possible future services as well as on student and faculty perceptions of the library's value in the context of the scholarly information environment. Other objectives included determining (1) what information resources are used to support research, teaching, and learning, and (2) how those sources and services are located, evaluated, and used by faculty and students at different kinds of institutions of higher education and in different disciplines. It is ex-

pected that the data will support evaluations of the library's current and potential future roles as well as more detailed studies on the development and use of collections.

This report includes 158 of the 659 data tables provided by Outsell, a few summary observations, and a brief discussion of some possible implications of the findings. In addition to publishing this report, CLIR will post to the Web all 659 of the data tables, and will deposit the raw data tapes with the Inter-University Consortium for Political and Social Research (ICPSR).¹

In this document, the tables have been grouped in three categories: (1) Faculty and Students; (2) Infrastructure, Facilities, and Services; and (3) Formats. The information presented in the tables overlaps to some extent; however, the tables included in Faculty and Students primarily contain data about who participated and what they do. Tables included in Infrastructure, Facilities, and Services contain data related to where faculty and students access information. Finally, tables grouped within Formats contain comparative data on the formats and media that faculty and students use for research, teaching, and coursework.

Data Collection

Data were collected at three types of institutions of higher education: public (state-funded) universities, private doctoral research institutions, and liberal arts colleges. These categories correspond as follows to the Carnegie Classification of Institutions of Higher Education²:

Study Classification	Carnegie Classification
Leading public (state-funded) research university	Doctoral Research Universities—Extensive—Public Institutions
Leading private research university	Doctoral Research Universities—Extensive—Private, Not-for-Profit Institutions
Leading liberal arts colleges	Baccalaureate Colleges—Liberal Arts—Private, Not-for-Profit Institutions

These institutions of higher education have well-defined missions with respect to research and teaching. The design of the survey has enabled investigators to recover data reflecting potential differences among these institutional types as well as across academic disciplines, as discussed in the following paragraphs. Most or all of these institutions house libraries that are also documented in other data collection efforts, such as those developed by the Association of Research Libraries, the Oberlin group of liberal arts colleges, and the Association of College and Research Libraries. The information provided by these other data collection efforts could be used in conjunc-

¹ As of this writing, Outsell is developing a codebook to accompany the data. When the codebook is complete, the data will be deposited and available from ICPSR at www.icpsr.umich.edu.

² The Carnegie Classification was originally published in 1973 and has been updated in 1976, 1987, and 1994. The Carnegie Foundation expects to undertake a revision of the classification system to be concluded in 2005. The classification is available at <http://www.carnegiefoundation.org/>.

tion with the results of this survey to enable further studies.

Outsell interviewed a total of 3,234 faculty members, graduate students, and undergraduate students from the three types of educational institutions (there were no graduate students in the liberal arts college sample) in the Carnegie Classification (see Appendix 1). The distribution of respondents is illustrated in the table that follows. Within each institution type, an equal number of members of the faculty were selected across the seven disciplines studied (arts and humanities, biological sciences, business, engineering, law, physical sciences/mathematics, and social sciences). Students were selected by institution type and level (graduate or undergraduate). Quotas for each subset of the sample were established by respondent type, institution type, and discipline to ensure representation from all combinations. The sample is considered representative of the underlying population at this set of institutions.

Distribution of Respondents

Institution Type	Faculty	Graduate Students	Undergraduate Students	Total
Leading doctoral research university, public	272	657	407	1,336
Leading doctoral research university, private	337	399	135	872
Baccalaureate colleges—liberal arts, private	321	0	705	1,026
Total	930	1,056	1,248	3,234

Trained interviewers worked randomly through the sample, using phone numbers of faculty members and departments. For students, a telephone sample for each institution was obtained, allowing investigators to dial into a student's apartment or dormitory room. After screening the students for type (graduate or undergraduate) and discipline, the interviewers administered the questionnaire to those who agreed to participate.

The intent had been to conduct a 30-minute interview. However, tests showed that more than an hour was generally required to complete the interviews. To limit the length of the interview without eliminating any of the questions, a rotation scheme was developed. Some questions were asked of all respondents, and subsets of questions were asked of different segments of the respondent population. In all, six versions of the questionnaire were used. Frequency distributions were constructed for responses to the full questionnaire. Data were aggregated by status (faculty, graduate student, and undergraduate student); type of institution (public Ph.D.-granting institution, private Ph.D.-granting institution, and liberal arts college), and discipline. The full set of 659 tables contains data on all subsets of respondents. Summary tables of a subset of these tables, including weighted averages, are included in this report.

Weighting factors were used to enable generalizations to the population represented by this sample (that is, faculty and students at Ph.D.-granting public and private universities and liberal arts

colleges). The initial sample reflected the underlying distribution according to status (faculty, graduate student, and undergraduate student).

Weighting factors were constructed by reviewing the percentage of degrees conferred by public research, private research, and liberal arts colleges in each of the seven disciplines in the last year available (1997-1998) to balance the results of the study with the population by discipline. Investigators achieved a 95 percent confidence level with a precision of 3 to 5 percent for all targeted segments. Tests of reliability are indicated in each table. When testing proportions for significant differences, investigators used a *z*-test. When testing means, investigators used a *t*-test.

PART 1: FACULTY AND STUDENTS

Part I: Faculty and Students contains 28 tables that summarize information describing basic demographic characteristics, major and minor responsibilities, use of different media, satisfactions, and frustrations. About 40 percent (41.3%) of those interviewed were associated with public research universities, 27 percent with private research universities, and just under 32 percent (31.7%) with liberal arts colleges (Table 13). The distributions across disciplines were roughly proportional by type of institution, with somewhat higher representation of arts and humanities at the liberal arts colleges (39.9%) and greater representation in the biological sciences and engineering (43.0% and 54.4%, respectively) at the public research universities. Just under 29 percent (28.8%) of the sample were faculty members, 32.7 percent were graduate students, and 38.6 percent were undergraduates (Table 2). There was a slight concentration (47.4%) of undergraduates in arts and humanities; graduate students were somewhat concentrated in the biological sciences, engineering, and law. Faculty members were fairly evenly distributed across disciplines, although there was a disproportionate representation (40.3%) within the physical sciences/mathematics.

Somewhat more than half of the study population was male (56.4%); 43.6 percent was female (Table 3). Faculty members were predominantly men (77.5%), but the gender distribution was more equitable among graduate and undergraduate students. Indeed, more than half of the respondents in the undergraduate sample studied were women (54.2%). Men clearly concentrate in physical sciences/mathematics, engineering, business and law, and women are more evenly distributed among all seven disciplines studied. Roughly half of the respondents in the biological sciences, social sciences, and arts and humanities were women.

The median age of the study group was the early 20s; mean age,

³ Tables have been renumbered for publication in this document; original table numbers are also provided in a chart at the end of this narrative to enable readers to link the subset of tables herein presented to the full set made available on the Web.

which is more sensitive to extreme values, was the early 30s (Table 4). Members of the faculty have been teaching on average 15.4 years (Table 6). Students reported working toward their current degrees for an average of 2.4 years (Table 8). Almost half of the respondents (48.6%) worked part-time, and 5.9 percent worked full-time (Table 7). More than half of the undergraduate population (52.2%) worked part-time, and 54.5 percent of the undergraduates at liberal arts colleges worked part-time. More than 40 percent (44.4%) of graduate students worked part-time; almost a third (30.1%) worked full-time. Eighty-three percent of the undergraduates have yet to decide on a major (Table 9) and 51.7 percent of the study respondents, including 24.8 percent of the undergraduates, lived off-campus (Table 10).

Respondents among the faculty and graduate students divide their time among teaching, research, and service (Table 13). Among the faculty at public and private Ph.D.-granting institutions, research was the dominant activity; 75.3 percent and 80.5 percent of the faculty at these institutions, respectively, reported research as a responsibility; only 55.8 percent and 62.7 percent of the faculty at these respective types of institutions think teaching is a responsibility. In contrast, at the liberal arts colleges, 99.4 percent of the faculty and graduate students consider teaching a responsibility and 84.3 percent consider research a responsibility. Research is an important activity across all seven disciplines; however, respondents from the arts and humanities tended to emphasize teaching over research. The balance between teaching and research seems most even among respondents from business (59.3% considered research a responsibility and 60.8% thought teaching was a responsibility).

Faculty and graduate students spend most of their time engaged in research, although full faculty members spend, on average, more of their time on teaching than on research (Table 14). Faculty reported spending an average of 15.79 hours weekly obtaining, reviewing, and analyzing information from all sources to support both teaching and research (Table 15). Respondents from public and private universities reported spending on average about one to two hours more per week on these activities than the average time reported by all faculty members in the sample. Respondents at the liberal arts colleges, in contrast, report significantly less time invested in these information-related activities—an average of 12.24 hours. Although these results for public and private doctoral universities reflect aggregated responses from faculty and students, the findings nonetheless indicate that faculty and graduate students at Ph.D. granting universities invest more of their time in information-seeking and analytical activities than their colleagues at liberal arts colleges do. This finding is consistent with the research focus of these institutions.

Tables 16 through 24 summarize information on the use of print and electronic media for research, teaching, and coursework. Overall, faculty members and students use a combination of media. At the extremes, 67.8 percent of the faculty members and 61 percent of the graduate students reported using print sources exclusively for their research (Table 16). Just under 35 percent (34.7%) of the faculty

members and just under half (49.2%) of the graduate students said they rely exclusively or almost exclusively on electronic sources for their research (Table 17). This trend was fairly consistent across disciplines, with the possible exception of the arts and humanities, where there seemed to be a greater need for print materials. More than three-quarters (78.4%) of the respondents in arts and humanities said that they rely all or most of the time on print materials for their research (Table 16).

Across the board, print figures importantly in teaching. More than 70 percent of the faculty members and graduate students reported using print all or most of the time in teaching, and well over 70 percent of the respondents in physical sciences/mathematics, social sciences, and arts and humanities said they rely most or almost most of the time on print for the classroom (Table 19). Less than 25 percent of respondents across all institution types and all disciplines—except for business (41.9%) and law (29.8%)—rely all or most of the time on electronic sources for teaching (Table 20).

Graduate students rely strongly on print resources (Table 22) while undergraduates seem more willing to rely on electronic sources. Just over half of undergraduates (51.6%) responded that they relied all or most of the time on print sources, in contrast to the more than 70 percent among graduate students and faculty. About half (49.2%) of undergraduates reported that they used electronic materials exclusively or almost exclusively (Table 23). Reliance on electronic sources is strongest among business students, 62.9 percent of whom reported using electronic sources all or most of the time. Less than half of the students in the biological, physical sciences/mathematics, social sciences, engineering, and arts and humanities reported this preference (Table 23).

Tables 25-27 summarize information documenting unmet needs and challenges. About one-quarter of the faculty members (25.6%) and well over one-third (38.3%) of graduate students expressed a need for more online journals (Table 25). A greater frustration is lack of time. Nearly 40 percent (38.8%) of the total sample of respondents and 60 percent (60.2%) of the faculty reported “having enough time” as their major problem (Table 26). Respondents expressed minor frustrations with finding information, determining its credibility, and getting access to and analyzing it (Table 27). Indeed, 38.4 percent of respondents saw having insufficient training on how to search for information as an impediment. This finding was roughly consistent across institutions and disciplines.

Finally, the library has a commanding authority. Slightly more than 98 percent (98.2%) of those surveyed agreed with the statement, “My institution’s library contains information from credible and known sources” (Table 28). There were less than three percentage points of variability across types of institutions and disciplines (Table 28). By way of contrast, 75.4 percent of respondents agreed with the statement, “The Internet provides high-quality information.” Only 45.9 percent of respondents reported using information from the Internet without additional verification.

Parts 2 and 3 of this document examine findings relating to infrastructure and facilities and use of formats. The major themes in this section suggest that the library is perceived to have a central role in higher education, particularly with respect to maintaining the quality of information available to faculty and students. However, libraries appear to be serving multiple constituencies with variable needs. Higher education comprises a spectrum of subgroups, ranging from faculty with long tenure and well-articulated research interests and teaching needs to undergraduate students who have been on campus for only a short time and perhaps have yet to declare a major. More than half of the students are working at least part-time, and about half of the total study population do not live on campus. Faculty and graduate students seem to expect a hybrid environment of print and electronic resources, while undergraduates seem more willing to live in a wholly online world.

PART 2: INFRASTRUCTURE, FACILITIES, AND SERVICES

Faculty and students use a range of equipment in their offices, at the library, and at home or in dorm rooms (Tables 29-31). Respondents seem most reliant on desktop computers, but for those who also use a computer from their off-campus residences, a laptop is important. Faculty members seem to prefer to access information from their offices; they reported spending 73.95 percent⁴ of their time accessing information for teaching and research from their offices (Table 32). Only 9.68 percent of their time devoted to accessing information is spent at a physical library. Undergraduates, in contrast, reported that about one-third of the time (33.58%) they devote to accessing information is spent at a physical library. About 40 percent of their information access/acquisition time (38.22%) occurs from their residences, and the remainder is spent in labs, classrooms, and other unspecified locations. Graduate students display an even greater mix of behaviors in their use of facilities.

On the other hand, when asked about the role of the physical *and virtual* library in providing access to information for purposes of research, faculty and graduate students reported that they made substantial use of these facilities. On average,⁵ faculty respondents said that almost 60 percent (59.34%) of the information they use for research comes from the library, and the percentages are even higher among graduate students and graduate students who are also members of the faculty⁶ (Table 33). Faculty and graduate students meet their information needs through a mix of print and online sources

⁴ Some of the percentages are given to one decimal; others are provided at two decimals. The results cited in this introduction to the summary tables are reported as given in the tables.

⁵ In the tables, both mean and median are given. In this introduction, the mean, which is the more commonly cited statistic, is given unless otherwise indicated.

(Tables 34-42), but even then, the library's Web site is an important conduit to relevant material. When asked what percentage of their online information needs relative to research were met by the library's Web site, faculty members responded on average 61.65 percent. Graduate students reported roughly the same (65.81%) (Table 36).

At the same time, on average, 58.08 percent of faculty members' and graduate students' information needs relating to research are reportedly met by the Internet⁷ (Table 37). When asked about the role of the library relative to teaching, faculty (including graduate students who were members of the faculty) placed less reliance on the physical and virtual library than graduate students did. But all three subgroups (faculty, graduate students, and graduate students who were members of the faculty) responded that on average, about half (53.65%) of their information needs were met by the physical and virtual library (Table 38). All three subgroups found information related to teaching online and on the Internet (Tables 40 and 42), but the library's Web site also plays an important role. On average and across all three subgroups, 59.10 percent of the online information needs related to teaching are met through the library's site (Table 41).

Collectively, these findings suggest that advanced researchers—faculty and graduate students—use multiple on- and offline sources to support research and teaching. They do not perceive a competition between library-based information and information they find on the Internet through search engines, the library's Web site, and other tools (Table 43). At the same time, faculty and graduate students are skeptical of the authenticity and credibility of Internet-based information and employ various strategies to vet the information (Tables 44 and 45).

Undergraduates' reliance on electronic sources suggests that their perceptions and behaviors might differ from those of faculty and graduate students. All students rely heavily on the physical and virtual library for their coursework; on average, between 65 and 70 percent of their information needs are satisfied through these facilities (Table 46). All students also rely heavily on the library's Web site for access to the online resources they use; on average, well over 60 percent of the online sources they use are accessed through the library's site (Table 49). On average, undergraduates use Internet sources for their coursework more than graduate students do; 66.53 percent of the former, versus 58.84 percent of the latter, claimed that

⁶In questions related to teaching, the study differentiated between graduate students and graduate students who are also members of the faculty.

⁷ Investigators asked two questions (1) how information needs were met by the campus library's Web site (and other campus-based Web-enabled resources, such as department Web sites) and (2) how information needs were met by going out to the Internet. Respondents may have been confused by this survey question. A local Web site can serve as a portal to local resources as well as to hyperlinked, non-local Internet resources. A user might also find the latter by going out onto the Internet independently. Thus, responses that reflect use of a locally constructed Web portal might be masking non-local Internet resources served up on a local Web page through a set of hyperlinks. How users differentiate between Internet resources and those organized and made accessible through local, Web-enabled resources remains an interesting question.

their information needs were met on the Net (Table 50). Like faculty and graduate students, undergraduates seem to need the library's Web site to find relevant material.

The Web has also emerged as an important mode of communication among faculty members and students; however, it appears to have augmented, not replaced, more traditional modes. Tables 51–55 summarize data on where faculty members make information available about courses (e.g., syllabi) and course readings for graduate and undergraduate students. Handouts are still popular, but 67.9 percent faculty also maintain Web pages with this information for their undergraduate students (Table 51). The information is available on reserve at the library, the campus bookstore, and the copy center as well. Faculty members still favor the local bookstore for making course readings available to undergraduates, but readings are also made available for undergraduates in handouts, on reserve in the library, in the library's general holdings, and through course Web sites (Table 52). Similar patterns characterize information about courses and course readings for graduate students (Tables 53 and 54).

Students' perceptions relative to their coursework differ somewhat in emphasis. They rely heavily on handouts for information about course requirements and use the course Web page as a backup (Table 55). The most frequently cited source for obtaining course readings is the bookstore, followed by holdings in the general collections at the library, reserve readings at the library, handouts, and the course Web page (Table 56). Faculty members expect both undergraduate and graduate students to find at least some of the course readings independently (Tables 57 and 58). Students, faced with juggling multiple courses, not surprisingly seem to perceive finding resources independently a slightly greater burden than do their teachers, but the trajectory of the responses is roughly aligned (Table 59).

For example, most of the faculty believe that their graduate students need to find all or some of the supplementary course readings (that is, course readings necessary for the class but not specified in the syllabus) independently. Slightly under half (49.4%) thought that "some of the readings" had to be secured independently, and 29.1 percent of the faculty respondents thought "it is all there for them" (Table 58). About one-fourth of the graduate students (25.4%) agreed that "it is all there," and 54.7 percent believed that they had to find at least some of the readings for themselves (Table 59).

When asked to evaluate the extent to which they relied on different institutions and services for keeping current with developments in their field, 33.3 percent of the entire study sample identified the library as one of the sources they consulted, and 32.8 percent rated it as the "most important" source (Table 60). This finding was consistent across faculty, graduate students, and undergraduates as well as across disciplines. Respondents in the arts and humanities are most reliant on the library; 37.5 percent consider it their most important resource for staying current. Respondents in business are least reliant on the library, but 22.5 percent still consider it their most important source.

Other sources for keeping current include the “open” Internet, personal libraries and subscriptions, professional meetings, interaction with colleagues, department and library Web pages, the bookstore, and online alerting services. The extent of reliance on these sources varied. Faculty place high value on their personal libraries and subscriptions to journals (55.9 percent think that these resources are the most important way to stay current). Thirty-eight percent of undergraduates, compared with only 21.4 percent of faculty, consider the open Internet to be their most important source for keeping abreast of developments. Again, notions of what constitutes “keeping current” are presumably different among demographic groups at different stages of their academic and professional development, and these differences in perceptions of relative value of the Internet versus the library or specific formats (such as journals) merit further scrutiny.

Respondents were asked a series of questions designed to determine the adequacy of existing sources in all media and of modes of delivery (Table 61). About half (54.7%) considered the medium important. Respondents had high standards, placing value on such variables as speed of delivery, ease of access, quality, currency, ability to search, coverage, and printing. However, less than half (43.8%) feel that their needs are being met. This finding appears to hold across all media and subgroups and disciplines. An interesting study might be conceived that systematically examined the differences between value placed on various attributes and system features (for example, speed of delivery, ease of access, search, printing, coverage) and the extent to which different user groups and disciplines believe that a given system or medium performs satisfactorily.

Respondents are basically satisfied with the content and services that the library provides (Tables 62–65). Slightly over 14 percent (14.3%) requested more print journals, and 10.7 percent would like more electronic journals (Table 62). These needs seem concentrated among faculty members and graduate students, and among respondents in the biological sciences, physical sciences/mathematics, and engineering. However, when asked what types of content were no longer necessary, 61.3 percent of the total sample responded “Can’t think of anything/everything is useful” (Table 64). This finding was fairly consistent across faculty members and students as well as across disciplines. When asked about library services, the level of satisfaction was even higher: 75.1 percent of the sample responded, “Can’t think of anything/nothing” (Table 65). Allegiance is particularly strong among liberal arts colleges and law, where almost 90 percent (86.5% and 88.9%, respectively) of respondents voiced this sentiment.

Loyalty to the library and its content and services notwithstanding, respondents believe that they are changing how they go about their work (Table 66). About 40 percent of the total (41.5%) reported that they work and study away from campus more than they used to. This finding was more pronounced among graduate students and those who are affiliated with public research universities than among

other survey respondents. About one-third of the sample (34.5%) reported that they use the library less frequently than they used to, with a preponderance among the faculty and, again, graduate students. Less than a fourth (23.9%) of the respondents participate in distance learning, but those who do tend to be disproportionately represented among undergraduates and respondents in the social sciences, engineering, and business. Relatively few—a little more than 15 percent (15.7%)—agreed with the statement, “The Internet has not changed the way I use the library.”

Overall, higher education places great value on the library and its services. The library is, however, only one of many elements in a complex information infrastructure. Clearly, teaching faculty and graduate students rely on the library and its collections, as well as the bookstore, copy center, and other modalities to provide coursework for their students. Moreover, traditional library-based functions of information selection, organization, and aggregation appear to be migrating to the Web as libraries build Web sites that users employ to access a broad range of online sources. Many respondents appear to welcome the proliferation of different media. This would suggest that the net effect of electronic sources is additive, and only occasionally does one medium appear to substitute for another. This “substitution effect,” while weak, is evident primarily among undergraduates. Whether this observation portends a wholesale change, or whether undergraduates’ attitudes toward the relative value of all elements in information infrastructure will evolve, is an open question.

PART 3: FORMATS

Faculty and students seek and use information from multiple sources, in different formats, and at many venues on- and off-campus. Outsell has collected consistent information on 17 formats: print/Hard-copy books; print/Hard-copy journals; electronic books; electronic journals; magazines; papers delivered at professional meetings; print abstracts and indices; online abstracts and indices; online databases, data sets, or data sources; manuscripts; proprietary software; data; photographs, prints, and other visual resources; technical reports; preprints; dissertations; and news. How electronic information is used has engaged the attention of a wide variety of researchers. One of the great strengths of the Outsell data is that they are based on a survey of multiple user groups, because this will make it possible for future scholars of communication to examine one format or set of formats from multiple perspectives on a large scale. A few observations on some of the basic trends and themes follow.

When asked which categories of information they used for their “job/coursework,”⁸ the most frequently cited answer was reference. Just under half of all respondents (47.3%) placed it among the sources they use regularly (Table 67). The second most frequently

cited category of information is scientific and technical information (39.9%). Social science information ranks third (29.4%) and humanities fourth (22.2%). When asked which category of information was most important, the top choice was scientific and technical information (28.6%), followed by reference (19.5%), social science information (16.8%), and humanities (12.4%). However, the most frequently cited second most important type of information was reference (27.8%). These priorities, particularly the pattern in first choice, more or less track the priorities of the faculty. However, undergraduates placed a greater value on reference information than faculty members did: 14.0 percent of faculty members, in contrast to 25.6 percent of undergraduates, considered reference information most important.

The distribution across disciplines tended to track the patterns evidenced across the sample with a few notable exceptions. Respondents in the biological sciences, physical sciences, and engineering placed a strong emphasis on scientific information, while respondents in the social sciences and arts and humanities placed less emphasis on material in their respective disciplines. For example, 85.5 percent of the respondents in engineering say they regularly use scientific and technical information, and 72.7 percent considered this their most important category of information (Table 67). By contrast, only 60.5 percent of the social science respondents regularly used social science information, and of them, only 41.9 percent considered this category of information the most important.

These patterns suggest several possibilities. The questionnaire was constructed to differentiate among information used in research, teaching, and coursework. Respondents, particularly faculty, may have interpreted the question to mean information they used daily, perhaps related to teaching rather than research. It is also possible that they construe their original research as separate from the literature they may consult as part of that process. In view of the effort faculty and graduate students invest in staying abreast of developments (see Part 2), the literature, particularly the journal literature, is clearly vital to the research process.

When asked which information types were used for research, 97.2 percent of all respondents cited print/Hard-copy journals, followed by print/Hard-copy books (96.6 %), online abstracts and indexes (88.2%), papers given at conferences (84.5%), data (82.1%), online databases, etc. (81.8%), and manuscripts and other primary source documents (81.1%) (Table 68). All the other formats investigated are used, but not as broadly. On the other hand, scholars and students in different disciplines rely on different information formats. More than 80 percent of respondents in the biological sciences and physical sciences/mathematics use electronic journals; the sample-wide response to this question was 74.9 percent. Only 59.2 percent of the respondents in arts and humanities reported needing "data" for their research activities. Technical reports are dispropor-

⁸ The term "job/coursework" is employed in the more detailed tables summarized in Table 67. For use of the term, see Table 57 in the full compilation.

tionately used by respondents in the biological sciences, physical sciences/mathematics, and engineering, reflecting a long-standing tradition for early distribution of research results in this format. Preprints figure prominently among respondents in the physical sciences/mathematics, as well as to a somewhat lesser extent in the biological sciences and in engineering, where this format has also historically been important.

When it comes to teaching, priorities are somewhat different. Slightly more than 95 percent (95.8%) of the respondents, who include faculty members and graduate students only, cite print/Hard-copy books rather than journals (Table 69). Print/Hard-copy books are followed in frequency of use by print/Hard-copy journals (81.1%), news (66.3%), and photographs, etc. (62.9%). These priorities are fairly consistent across disciplines, all of which reported using print/Hard-copy books most frequently. Respondents in business and law stand out in their use of news (89.6% and 89.4%, respectively) while those in the biological sciences and arts and humanities are particularly active in their use of photographs and visual resources for teaching (83.3% and 78.3%, respectively).

Students' use of information types represents a mix of their professors' and instructors' preferences and the materials they might need for research projects. Print/Hard-copy books are the most frequently used format (93.3%) (Table 70). The next four most frequently used types among all students are print/Hard-copy journals (80.6%), online data databases, etc. (80.2%), data (75.2%), and online abstracts and indexes (73.1%). Compared with the researchers' use, students' use of information for coursework thus appears to be more concentrated in books than in journals and other formats. This suggests that although the interests of faculty and graduate students are well defined and focused, their information requirements are fairly broad in terms of formats. Undergraduate students seem to be quite the opposite: their intellectual and professional interests are not as well formed, yet they rely fairly heavily on one format, books.

A selection of the findings follows. It is focused on findings relative to print/Hard-copy books, print/Hard-copy journals, and electronic journals (Tables 71–88). Print/Hard-copy books and journals figure importantly in research and teaching; electronic journals have been the subject of intense discussion among librarians, publishers, and researchers about patterns in scholarly communication. This interest justifies a preliminary look at the e-journal format as well as the formats that appear to be more frequently used on campus. Still, analysis of the other, somewhat less frequently used formats (for example, dissertations, manuscripts, technical reports, and data) awaits more sophisticated investigation. Remaining summary data are contained in Tables 89–162.

Print/Hard-copy Books

The investigators asked two related questions about each format: Where do you go to find information *about* material? and Where do

you go to find the *material itself*? In response to the first question, with respect to print/Hard-copy books used for research, the overwhelming response within the study sample is "Go online" (82.7%) (Table 71). Less than half of respondents (47.7%) go to print sources, such as finding aids, to find information about material, and less than one-fourth (23.2%) ask for assistance. The finding was consistent across faculty members and graduate students (undergraduates were not asked this question) and across all disciplines. When asked where they went to find the material itself, 90.3 percent of respondents went to the campus library (Table 72). The second most frequent way to find the books is to go online, but only 16.8 percent of respondents find print/Hard-copy books in this way.

To find information about books for teaching, faculty and instructors cast their nets somewhat more broadly (Table 73). Slightly more than 65 percent (65.2%) of the entire study sample go online, including online library catalogs and finding aids, and 54.6 percent use print aids at the campus library. About 30 percent (30.3%) seek some form of personal assistance, either from a colleague or, rarely, from a librarian (9.2%). Otherwise, professors and instructors use a wide range of tools and strategies: personal libraries, Web directories/subject-related Web pages, search engines, their institution's Web sites, and online reference services. To find the information itself, 64.7 percent of the respondents go to the campus library (Table 74). Less frequently used places to find the material include the bookstore (15.2%), online access (13.1%), and the publisher (11.3%).

When students look for information about print/Hard-copy books needed for a course, they also go online (70.7%) (Table 75). To a substantially lesser extent, they ask for help (33.6%), typically from a member of the faculty or a librarian. Less than one-third of students (31.5%) also consult print aids, primarily at their libraries. Still, when they go online, they are accessing services offered by the library; in descending order, online finding aids they consulted included the online catalog (21.4%), the institution's Web site (16.7%), and Internet search engines (16.3%). To find or use the material itself, 84.6 percent of the undergraduate and graduate students go to the library, which is by far the most frequently used location (Table 76). The next most frequently cited place for finding print/Hard-copy books is the physical bookstore, where 18.8 percent of respondents reported that they purchase the books they need for coursework.

Print/Hard-copy Journals

When asked where users go to find information about print or Hard-copy journals for use in research, the most frequent response was "online" among all groups studied (87.2%) (Table 77). Within the general category of "online," however, respondents in all disciplines use an array of sources: databases, the library catalog and finding aids, the university or college Web site, Web directories/subject-related Web pages, Internet searches, and online abstracting and indexing services. Respondents in the arts and humanities rely disproportionately on the library's online services; 41.0 percent reported library

catalogs and finding aids as their *preferred* source. Nearly one-fourth (23.1%) of respondents reported using the library's online aids, but only 14.6 percent consider it their preferred source. Just under half (48.7%) of the whole group also use print sources as discovery tools; these are generally located at the campus library, although only 14.7 percent of respondents consider using print sources at the library the preferred method. Just under one-fourth (24.4%) asked for personal assistance. Only 13.9 percent ask a librarian, and a bare 3.2 percent consider consulting a librarian a preferred way of identifying information related to journals.

On the other hand, the campus library figures prominently in use of print/Hard-copy journals. Almost 90 percent (87.1%) of all respondents cited the library as the place where they find such journals for research, and 61.5 percent consider the library the preferred source (Table 78). This finding was fairly consistent across disciplines, although the percentage was slightly lower among respondents in the biological sciences (78.7%). Moreover, only about half of the respondents in the biological sciences (49.3%) consider the library their preferred location for finding print/Hard-copy journals related to their research. The highest usage is among respondents in the arts and humanities, where 95.1 percent of the respondents reported finding print/Hard-copy journals for research at their campus libraries and 83.6 percent consider the library the *preferred* location. In declining frequency of use, respondents named online access, interlibrary loan, borrowing from other libraries, personal holdings, and consulting colleagues as sources for locating print/Hard-copy journals.

Online resources are the principal means by which faculty members and teaching graduate students obtain information about print/Hard-copy journals they use for teaching (Table 79). About three-fourths (74.6%) find this information through one of several online tools (for example, databases, search engines, Web directories/subject-related Web sites, their institution's Web site, and online library catalogs and finding aids). About 60 percent (61.1%) reported using print sources as well, and about half (49.3%) find these sources in the campus library. Just over 20 percent (20.5%) of the respondents consider finding information about print/Hard-copy journals for teaching in the library to be their preferred strategy. As is the case in use of online resources for identifying relevant teaching material in print/hard-copy books, respondents use a range of strategies when they look for information about print/Hard-copy journals among offline resources. Sources include their own collections, personal subscriptions, references or citations in books and journals, abstracting and indexing tools, and so on. About one-fifth (20.9%) asks for help in several ways: from colleagues on campus (14.0%), librarians (9.6%), colleagues at other institutions (4.0%), and elsewhere.

The trajectories of use reflected in Table 79 seem to be similar across disciplines and types of institutions, although the liberal arts colleges tend to show higher uses of both print and online resources to support the use of journals in teaching and more frequent use of the library. For example, 74.0 percent of the respondents at these in-

stitutions reported using print resources (as opposed to the sample-wide response of 61.1 percent). Almost one-fourth (24.4%) of liberal arts college respondents said they consulted with others (as opposed to 20.9% across the entire sample), and 15.2 percent asked a librarian for assistance (as opposed to the sample-wide response, 9.6%).

Just under 80 percent (79.5%) of all respondents in the subgroup of faculty members and graduate students who teach reported that when they use print/hard journals, they use them at or borrow them from the library (Table 80). For 57.6 percent, the library is the preferred venue. This finding appears consistent across all institution types and disciplines, although the liberal arts colleges and arts and humanities are somewhat more prominently represented (62.3% and 62.5%, respectively). Somewhat over one-fourth of all respondents in this subgroup (26.9%) said that they found these journals online. Otherwise, respondents find print/Hard-copy journals in a variety of ways: through personal collections, personal subscriptions, inter-library loan, course Web sites, and the campus bookstore, and from colleagues and collections within their departments, on-demand document delivery services, and publishers.

Nearly three-fourths (73.4%) of graduate and undergraduate students go online to find information about print/Hard-copy journals they need or use for coursework (Table 81). About one-third (32.4%) asks for help, most frequently from a librarian (22.6%) or from faculty (16.7%). Finally, 29.1 percent of the students look for this information in the library. These patterns appear to hold across all institution types and disciplines. Undergraduates and respondents from liberal arts colleges and from arts and humanities, engineering, and business seemed somewhat more willing to seek personal assistance, generally from a librarian. Respondents from private research universities as well as those in the arts and humanities and law seem to take greater advantage of library facilities than respondents in the other types of institutions and disciplines surveyed.

Use of print/Hard-copy journals for coursework is centered in the library; 87.1 percent of respondents said they either borrow journals or use them within the library (Table 82). More than one-fourth (27.9%) of the respondents have access to the material online. Additional access strategies include borrowing from other libraries, inter-library loan, purchase at the bookstore, loans from faculty, personal holdings, on-demand document-delivery services, and so on.

As had been suggested by the patterns exhibited in association with print/Hard-copy books, the information summarized in this section further confirms the importance of the library in supporting identification and use of print/Hard-copy journals for research, teaching, and coursework. The relevance of the library's resources to teaching and coursework appears particularly important. Undergraduates seem more willing than graduate students and faculty members to ask for help, but even intellectually sophisticated scholars appear to need the library's organizational and selection functions—even though that functionality may be available online rather than in the library building itself. It is also important to note

that faculty and instructors display a range of information-seeking and use behaviors. It is unclear whether this creativity has always been a hallmark of scholarship and teaching or whether it represents a response to perceived (or real) limitations in existing tools and services or to changes in the way that scholars now work.

Electronic Journals (E-journals)

Nearly all respondents who use e-journals for research (92.7%) find out about them online (Table 83). Finding aids include online databases (21.8%), search engines (18.2%), Web/subject-related directories (15.1%), and Internet searches (10.8%), as well as a host of other services, including online abstracting/indexing services, online reference services, department Web pages, and so on. Only 21.7 percent of the respondents who use e-journals for research identify them through print sources, frequently at the campus library. Among e-journal users, a disproportionate number of respondents in the biological sciences (24.1%) reported using print sources to identify e-journals, although only 3.4 percent considered this their preferred mode. Consistent with earlier observations, 16.5 percent of all respondents ask for personal assistance and only 2.5 percent prefer to ask a librarian.

Just over 80 percent (81.2%) of those who use e-journals for research access them online, and about three-fourths (74.1%) of the respondents consider online access the preferred modality (Table 84). Nearly one-fourth (23.0%) reported using electronic journals in the library or borrowing them from the library, but only 13.9 percent consider this a preferred strategy. Otherwise, respondents again displayed a wide range of access strategies (for example, office use, interlibrary loan, and personal holdings). Respondents at liberal arts colleges are disproportionately represented among online users of e-journals (96.8%), while respondents at public research universities are represented in a relatively low proportion (76.0%).

Across the disciplines, the most frequent users of e-journals are in law (94.7%); individuals in this discipline use e-journals more frequently than persons in the biological sciences, physical sciences/mathematics, and engineering. However, the sample sizes in these subjects (specifically law) are low, which means that results should be approached with some caution. Physical sciences/mathematics and engineering have a tradition of using preprints and technical reports for early release of results, which may affect the scholars' use of the formal literature for research. How the availability of multiple communication modalities within given disciplines or sets of disciplines affects relative use of the available formats is an important question for future research.

Just over 86 percent (86.7%) of those who use e-journals for teaching obtain information about them online (Table 85). These respondents use an array of discovery tools with little obvious preference: search engines (18.6%), online databases (18.4%), online library catalogs and finding aids (17.3%), institutions' Web sites (16.0%),

Web directories/subject-related sites (14.8%), and Internet searches (12.8%), together with a variety of other strategies and services. None of these strategies fares particularly well among the respondents as a preferred approach. For example, only 9.5 percent of the respondents consider search engines, the most frequently cited tool, a “preferred source of information” about e-journals for teaching. These findings seem to hold across institutions and disciplines, although private universities and liberal arts colleges are relatively frequent users of online library catalogs and finding aids (24.6% and 20.2%, respectively), as are respondents in the biological sciences (23.8%) and arts and humanities (30.4%).

Other means of identifying relevant e-journals for teaching include print materials (22.8%), which are most frequently accessed at the library, and personal assistance (22.3%). Requests for personal assistance conform to the patterns observed with respect to formats. Somewhat more than 10 percent (11.3%) consult a librarian, and only 4.4 percent consider asking a librarian a preferred strategy. Faculty and graduate students are most likely to ask a colleague (13.4%).

Among those faculty members and graduate students who use electronic journals for teaching, 80.5 percent reported finding the materials online, and this is the preferred source for 75.3 percent of the respondents (Table 86). Another 22.7 percent borrow or use e-journals at the library, but only 14.7 percent consider this a preferred strategy. In addition, respondents in this subgroup employ a broad range of strategies and tools: access in their offices, on-demand document delivery, interlibrary loan, and purchase. Less than 1 percent (0.6%) own e-journals in their personal collections, and less than 1 percent (0.6%) acquire them from the publishers directly. The low level of ownership suggests that, at least for teaching purposes, faculty and graduate students rely on third-party access, presumably the library, which may make the material available online through its Web site. This suggestion, which is consistent with earlier observations about reliance on the library’s Web site, points to the importance of the Web site as an element in the infrastructure of higher education. This topic might be profitably explored in future studies.

Nearly 90 percent (88.1%) of students who use e-journals for coursework find out about them online (Table 87). Discovery tools include online library catalogs/finding aids (22.7%), institutional Web sites (22.5%), search engines (21.0%), online databases (19.2%), and Internet searches (11.3%), among others. About 20 percent (20.1%) ask for help in some form: from librarians (12.8%), faculty (10.5%), and other students (4.1%). Undergraduates are clearly the most willing to ask for help (23.5%), particularly those who have yet to declare a major (41.7%).

Seventy-five percent of students who use e-journals for their coursework access the journals themselves online, and for 68.5% percent, this is the preferred strategy (Table 88). Nearly 40 percent (39.5%) use or borrow the material from the campus library, and 25.5 percent consider this the preferred method. Other strategies are also employed at very low levels, including interlibrary loan (2.8%),

borrowing from other libraries (2.2%), and on-demand document-delivery systems (0.5%). These observations seem to hold across institution types and disciplines, although arts and humanities are underrepresented within the group who access e-journals online; 68.5 percent of the arts and humanities respondents reported such use. However, a disproportionately high percentage of respondents in the arts and humanities (48.1%), social sciences (43.7%), and biological sciences (43.3%) borrow e-journals from the library or use the material there.

OBSERVATIONS AND IMPLICATIONS

These data characterize key segments of the higher education population—faculty, graduate students, and undergraduates—from several perspectives, enabling us to view behaviors and preferences in terms of different roles and functions. The information needs of the faculty are represented in terms of the functional roles of researcher and teacher, and both roles are then considered independently relative to the library. Similarly, the students' views, whether graduate or undergraduate, are treated independently, making it possible to see how information needs may evolve as intellectual interests become more focused and more sophisticated. In this regard, graduate students occupy a telling middle ground: at some times their information preferences and behaviors are generally aligned with those of undergraduates; at other times, for example, in their roles as instructors, the graduate students' interests and preferences converge with those of the faculty. It is a point that might yield interesting results from further study.

At least two categories of future studies can be envisaged. The first category would delve more deeply into subsets of the data. The second would contextualize the data in comparative studies with other information-intensive user populations (e.g., full-time researchers in industry, research institutes, and government) or other segments of the higher education community (e.g., part-time/adjunct faculty or students in remote or continuing education settings who may pursue additional training not related to an academic degree). Studies that plumb the data more deeply might examine differences across and within disciplines and across status.

Preliminary observations have brought to light several examples in which respondents in the liberal arts colleges and in the biological sciences and arts and humanities seem to rely on the library and its functions and services more than their peers in the other disciplines do. Respondents in law also seem to show greater use of the library and its functions. This suggests, for example, that law may require and reward skills that rely on a tightly integrated use of library facilities to support notions of acceptable evidence and the style of argument that is part of the legal culture, which borrows heavily from precedent and may resemble, for example, historical and literary research. This understanding of the nature of evidence and argument may differ substantially from that that prevails in laboratory or

experimental sciences, which have their own canons of evidence and interpretation. Thus, the legal profession may selectively draw on graduates from liberal arts colleges and on the cognitive frameworks that students in the arts and humanities and biological sciences develop. How the intellectual content of these and other disciplines interact may be a fruitful topic for further study, as is the question of how institutions of higher education incubate learning styles and scholarship, and of how the library and its functions support that process. Other topics are sure to be imagined as researchers become familiar with this data set.

Library directors and college and university administrators face an increasingly complex institutional and informational environment. The population they serve is far from homogeneous in its level of sophistication, information needs and infrastructure requirements. Faculty and graduate students, in particular, seem to be omnivorous in their appetite for information, creative in their strategies for seeking and acquiring information in all forms, and very independent. They appear to seek tools, services, and facilities that they can use where and when they need them. So far, most faculty, graduate students and undergraduates seem to prefer a hybrid information environment in which information in electronic form does not supplant information in print but adds to the range of equipment, resources, and services available to teachers and students.

Like the bookstore and copy center, the library is a facility that serves campus information needs and is vital to teaching, learning, and research. For example, faculty members place course readings on reserve and require use of items in the general collection as part of their curricula, continuing to take advantage of the physical facility and the analog collections. In addition, many of the librarian's functions—as selector, organizer, guarantor of quality, and perhaps as teacher—seem to be finding expression in the electronic medium, where the library's Web site, for example, is seen as an important element in the local information infrastructure. Liberal arts colleges, where the teaching mission is particularly important, also seem to be institutions in which there is consistently greater reliance on the library and where the library has a greater presence in supporting the curriculum. Undergraduates, far more than graduate students and faculty, ask librarians for help in their coursework, adding to the function of the librarian as teacher as well as editor, selector, and guide. Thus, integrating librarians' functions and services into the undergraduate learning experience may prove a fertile area for future growth.

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SELECTED DATA TABLES

Key to Tables

The following tables contain summaries of the survey data. Each table contains the responses to one survey question, with the possible responses down the left-hand side, and frequencies and percentages of those responses in the body of the table. The first column represents the results from the total number of respondents to the question. The remaining column headings represent subsets of respondents to that question by respondent type, institution type, discipline, and gender. The base samples for the total responding to that question and for the other subsets is listed just below the column heading.

Letters appear next to some of the values. These letters correspond to the letters beneath the column headings, and they indicate significant differences identified by statistical testing. It means that the value is statistically different from the values given for other respondent groups represented by the letters. The results are tested at the 95 percent level of confidence (that is, there is a 5 percent or less chance that the differences between the data are due to chance). The number with the greater magnitude has the significance letter attached to it, indicating that it is “significantly greater” than at least one other comparative number.

Questions that were open-ended (e.g., “How many hours do you spend on research?”) show actual responses followed by the mean and/or median and standard deviation.

This document includes 158 of the 659 data tables provided by Outsell. Each of these 158 tables has been numbered according to its order of appearance in the narrative. The numbers assigned for this publication, therefore, differ from those that were originally given by Outsell. The List of Tables that follows matches each table used in this document with its original table number.

Most, but not all, of the tables presented in the following pages are specifically referenced in the narrative.

List of Tables

