

Spanish Faculty Preferences and Usage of Library Services in the Field of Science and Technology

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abstract: The authors compare Spanish faculty use of library services and the interest they express in value-added services and improvement actions. The results are based on data from a survey of 546 faculty in the field of science and technology. The study differentiates between the areas of pure science, engineering and architecture, and life sciences. Results reveal a general trend toward a greater use of virtual services, although some services such as in-person consultations remain popular. Interest in increasing collections is also expressed. Findings also reflect differences among the three groups.

Introduction

The cumulative nature of scientific knowledge requires that scientists need to be aware of what is already known about a particular subject in order to undertake new research. Access to a broad array of scientific and technical information, therefore, is an essential requirement of the scientist. As David Lide notes, access to technical information is crucial to all phases of the scientific process.¹ Consequently, to facilitate successful scientific research and development, there must be a viable information infrastructure. This includes libraries with strong collections, both print and digital, and systems that facilitate efficient and easy access to materials and information. The Internet has spawned a culture that requires immediate access.

Scientific/technological innovations are constantly changing the information landscape. Science and technology faculty are the immediate generators and transformers of new knowledge. Researchers and scholars must have this considerable knowledge base available to them. The modern world is heavily reliant on access to information and



knowledge, and this has created new demands on libraries and librarians. This requires that libraries must constantly rethink and realign their strategies for service provision with an eye to the unique needs of distinct user populations.

Different fields of research have needs, habits, and uses for information that set them apart, and this is particularly true in the scientific disciplines. This issue has been studied in depth in the field of information science for many years,² but interest has also spread to other scientific disciplines.³

Problem Statement

In recent years, it has become clear that libraries must respond more efficiently and effectively both to the existing demands of specific research carried out in the fields of science and technology and to faculty's emerging expectations and needs. It is therefore, important to discover and analyze these needs, opinions, and expectations. Users, faculty or otherwise, generally begin with the same basic expectation—to obtain the maximum amount of information with the least effort and in the shortest possible time frame. This requires that libraries and the systems that they develop or purchase must prepare, organize, and filter information effectively and efficiently.

"For librarians and other information professionals to be effective information providers, they require a fuller understanding of the information-seeking behaviour, needs, and uses of individuals."⁴ This is vitally so for those serving the research needs of science faculty. The typological classification of users in the fields of science and technology is by no means simple because variations may at times cloud appropriate understanding of their information needs. However, scientific faculty can be grouped into three basic fields, according to the main focus of their research and teaching: pure sciences (physics, chemistry, mathematics), life sciences (biologists, veterinarians, biomedicine), and applied sciences (engineers and architects).

Studying the behavior and preferences of different groups in relation to their use of library services provides a better insight into their user profile. This enables the library to plan and improve its services in order to meet their needs more effectively. Although numerous studies of this type have been undertaken with a wide range of user groups and in different contexts, the research on information behavior in the Spanish academic context is scant; and no study has specifically focused on the three above-mentioned user groups.

Literature Review

The subject of information-seeking behavior in the academy has been widely studied in the scientific literature from a variety of perspectives, frequently through the results of surveys or personal interviews.⁵ Log analysis has also been used to explore service and electronic resource usage.⁶ The vast majority of these studies describe the behavior or habits of specific individuals or groups in isolation, rather than taking a comparative approach and focusing on identifying behavior patterns that are, to varying degrees, common to all users. However, the scientific literature also includes studies that examine the asymmetries among different groups with the aim of identifying distinct behavior patterns associated with the specific characteristics of individuals in each academic



subject area. Comparisons of academic areas have revealed many similarities in the use of library services but also many differences.

These differences are greater when a wider range of disciplines is compared, as can be seen in the work of Ethelene Whitmire, who studied the differences in undergraduates' information-seeking behavior.⁷ She found significant differences among disciplines, as classified according to Anthony Biglan's model⁸—namely between hard/soft, pure/applied, and life/nonlife disciplines. The greatest contrasts are seen between the human and social sciences and the pure and applied sciences.⁹ In this vein, Steve Hiller examined the differences, according to their priorities and information needs, in the way students and professors use libraries in three disciplines: humanities and social sciences, health science, and science and engineering. He analyzed data gathered from a questionnaire distributed in 1998 and in 2001 to which approximately 3,000 people responded over a two-year period. Although these data reveal similar overall levels of satisfaction with library services among the groups studied, certain specific differences emerge in the use of some services and resources. Virtual library use is much lower in humanities and social sciences—disciplines that use books more than any other resources—and health science and science and engineering fields show a preference for scientific journals.¹⁰

Sue Sparks also found significant differences among disciplines, particularly the overwhelming importance of journal articles for the medical and biological sciences, the importance of e-prints (pre and post) in the physical sciences and engineering, the broader mix in social sciences, and the particular importance of books in languages and area studies.¹¹ However, other prior studies such as that by David Ellis, Deborah Cox, and Katherine Hall analyzed information-seeking behavior among researchers in the physical and social sciences and found no significant differences among the academic fields studied.¹²

With regard to library usage, the literature reports an increasing tendency across all scientific areas toward the virtual use of library services, with a corresponding decline in in-person use of these services. However, there are suggestions that in-person use is higher in the humanities and social sciences, as indicated in the Research Information Network and the Consortium of Research Libraries 2007 report and other recent studies.¹³ The dramatic increase in the availability of electronic resources, particularly e-journals, and their great acceptance by the university community has entailed a gradual shift from the use of printed to electronic resources.¹⁴

According to Carol Tenopir et al.,

Access to electronic journals and articles has involved three system phases: an early phase following introduction of electronic journals; an evolving phase in which a majority of scientific journals are available in electronic format, new features are added to some journals, and some individual articles are made available through preprint archives, author web sites, etc; and an advanced phase in which searching capabilities, advanced features, and individual articles are integrated in a complete system along with full text of core journals available back to their origin.¹⁵

Although this tendency toward greater use of electronic format resources to the detriment of the printed format is fairly general, there are slight variations between scientific areas.¹⁶ In the area of sciences, Cecelia Brown analyzed the information-seeking behavior of astronomers, chemists, mathematicians, and physicists at the University of



Oklahoma using a 20-item questionnaire. The 49 respondents showed a preference for print journals as their main information source.¹⁷ Brown also notes certain differences between mathematicians and respondents from the other disciplines with regard to the type of resources used regularly; in addition to electronic journals and databases, mathematicians also made frequent use of monographs, preprints, and informal communication.¹⁸ Mathematicians' physical use of the library was also lower than the other groups studied.¹⁹

Lisa Covi investigated the use of paper and electronic materials by 96 faculty members and 28 doctoral students in four disciplines (molecular biology, literary theory, sociology, and computer science) at eight U.S. research universities and found differences among them, both in terms of information-seeking strategies and in the type of materials used.²⁰ Her study found a greater use of OPACs in the fields of literary theory and sociology, of databases in the field of molecular biology, and of informal sources (electronic mail requests, discussion lists), preprints, and electronic technical reports in computer science. Covi analyzed the "work characteristics in the four disciplines" and associated them with the various uses of library materials.²¹ Sanna Talja and Hanni Maula's study of two universities in Finland follows a similar line.²² These authors analyzed and explained the differences in the use of electronic journals and databases in four disciplines: nursing science, literature/cultural studies, history, and ecological environmental science. They conclude that differences are related to factors such as the size of the domain, the degree of literature scatter, and domain-specific relevance criteria.

In the humanities and certain social science disciplines, the tendency toward electronic resources, while evident, is not as pronounced.²³ This is due, in part, to the lower use of journals and greater use of books,²⁴ which have not enjoyed the same success in electronic format as journals.²⁵

Objectives

The aim of the present research was to learn the opinions of Spanish science and technology faculty about the services provided by university libraries and the use they make of them. The study is based on the hypothesis that not all library services are used or valued to the same extent and that this use and appraisal will vary substantially from one academic field to another. Our objective was, therefore, two-fold. First, we wanted to discover which services are most frequently requested and used and to uncover any differences among faculty in the pure sciences, the life sciences, and the applied sciences regarding their use of and interest in library services. Secondly, this improved knowledge of the behavior patterns and preferences shown by science and technology faculty in their use of library services would hopefully allow libraries to tailor their services to the characteristics of these users in order to offer better service and obtain higher levels of satisfaction. As Ross Housewright and Roger Schonfeld point out, "Different disciplines have dramatically different needs, interests, and priorities. An understanding of these differences must guide campus information strategy; a 'one size fits all' solution will not, in fact, fit all."²⁶

The choice of Spanish faculty for our sample population was made for several reasons. First of all, our professional work deals with Spanish information systems and services; and we, therefore, have greater access to this group of faculty for interviewing purposes. Secondly, no previous studies have investigated the use of library services



in the sphere of Spanish science and technology from a holistic perspective. This study uncovers faculty behavior and enables us to place it in a global context. Thirdly, although we are aware of the clear differences between social and human sciences and pure and applied sciences (as shown in the literature review), we start from the initial hypothesis that differences also would be found in the information behavior of faculty from different disciplines within the field of science and technologies. This study will demonstrate that such is the case.

Methodology

Some of the data used in the present study are taken from the BIQUAL project.²⁷ The aim of the BIQUAL project was to discover the perceptions and levels of satisfaction among Spanish university researchers in the areas of science and technology with regard to the services provided by university libraries, together with their habits as users and their preferences within these services.²⁸ The online questionnaire used to gather data for the BIQUAL research was divided into five sections: the first asked for the respondent's opinion on the importance of a series of library services and his or her degree of satisfaction with these services (on a scale of 1 to 5); the second section asked about the frequency with which the respondent used the library services, both in person and virtually; the third section contained a list of library services, and respondents were asked to mark those they normally used; the fourth section asked respondents to indicate which of a series of value-added services listed would be of interest to them; and finally, an open-ended question offered respondents the chance to suggest changes to improve university library services (the online survey is not currently operative).

The BIQUAL study population was first defined and characterized. It consisted of faculty in Spanish publicly funded universities working in the fields of science and technology.²⁹ The classification of knowledge areas provided by the University Coordination Council was consulted.³⁰ Science and technology areas were selected (77 of the 190 areas), with the exception of medicine, which was excluded on the grounds that it represents a complex area of knowledge and, as such, is worthy of separate study.

Once the areas had been selected, faculty from these areas were identified through the Web sites of the corresponding universities and departments. However, the resulting population was too large, and it was decided to select a representative number of universities for the sample; 19 of a potential 50 were finally selected (see appendix A). The final sample consisted of 10,276 faculty.

The questionnaires were sent out during the first five months of 2005 via electronic mail. The disadvantage of this method is that it tends to elicit a fairly poor response rate (generally in the region of 10–15 percent), but we considered it to be the most suitable method, as face-to-face administration of the survey would have been impossible, both financially and in terms of time. A total of 564 questionnaires were returned, of which 546 were valid, giving a response rate of 5.5 percent. Although this is a low figure, the total number of responses was far from negligible, particularly when one bears in mind that many studies of a similar nature have been based on fewer responses.

In our study, we started from the hypothesis that the habits of library users and their information needs would vary according to the users' subject area. In order to detect any significant differences in the habits and needs of different types of users from the



field of science and technology, the returned questionnaires were classified into three large, perfectly differentiated groups. This enabled us to detect any variations among them and to determine in what aspects they differed whenever variations arose. The three subject groups were defined accordingly: (group 1) life sciences, which covered disciplines from the fields of biology and the natural sciences; (group 2) applied sciences, from the fields of engineering and architecture; and (group 3) pure sciences, comprising physics, chemistry, and mathematics.

Three questions were used, each one referring to a specific aspect of library service:

1. Virtual/in-person library use

Respondents were asked to indicate the frequency with which they used these two forms on the following scale: "never," "fewer than 5 times a month," "between 5 and 10 times a month," and "over 10 times a month."

2. Use of a series of library services

A total of 13 library services were listed, and respondents were asked to indicate those they normally used.

3. Interest in the provision of a series of improvements for library services

From a list of 11 items, respondents were asked to indicate those they considered to be of interest to them.

The gathered data were then subjected to a quantitative analysis using the SPSS 14.0 program. A descriptive analysis of the results was first carried out to obtain the absolute and relative frequencies of the responses to each item. Subsequently, an analysis of the correlations between the items was performed to discover if there were any relation among them. Because these were binary data, neither Pearson nor Spearman correlation coefficients were appropriate; these are designed for use with quantitative and ordinal data, respectively. Consequently, we applied the Jaccard index, also known as the Jaccard similarity coefficient, which measures similarity between variables or cases for binary data. This index ignores conjoint absence and gives equal weighting to concordances and discordances. The index is calculated with the formula:

$$J = a / (b + c + d), \text{ } a = \text{common appearances, } b = \text{appearances exclusive to group 1, } c = \text{appearances exclusive to group 2, and } d = \text{no common appearances.}$$

Contingency tables were used to compare responses to each item in order to identify any significant differences in the habits and preferences of faculty from each of the three disciplinary areas analyzed. This process revealed the aspects in which the groups differ and those in which they coincide. We used chi-square tests for each item in order to observe the differences among the three groups in each item and because the questionnaires provided binary data; as a result, we were only able to work with proportions of the population (the proportion of respondents in each group that use or prefer a service).³¹

In January 2007, a qualitative analysis was carried out in light of the results of the quantitative study. This was performed with the help of a focus group of librarians who provided their thinking about the reasons for the results obtained. The librarians were all working in science and technology faculties or in professional colleges and were, therefore, familiar with this type of user and had an in-depth knowledge of their habits, tastes, and preferences.



Results

In-Person/Virtual Use of Library Services

The first question referred to the use respondents made of library services, both in person and virtually. The results appear in tables 1 and 2.³² The tables show a fairly scarce physical use of library services in all three groups; most respondents (66.8 percent) claim to use these services fewer than five times a month. However, virtual service usage is noteworthy; 27.9 percent of the respondents use these services between five and 10 times a month, and 45.7 percent use them over 10 times a month. This result is due to the pronounced growth in the electronic information format over recent years and a preference on the part of the research community for library use at a distance. The convenience and speed with which people can access the information they need via their computer, without having to actually visit the library premises and with no timetable restrictions, have clearly influenced this preference. Although the tendency toward a greater virtual use of library services is very similar in the three groups, certain differences can be ascertained. In the case of pure sciences, use of library services in person is slightly higher than in the other two groups.

The responses provided by the pure science and life science groups about their use of virtual services were very similar. However, less use was detected in the area of engineering and architecture; only 36.6 percent of this latter group used virtual services more than 10 times a month, in contrast to almost 50 percent in the other two groups.

Although the tendency toward a greater virtual use of library services is very similar in the three groups, certain differences can be ascertained.

Use of the Various Library Services

In the second section of the questionnaire, respondents were asked to indicate the specific services they normally used. The results are shown in appendix B, together with the results of the contingency tables: the χ^2 index (p-value, $\alpha = 0.05$), degrees of freedom and asymptotic significance.

The use made of library services is very similar across the three groups. The highest user rates (over 60 percent) were access to electronic journals and database consultations for virtual services and consultation, photocopying of journal articles, and book consultations for physical services.

Significant differences only appear in three of the 13 services listed in the questionnaire:

- Consultation of audiovisual, cartographic, and other special materials
This is notably higher in the engineering and architecture group (20.8 percent as compared to 12 percent in life sciences and a very low 3 percent in pure sciences). According to the librarians consulted, scant use is made of audiovisual material in general, but engineers and architects are more likely than other disciplines to use types of material such as plans and maps.

Table 1.
Use of library services in person

	Never	Fewer than 5	From 5 to 10	Over 10	No respons	Total answers
Life sciences	6 (4.6%)	97 (73.5%)	21 (15.9%)	8 (6.1%)	18	132
Engineering and Architecture	24 (12.2%)	125 (63.5%)	43 (21.8%)	5 (2.5%)	15	197
Pure sciences	4 (2.5%)	106 (65.4%)	34 (21.0%)	18 (11.1%)	22	162
Total	34 (6.9%)	328 (66.8%)	98 (20.0%)	31 (6.3%)	55	491

Table 2.
Virtual use of library services

	Never	Fewer than 5	From 5 to 10	Over 10	No respons	Total answers
Life sciences	8 (6.2%)	21 (16.3%)	36 (27.9%)	64 (49.6%)	21	129
Engineering and Architecture	19 (9.6%)	51 (25.9%)	55 (27.9%)	72 (36.6%)	15	197
Pure sciences	5 (3.1%)	25 (15.4%)	45 (27.8%)	87 (53.7%)	22	162
Total	32 (6.6%)	97 (19.9%)	136 (27.9%)	223 (45.7%)	58	488



- **Consultation and photocopying paper format journal articles**
Two-thirds of researchers in the areas of pure and life sciences claimed to use this service, whereas the number was significantly lower (below 50 percent) for engineering and architecture faculty. Although electronic journals are welcomed by the university community (rates of use in the three groups are close to 65 percent), it appears that they have not completely replaced the paper format journal, for two main reasons. First of all, not everyone has changed to the virtual library system; and, second, not all periodical publications are available in electronic format. The reason for the lower use of this service among engineers and architects may be two-fold: their general lower use of services in person and fewer journals in these disciplines have an electronic version.
- **Use of the researchers' room**
As with the two previous services, this is lower among engineering and architecture researchers. The librarians who participated in the focus group suggested that this result might also be due to the lower use these researchers make of the library in person. A higher, yet still moderate, use is made of this service by researchers in the pure sciences.

Interest in Value-Added Library Services and Improvement Actions

Broadly speaking, the results reveal that faculty are particularly interested in seeing an increase in the electronic journal and document collection, the digitization of the most requested books/articles in their field to provide greater possibility of access, and the receipt of regular information and bibliographical references relating to their teaching and research topics (over 50 percent). However, little interest was shown in information-seeking skills and knowledge training (information literacy) or information regarding research groups working in their field of interest, projects in their areas of expertise, or relevant conferences.

Differences among the three groups' interest in value-added library services and improvements were greater than those regarding the use of existing services (see appendix C). As in the use of services, the areas of engineering and architecture differed from the other two groups.

The most significant differences were found in the following areas:

- **An increase in the electronic format collection**
All three groups were interested in seeing the collection grow, although interest was lower in the case of engineering and architecture (60.9 percent, compared to 75 percent and 78 percent in pure sciences and life sciences, respectively). Given that this group, according to the results of this survey, use paper format journals and in-person services less frequently, use inter-library loan to a somewhat lesser extent, and use electronic journals to a similar degree as the other two groups, we are inclined to believe that they are more satisfied with the electronic collection already available to them.

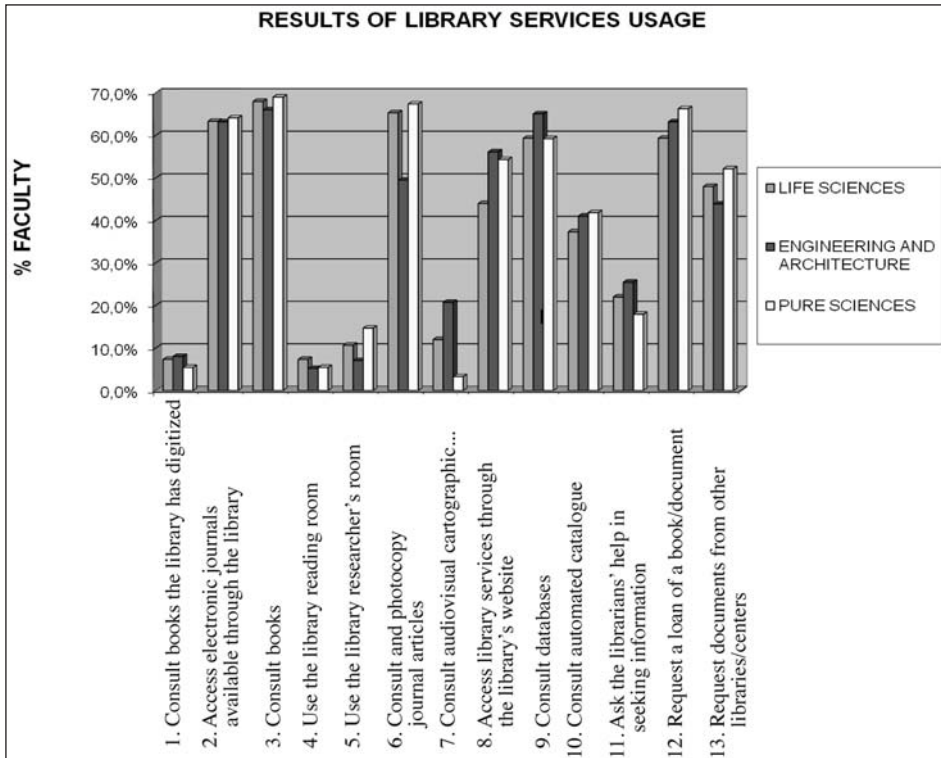


Figure 1. Results of library service usage

- Selection and distribution of documents of interest
Lower interest in this service was noted in pure sciences (30.4 percent), possibly due to the greater information-seeking autonomy of researchers in this group. Engineering and architecture faculty expressed a higher interest in this service (48.6 percent). The focus group librarians perceived higher levels of interaction and communication with engineering and architecture faculty, a factor that may encourage greater levels of trust in the librarian as an information supplier, thereby explaining this result.
- Regular information on subjects of interest, conferences, and projects
Interest shown by the engineering and architecture group in these three services was higher than in the other two groups, thus bearing out the view

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expressed above regarding the level of trust in the librarian among faculty from these areas. Considering that the result for this group in item 16 indicates little interest in receiving training in information skills (28.8 percent), the reason for these results is not likely to be due to lower skill

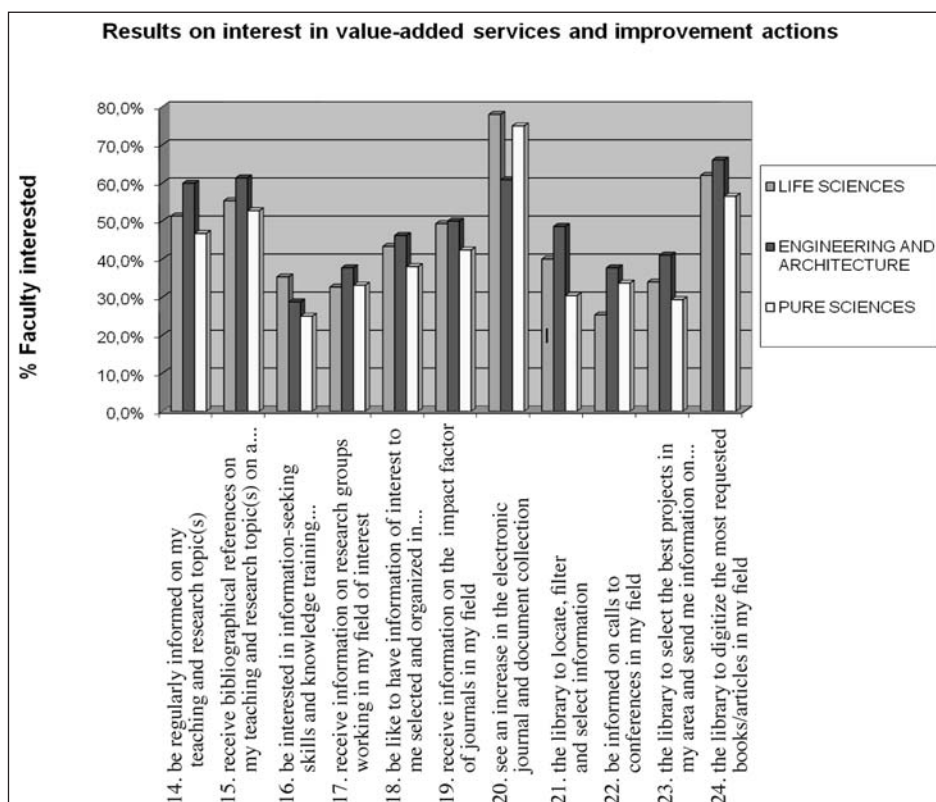


Figure 2. Results on interest in value-added services and improvement actions

levels in information-seeking techniques. The item referring to the provision of information on conferences attracted less interest from the life sciences group, which we believe is due to their greater autonomy in locating this type of information.

Relation Between the Variables

The relation between the items (variables) was analyzed using the Jaccard similarity index because we were dealing with binary data. A relatively strong relation can be seen in three pairs of variables: the use of electronic journals (item 2) and the use of bibliographical databases (item 9) have a similarity index of 0.72 in this study. This result is to be expected, given that the researcher normally first consults specialized databases when searching for journals with information on a particular subject. Furthermore, many databases provide a direct link from the search results to the full-text version of the article. Interest in receiving regular information on teaching and research topics (item 14) and bibliographical references (item 15) are also closely related (0.709), which again is fairly logical since the two services are in essence quite similar. Consultation of paper format books (item 3) and loan of materials (item 12) have a Jaccard similarity index of 0.70. This relation is explained by the fact that the bulk of the material that libraries loan consists of books, and a strong relation would, therefore, be expected.

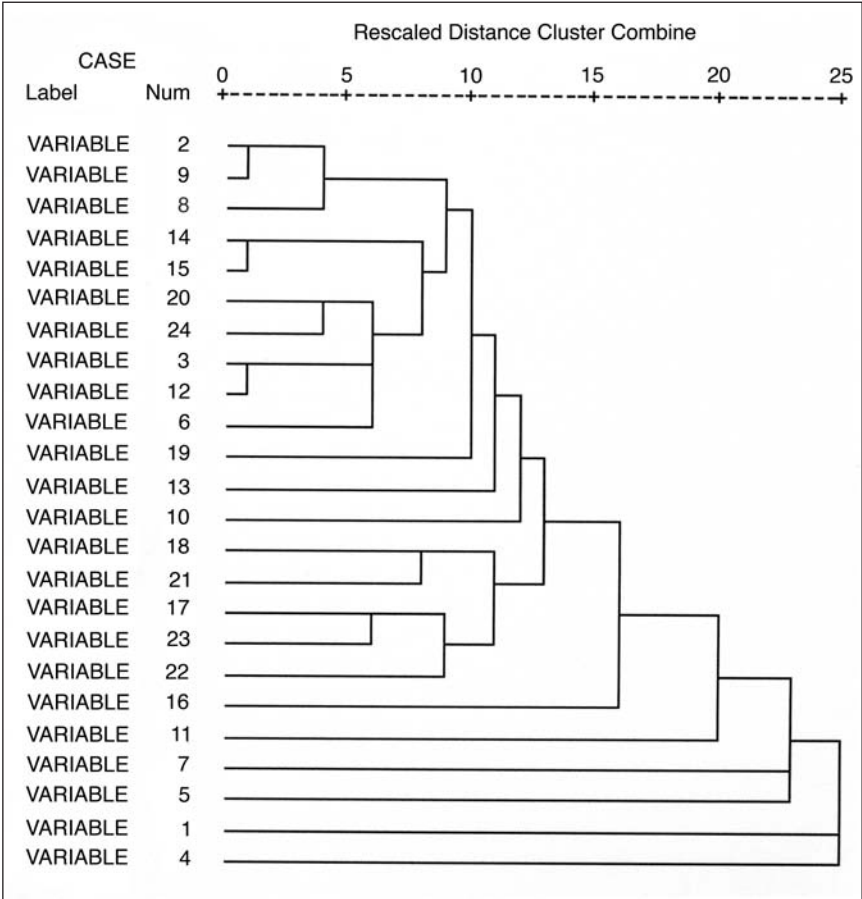


Figure 3. Dendrogram of similarities between variables

The remaining pairs of variables show lower similarity indexes. However, as seen in the dendrogram (figure 3), item 8 (use of the library Web site) is also related to items 2 and 9, and interest in increasing the electronic collection is related to interest in greater ease of access to books and articles through digitization.

Discussion

The results of this study indicate that Spanish faculty are following the trend already identified in previous works from other countries, namely that, in general, electronic library resources are meeting with a favorable reception among the scientific and academic communities,³³ particularly in the case of e-journals. In this vein, our results on e-journal use (63.5 percent) reveal a similar pattern to those of another Spanish study by Angel Borrego et al. that found that most faculty in Catalonia use e-journals mainly or exclusively (52 percent), 28 percent use print and electronic formats similarly, and that use of e-journals is higher in science disciplines than in the social sciences and humanities.³⁴ Our findings also coincide with studies undertaken in other countries that



reveal e-journal use to be one of the most popular library services. In a survey carried out at the University of Istanbul, Hulya Dilek-Kayaoglu identified a greater use of e-journals (64.1 percent) than print journals (22 percent) and a higher acceptance of the former among science faculty than in the social sciences and humanities.³⁵ Also, in the late 1990s, Deborah Lenares reported that 90 percent of physical science faculty used electronic journals at least part of the time, compared with 61 percent of all faculty users in ARL universities.³⁶

Differences among faculty users of virtual library services according to scientific field have also been highlighted in other studies. Leigh Watson Healy provided further information about disciplinary differences, suggesting that 66 percent of law faculty used electronic resources for research all or most of the time, compared with 56 percent of business faculty, 48 percent of biological science and engineering faculty, 46 percent of physical sciences, 37 percent of social sciences faculty, and 25 percent of faculty in arts and humanities, whose preference for print format persisted.³⁷ Brown also noted certain differences between mathematicians and respondents from the other disciplines with regard to the type of resources used regularly; in addition to electronic journals and databases, mathematicians also made frequent use of monographs, preprints, and informal communication. This group was also found to use the library less in person than the other groups in the study.³⁸

These differences in virtual library service use increase when the sciences are compared with the social sciences or humanities.³⁹ Because our study focused solely on three branches of science and technology, significant differences in e-journal and database use did not emerge. The only differences between the three groups were found in their use of certain in-person services.

The use of e-books among Spanish science and technology faculty is very low, with rates of around 7 percent, in line with other studies.⁴⁰ Regarding this issue, the focus group formed in Danielle Carlock and Anali Perry's study revealed that faculty had generally unsatisfactory experiences in using e-books in their research and teaching owing to the unreliability of access, lack of manipulability, and the steep learning curve of the various interfaces.⁴¹

The results of our study reveal a growing use of virtual library services, coinciding with Hiller's findings regarding a decrease in physical visits to the library by graduate students and faculty, especially in health sciences, science, and engineering.⁴² The positive reception of electronic formats has not entailed an abandonment of traditional formats and in-person library services. This tendency was noted in the report "Researchers' Use of Libraries and other Information Sources: Current Patterns and Future Trends,"⁴³ which showed that engineering and physics faculty in the United Kingdom set great store by paper format journals (96 percent) and books (77 percent), more so even than e-journals (62 percent). In the same vein, Don Dickenson's Colorado academic library study of undergraduate students and faculty from nine colleges and universities uncovered greater preferences for traditional print resources (87 percent) than for e-journals (61 percent).⁴⁴

The positive reception of electronic formats has not entailed an abandonment of traditional formats and in-person library services.



Our results concerning researchers' priorities for improving library services confirm the general trend of a strong preference for increased collections.⁴⁵ However, in contrast to the Ithaka study results regarding the librarian's role as an information-search mediator, which revealed a very low evaluation of this function, our results demonstrate that, in certain areas, faculty do request the librarian to provide them with information and bibliographical references in their scientific field.⁴⁶

The book in its traditional form continues to enjoy favor among users, and print format journals are still frequently consulted. In this vein, we agree with Ziming Liu's assessment that "users desire a hybrid information environment in which online information does not supplant information in print but adds new access opportunities for users to choose. Digital libraries and traditional libraries have their unique advantages and limitations; they satisfy the information needs of users in different circumstances."⁴⁷

Despite the limitations of this study, owing to the sample size and low response rate, it has shown us that some library services are used more in certain subject areas than in others and that interest in value-added services and improvements vary from

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one discipline to another. Through this research, we have attempted to identify how specific aspects of usage and preferences vary among the groups studied. Thus, we have seen how the area of engineering and architecture differs quite appreciably from the areas of pure sciences and life sciences, whereas the responses gathered from

the latter two areas are fairly similar. Although virtual use of library services is greater than physical use in all three areas, virtual use by engineering and architecture faculty is not as frequent as in the other two groups. It should be noted that not all library resources are available in electronic format, chiefly occasional papers, certain special materials, and older journals in the fields of science and technology; however, up-to-date information is essential, and today almost all of the information these researchers need is available in electronic format.

The results of this research lead us to think that, as a group, engineering and architecture faculty have a higher level of trust in the librarian as an intermediary in the information-seeking process. They express a greater interest in the librarian providing regular information on a range of issues related to their teaching and research fields, particularly information that does not strictly form part of the library collection (Internet resources, research groups working in the same areas of research, and so on). This group also uses certain library services less frequently in person, such as the researchers' room or the use and consultation of print journals, but they do make higher use of plans and maps.

Conclusion

Preferences and usage of library services and resources may vary from one group to another owing to various factors, ranging from subject area expertise to the level of information literacy, as well as a person's professional situation or age.⁴⁸ However, al-



though all these factors have an influence, the researcher's scientific field is of particular consequence because the scientific discipline is what determines both the procedures he or she follows in undertaking research and the information needs specific to his or her investigations. A review of the scientific literature reveals substantial differences between the preferences and uses of faculty working in the human and social sciences and those working in the hard sciences and engineering, particularly in terms of information source's consulted. Information professionals must take into account the differences among the disciplines in each of these large areas. Information-seeking behavior studies are excellent tools with which to determine not only the behavioral trends of general library use, either focusing on specific library services or the complete range of services offered, but also the particular features of different user groups, which if they are clearly defined, allow behavior profiles to be identified.

What is clear is that, for librarians to be able to provide quality services, they must know their users, their characteristics, habits, needs, and preferences. Such knowledge will make them well prepared and able to make decisions that will personalize the services they provide and increase user satisfaction to its highest possible level. To this end, an awareness of the behavior and needs of scientists from each subject area is fundamental.

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Acknowledgements

The authors are grateful to the Spanish Ministry for Science and Technology (SEC 2002-03092) for the financial support given to undertake this research. The authors would also like to thank Mary Savage for her translation of this paper and would like to thank the editors and the two referees for their constructive comments from which our paper has benefited greatly.



Appendix A

Table 3.
Universities

Alcalá de Henares	Málaga
Autónoma de Barcelona	Oviedo
Autónoma de Madrid	Politécnica de Cataluña
Cádiz	Politécnica de Madrid
Cantabria	Santiago
Complutense de Madrid	Sevilla
Córdoba	Valencia
Granada	Vigo
Jaime I	Zaragoza
León	

Table 4.
Results of library service usage

ITEM	TOTAL	Life sciences	Engineering and architecture	Pure sciences	χ^2 index	df	Asym. sig.
1. Consult books the library has digitized	38 (7.0%)	11 (7.3%)	17 (8.0%)	10 (5.4%)	1.060	2	0.588
2. Access electronic journals available through the library	347 (63.6%)	95 (63.3%)	134 (63.2%)	118 (64.1%)	0.041	2	0.980
3. Consult books	369 (67.6%)	102 (68.0%)	140 (66.04%)	127 (69.0%)	0.417	2	0.812
4. Use the library reading room	32 (5.9%)	11 (7.3%)	11 (5.2%)	10 (5.4%)	0.824	2	0.662
5. Use the library researchers' room	58 (10.6%)	16 (10.7%)	15 (7.1%)	27 (14.7%)	5.991	2	0.050
6. Consult and photocopy journal articles	327 (59.9%)	98 (65.3%)	105 (49.5%)	124 (67.4%)	15.636	2	0.000
7. Consult audiovisual, cartographic or other material	68 (12.5%)	18 (12.0%)	44 (20.8%)	6 (3.3%)	27.688	2	0.000
8. Access library services through the library's website	285 (52.2%)	66 (44.0%)	119 (56.1%)	100 (54.4%)	5.696	2	0.58



Table 4, continued.

ITEM	TOTAL	Life sciences	Engineering and architecture	Pure sciences	χ^2 index	df	Asym. sig.
9. Consult databases (Web Science, INSPEC, Chemical Abstract, ICYT, IEEE etc.)	336 (61.5%)	89 (59.3%)	138 (65.1%)	109 (59.2%)	1.852	2	0.396
10. Consult the automated catalogue	220 (40.3%)	56 (37.3%)	87 (41.0%)	77 (41.9%)	0.780	2	0.677
11. Ask for the librarians' help in seeking information	120 (22.0%)	33 (22.0%)	54 (25.5%)	33 (17.9%)	3.263	2	0.196
12. Request a loan of a book / document	345 (63.2%)	89 (59.3%)	134 (63.2%)	122 (66.3%)	1.726	2	0.422
13. Request documents from other libraries / centers	261 (47.8%)	72 (48.0%)	93 (43.9%)	96 (52.17%)	2.727	2	0.256
TOTAL	2806	756	1091	959			



Appendix C

Table 5.

Results on interest in value-added services and improvement actions

ITEM	TOTAL	Life sciences	Engineering and architecture	Pure sciences	χ^2 index	df	Asym. sig.
14. I would like to be regularly informed on my teaching and research topic(s)	290 (53.1%)	77 (51.3%)	127 (59.9%)	86 (46.7%)	7.120	2	0.028
15. I would like to receive bibliographical references on my teaching and research topic(s) on a regular basis	310 (56.8%)	83 (55.3%)	130 (61.3%)	97 (52.7%)	3.147	2	0.207
16. I would be interested in information-seeking skills and knowledge training (information literacy)	160 (29.3%)	53 (35.3%)	61 (28.8%)	46 (25.0%)	4.306	2	0.116
17. I would like to receive information on research groups working in my field of interest	190 (34.8%)	49 (32.7%)	80 (37.7%)	61 (33.2%)	1.326	2	0.515
18. I would be like to have information of interest to me selected and organized in a							

Table 5, continued.

ITEM	TOTAL	Life sciences	Engineering and architecture	Pure sciences	χ^2 index	df	Asym. sig.
subject-based portal or dossier for teaching or research purposes	233 (42.7%)	65 (43.3%)	98 (46.2%)	70 (38.0%)	2.733	2	0.255
19. I would like to receive information on the impact factor of journals in my field	258 (47.3%)	74 (49.3%)	106 (50.0%)	78 (42.4%)	2.647	2	0.266
20. I would like to see an increase in the electronic journal and document collection	384 (70.3%)	117 (78.0%)	129 (60.9%)	138 (75.0%)	15.284	2	0.000
21. I would like the library to locate, filter and select information (Internet, articles, congresses, books, audiovisual) and send me the original documents I am interested in.	219 (40.1%)	60 (40.0%)	103 (48.6%)	56 (30.4%)	13.510	2	0.001
22. I would like to be informed on calls to conferences in my field	180 (33.0%)	38 (25.3%)	80 (37.7%)	62 (33.7%)	6.181	2	0.045
23. I would like the library to select the best projects in my area and send me information on them.	192 (35.2%)	51 (34.0%)	87 (41.0%)	54 (29.4%)	6.027	2	0.049



24. I would like the library to
digitize the most requested
books/articles in my field to
increase access possibilities

TOTAL	337 (61.7%)	93 (62.0%)	140 (66.0%)	104 (56.5%)	3.782	2	0.151
	2753	760	1141	852			



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