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Library Technologies

Diffusion and Perceived Advantages of CD-ROM, Online Databases, and Print Sources in the Libraries of New York State

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This research examines change agents' and opinion leaders' perceptions of CD-ROMs, online databases, and print sources in the academic library environment. The change agents and opinion leaders are librarians who advocate and influence the purchase decisions regarding computerized information systems. From a survey of librarians' perceived advantages of CD-ROM, online, and print sources and a comparison of the findings to the literature, it is evident that CD-ROM surpasses both online and print sources in terms of cost, ease of use, speed, convenience, compatibility, and testability. CD-ROM may possibly be the most adopted information system in libraries for the future.

Both online and CD-ROM database systems have become essential tools for research and information gathering in many of today's libraries. The older of the two, online databases, were developed fifteen years ago and seem to be more up-to-date in terms of the information provided. CD-ROM (Compact Disc Read Only Memory), which was not readily available for library services until 1985, provides greater ease and thoroughness for the novice researcher. Therefore, CD-ROM is often considered as the major electronic information search tool in the library environment for the 21th century. While both library electronic technologies provide fast and convenient services, the role of some print sources is in question. This study examines library opinion leaders' and change agents' (librarians) perceived relative advantages of these three systems to predict future trends in library technology.

OPINION LEADERSHIP IN ADOPTION OF INNOVATION

When an innovation is adopted by an organization, it is usually modified to fit in the environment of the organization (Rogers, 1983). Furthermore, the organization may need to change to accommodate the innovation. CD-ROM and online systems in the libraries are good examples. During the past few years, there was tremendous growth in the development and adoption of CD-ROM and online databases in the libraries. In order to provide the more effective and efficient information services for their

clients, libraries engaged in training programs for reconstructing of their information systems. Such modifications originated from the change agents and opinion leaders within the organization. Many librarians in academic libraries are the change agents or opinion leaders who influence innovation decisions formally or informally.

The Commissioner of Libraries of the Commonwealth of Pennsylvania, Parker (1991, p. 51), described himself and other participants in the American Library Association as change agents. "A change agent is an individual who influences clients' innovation decisions in a direction deemed desirable by a change agency" (Rogers, 1983, p. 312). Moreover, "all of these change agents provide a communication link between a resource system of some kind (commonly called a change agency) and a client system" (Rogers, 1983, p. 313). Being the change agents who influenced the adoption decision of computerized information systems, many librarians have presented their opinions in the library associated journals.

In addition to change agency, some librarians exercise the role of opinion leadership with regards to the adoption decisions of computerized information systems. Opinion leadership, according to Rogers (1983, p. 271), is "the degree to which an individual is able informally to influence other individuals' attitudes or overt behavior in a desired way with relative frequency."

THE PERCEIVED ADVANTAGES AND DISADVANTAGES OF ONLINE, CD-ROM, AND PRINT SOURCES

The following sections summarize and analyze the existing literature on the perceptions of the library change agents and opinion leaders in terms of CD-ROM, online databases, and print sources. Their opinions represent, reflect, and affect most librarians' purchase decisions of library information sources.

CD-ROM

CD-ROM, an optical technology, stores about 550 megabytes of data, which approximately corresponds to 200,000 pages of text (A4) or about 1,400 3.5" floppy disks. CD-ROM provides a means of performing both mediated and non-mediated searches without telecommunication charges or extensive training of novice searchers. The traditional CD-ROM arrangement consists of a CD-ROM based workstation. The workstation contains a microcomputer (complete with keyboard and monitor), a CD-ROM drive, and the selected disc (database).

Generally, CD-ROM has the following capabilities (Peters, 1987). First, the random access and still-framing capability of the ROM drive, while under microcomputer control, allow brief tutorials on database searching for the novice user. Second, for the CD-ROM vender, CD-ROM's read-only memory is an opportunity to control the secondary use of the information contained in the database, since it is impossible to completely replicate the data and the search software. Third, full-text and field-specific

searching allow the user to develop sophisticated strategies for seeking the information contained within the CD-ROM format. Forth, CD-ROM offers advantages to all types of database users by providing electronic access to large files of historical information required for comprehensive searches of topics without incurring telecommunication charges. Fifth, CD-ROM opens library resources to greater use by allowing end users to experiment with the strategies needed to search electronically-published databases at less than online prices. In terms of price, CD-ROM is preferred by the librarians because it

> eliminates the expense of long distance telephone charges that were previously incurred in performing online searches for the same information. The use of CD-ROM (1) provides administrators with a predictable budget line, (2) eliminates the concern over "how fast the clock is ticking" when a student or teacher conducts a lengthy search, and (3) eliminates costs associated with the downloading or off-line printing of citations (Epler & Cassel, 1992, p. 117).

Online Information Systems

According to Garman (1990, p.6),

> Online is an old data processing term, frequently hyphenated as "on-line". In the historical context, its broadest definition has meant anything that is linked by wire in a host-to-terminal configuration, with real-time interaction between the two. Online was Online regardless of whether the host and terminal were across the room, upstairs in the same building, or a thousand miles away... The beauty and strength of the term "Online" is its ability to encompass the diverse range of automated information retrieval processes that have developed in the past twenty years or so and its potential to serve as an umbrella term for some emerging technologies.

In the past, online searching was power in hands of the few, since it was considered too complicated or expensive to disperse

among all library professionals (Barnett & Siegel, 1988). Accordingly,

> Many experienced professionals in the field of Online literature searching have expressed the opinion that only the most intelligent and personable of information professionals can be good search intermediaries, as Online searching is a difficult and demanding task, involving both cognitive and communicative challenges. (Bellardo, 1985, p. 225).

Today, online searching is not a restricted activity, and concern about precise, carefully planned searches has given way to discussions of how to train and manage end-users (Garman, 1990). In the future, "online is capable of expanding to adequately encompass many of the changing technologies of the 90s and beyond-better than any similar term" (Garman, 1990, p. 8). The most prominent characteristic of online information systems is its ability to search and locate the most current information on various topics.

Print Sources

In light of today's technologies, Havener (1990, p. 22) has asserted that "using print sources when computerized sources are available is equivalent to using a goose quill pen instead of a word processor." Based on this statement, the question is raised as to whether print sources are necessary when computerized sources provide the same information? Will people solely depend on electronic information systems? When making the transition from traditional information sources to computerized information systems, what problems will people encounter? How will people

cope with these problems? How would they perceive these information sources?

Comparing CD-ROM with Print Sources

Although some CD-ROM databases contain the same information as their printed equivalents, methods of information retrieval differ. By using print sources, users may browse through the book to pick up information on their topics. On the other hand, by using CD-ROMs, users may access many different points of retrieval including subject, title, abstract, journal name for articles, and language. However, browsing through a CD-ROM source requires more effort on the part of the user, usually a keystroke, to scan the material.

Many CD-ROM users discontinued the use of printed versions because of the ease of CD-ROM use. However, Demas (1987) concluded that the CD-ROM version of Books in Print could not replace the printed version until it became more user friendly and accessible to more than one per workstation.

Salomon (1988) found that about 24% of reference chairpersons in 150 academic libraries believed that CD-ROM would replace the print version of ERIC, Books in Print, and Dissertation Abstracts International. Only 17% believed this would happen for the Business Periodicals Index within five years. About 35% felt CD-ROM would not replace any of the print sources.

Comparing Online with Print Sources

Havener (1990) studied 68 librarians at 38 different libraries in 16 states and the District of Columbia. The librarians were provided questions to search for information from either print sources or online databases. For all conceptual questions, subjects were asked to provide 10 relevant citations. The print group averaged 11.5 minutes per question. In contrast, the online group required only 9.2 minutes per question. The study concluded that (Havener, 1990, p. 25):

> The time savings achieved by using Online rather than print sources doubled when the number of concepts being searched increased from one to two. Moreover, subjects in the Online group supplied over 87% of the requested citations while those in the print group supplied under 74% of the requested citations.

Additionally, the results indicated that the relative benefits of using print and online tools varied according to question type. Print sources were more efficient in answering factual questions, but online databases were more efficient in answering conceptual questions.

Two guidelines for using print and online sources were postulated: (Havener, 1990, p. 26)

> (1) When bibliographic information is available in both print and Online formats, Online sources should be the tools of choice. This is true even for simple one-concept questions, but the advantage of using Online is even more marked for multiple-concept questions. (2) Simple factual queries can be answered more quickly using print sources than going Online.

Comparing Online with CD-ROM

Change agents and opinion leaders perceive differently of CD-ROM

and online databases. Some of them believe that CD-ROM is more competitive than online databases. Although they perceive online and CD-ROM to be similar in equipment cost, both online and CD-ROM require maintenance fees, staffing, patron training, logistical expenses, space, and security; however, staffing, security, and searching costs are higher for online than CD-ROM. In some cases, these costs are passed on to the user. Since price is extremely important to the student patron, fees for database services may affect what services they select. Thus, if a library adds an information database and charges for its use, students will be less likely to use it than one without a fee.

In most cases, CD-ROM is provided to the user without direct cost. This allows the researcher to work in a less threatening environment, since there is no reason to calculate the connect time charges or record the number of searches completed. Moreover, CD-ROM is an excellent environment for learning and experimenting with the techniques of computerized literature searching.

In addition to the cost, online has other drawbacks. Librarians usually perceive online communication as more cumbersome than CD-ROM. They realize that online connection problems are very demanding of staff time by requiring a high level of expertise. These problems often can not be solved by part-time staff members and student workers. However, with CD-ROM, it is easier to train staff to change CD-ROMs and make modifications at the workstations.

Rapp et al. (1990) presented an overview of the nationwide field evaluation of MEDLINE products on CD-ROM. Although some users expressed a preference for online searching, a substantial number preferred the CD-ROM system. Over 50% of users claimed they would choose CD-ROM the next time they had a similar information need. Preferences for CD-ROM may change as it becomes more, widespread and word-of-mouth increases awareness. Several reports mentioned that library staffs use CD-ROM instead of online databases for simple searches, pre-search testing, and bibliographic verification.

However, some change agents and opinion leaders believe that currently, CD-ROM has its problems. On one hand, there is waiting problem. Studies show that the most frequent complaint the librarians hear from CD-ROM users is "I had to wait 15 minutes/30 minutes/an hour before I could use the databases" (Anders & Jackson, 1988, p. 30). On the other hand, given the circumstance that the library paid half the connect costs and the user paid the remainder of the connect costs plus all printing costs, Anders and Jackson (1988) found that the majority of these end-users will search for information in the online database. In their study, many students perceived online to be superior than CD-ROM. They agreed and thought that until the clock speed of the CD-ROM microcomputers was increased, online was certainly faster.

According to Garman (1990), when CD-ROMs are composed of the same databases, use similar search software and protocols, and

require the same searching techniques and patterns as online systems, CD-ROM will never replace online. CD-ROMs cannot compete in scope and price with the excellent classroom rates and programs offered by the online services. In the future, however, Garman (1990) predicts that newer technology will present more competition through CD-ROMs, in an arena where they really surpass online: the graphic and audio capabilities of multimedia.

In summary, the major advantages of CD-ROM, when compared with online databases in the library environment, are ease of use and low cost. While the major advantages of online systems is speed and currency. Generally, CD-ROM enables librarians to offer the benefits of computer-assisted searching to very large numbers of students and faculty with a low cost or no cost. This is a service librarians "have not been able to do in the past, given the numbers of the users and the pricing structure of remote online services" (Bristow, 1988, p. 25).

Comparing Print Sources, CD-ROM, and Online

When comparing the print, online, and CD-ROM versions of a single reference tool, Pooley (1987) identified three factors that distinguish these systems: (1) Content: the content of the printed version may only represent a subset of the online or CD-ROM counterpart; (2) Currency: to update a CD-ROM, a new disc must be manufactured, but online databases are frequently updated on a weekly or even daily basis; and (3) Price: the cost of an online search depends on online connect time, the amount of

citations printed on- or off-line, and the telecommunications costs. In comparison, CD-ROM has a set price and it is not on a "pay-as-you-go" basis.

In regard to users' choice of print sources, CD-ROM, or online system, Rapp et al. (1990, p. 180) found that when asked "how users would have gotten the information they needed if the CD-ROM system had not been available," over half the library users selected print sources, at six of the 13 test sites. When looking at online searching as the alternative, seven of the test sites (Rapp et al., 1990) showed 26-50% of the users would have conducted an online search if the CD-ROM system had not been available, and at the remaining six sites, 15-25% of the users would have chosen online. From the results of the above research, it is implied that, generally, CD-ROMs are the most favorable, print sources are the second, and online systems are the least favorable tool from the library users' point of views.

PROBLEM STATEMENT AND RESEARCH QUESTIONS

Librarians' perceived advantages of information sources has a great impact on their adoption decisions. Based on prior research (Demas, 1987; Pooley, 1987; Anders and Jackson, 1988; Salomon, 1988; Rapp et al., 1990; Garman, 1990; Havener, 1990), library change agents and opinion leaders suggested that there should be different perspectives for librarians and end-users to favor CD-ROM, online system, or print sources.

How CD-ROMs, online systems, and print sources are perceived

by librarians and end-users? Specifically, given the previous literature, researchers found online systems to be the most up-to-date among the three; however, CD-ROMs to be easy to use and less costly. Moreover, print sources were favored when conducting simple factual queries. To verify their findings, the following research questions are proposed.

RQ1: From the library's and the patron's point of view, what are the librarians' perceived advantages of CD-ROM, online and print sources?

RQ1a: Specifically, how do librarians perceive CD-ROM, online and print sources in terms of their cost, speed, thoroughness, currency, ease of use and as the ideal information source from the patron's perspective?

RQ1b: From the library's point of view, how do librarians perceive CD-ROM, online and print sources in terms of their convenience, compatibility, testability for staffs, testability for end-users, training, cost and as the ideal information source?

PROCEDURES

To examine the relative advantages and disadvantages of the three different information sources, a survey of librarians as opinion leaders or change agents in the adoption process was conducted. Before the questionnaire was constructed, interviews were held with ten academic libraries from private schools in upstate New

York. Three areas were covered in the interview: (1) Information about the decision process regarding adoption or nonadoption of CD-ROM and online databases (e.g., how/why/when decisions were made, who was involved); (2) The librarians' perceptions of the advantages and disadvantages of CD-ROM, print sources and online databases; and (3) Information about current usage (e.g., usage levels, instruction, user access). Based on the result of the interviews, a formal questionnaire was formulated.

The questionnaire asked the librarians to compare the advantages of: (1) the CD-ROM systems, online databases, and print sources from the patron's point of view; and (2) the three information systems from the library's point of view. They were asked to rate the three systems from the patron's viewpoint with respect to their: (1) low cost to user, (2) speed, (3) thoroughness, (4) up to dateness, (5) easy for patrons to use, and (6) ideal for user on a scale of 0 to 10, where 0 represents no advantage and 10 stands for maximum possible advantage. Based on the same scale, the respondents were asked to evaluate the advantages of the three systems from the library's viewpoint in terms of the system's: (1) convenient for library staff, (2) compatible with library service mission, (3) could be (or were) tested by staff before adoption, (4) could be (or were) tested through end-user trials, (5) require little training of patron end-users, (6) low cost to library, and (7) ideal for library.

The sample included 75 libraries in the State University of New York SUNY system. The SUNY system is composed of University

Centers, Colleges, and Community Colleges through out New York State. Basically, University Centers focus on research and graduate academic activities; Colleges emphasize undergraduate education; whereas Community Colleges are offering interdisciplinary studies, transfer programs and job-related classes. The questionnaire addressed to the head of reference librarian was mailed to the 75 libraries in November 1990 with the letter emphasizing the importance of the research. 67 libraries (89%) returned and completed the questionnaires by May 1991.

Means and standard deviations of the perceived relative advantages of the three information systems were displayed and compared. T-tests were employed to assess the significant differences among the three information sources in terms of their perceived relative advantages. Correspondence analysis was used to compare the attributes in association with each information source.

Correspondence analysis is a multivariate descriptive statistical method that graphically displays the rows and columns of a categorical data matrix in the same low-dimensional coordinate space (Hoffman & Franke, 1986). It also may be used for ordinal, interval, or ratio data. First, correspondence analysis normalizes the given matrix by pre and post multiplication by the square root of the reciprocals of the row and column sums. Second, chi-square distances are then computed on this matrix. Third, the distances are orthogonally decomposed

and centered to produce a matrix of distances. Finally, a map simultaneously displaying both the row and column may be constructed from the matrix (Barnett, 1993, p. 4).

Barnett and Danowski (1992, p. 270) explained how correspondence analysis is able to represent its results graphically in the following way:

> The squared distances between the points in the resultant space bear a simple relationship to the original data such that the scores of two row categories are close together if their corresponding rows are more similar. It is a discrete principal components analysis or a singular value decomposition of a matrix of chi-square distances. The decomposition produces a set of coordinates from which the nodes' location in the coordinate space may be graphically represented as a map.

Due to correspondence analysis' ability to simultaneously present the information source and the attributes which differentiate the systems, correspondence analysis is applied to display the pattern of the librarians' perceived relative advantages of CD-ROM, online and print sources from both patron's and the library's point of view.

RESULTS

CD-ROM Adoption

CD-ROMs were first adopted by the responding libraries from 1984 to 1990. Between 1987 to 1988, 32 out of the 67 libraries adopted their first CD-ROM database systems. 52 (78%) libraries adopted CD-ROMs during April 1990 to April 1991. The number of CD-ROMs adopted during the 1990-1991 year in the individual library ranged from one to three.

The CD-ROMs which were adopted include: Periodicals Abstracts (UMI Ondisc) adopted by 7 libraries, Academic Index and Psyc Lit adopted by 6 libraries, Eric and Social Science Index, both adopted by 5 libraries, Infotrak and Book in Print Plus, both adopted by 4 libraries; National Newspaper Index, Medline, Cadillac and Wilson Disc each adopted by 3 libraries.

Online Adoption

SUNY Libraries first adopted an Online database from 1967 to 1989. Most libraries adopted their first Online database systems in 1985. 17 (25%) libraries adopted Online database systems during the 1990-1991 year. The total number of Online vendors adopted during the 1990-1991 year in the individual library varied from one to three.

The Online database systems adopted most frequently include: Epic, the most adopted Online database vendor, adopted by 6 libraries during the period; Dialog was second, adopted by 4 libraries, and both BRS and OCLC were adopted by 3 libraries.

Perceived Relative Advantages

On the average, there were 522 CD-ROM and 25 Online sessions conducted each week. Table 1 presents the means and the standard deviations of the perceived advantages of the librarians who answered the questionnaires from the patron's viewpoint and from each library's perspective. Figure 1 shows the result of the perceived advantages from the patron's viewpoint.

Table 1 & Figure 1 About Here

In terms of Low Cost to User, CD-ROM is perceived as costing the least ($x = 8.27$); print sources are second ($x = 8.14$), and online the most expensive ($x = 4.14$). T-tests show the significant differences are between CD-ROM & online ($t = 4.64$, $p<0001$), and Online and print ($t = -6.67$, $p<0.0001$). However, CD-ROM and print sources are not significantly different.

CD-ROM is perceived as the fastest ($x = 8.91$). Online is the second ($x = 7.73$), and print sources are the slowest ($x = 3.46$). These differences are significant (CD-ROM and online, $t = 3.09$, $p<0.005$), (online and print, $t = 9.09$, $p<0.0001$), and (print and CD-ROM, $t = -15.40$, $p<0.0001$).

Online databases are perceived as significantly more thorough ($x = 8.11$) than CD-ROM ($x = 6.98$) , ($t = 6.98$, $p<0.0001$). Print is perceived as the least thorough ($x = 6.65$). Online and print sources are significantly different ($t = 3.31$, $p<0.005$); however, print and CD-ROM are not significantly different.

Online databases are perceived as the most up-to-date ($x = 9.14$); CD-ROM is the second ($x = 7.77$), and the print sources are the least current ($x = 5.86$). These differences are significant (CD-ROM and online, $t = -4.97$, $p<0.0001$); (online and print, $t = 10.45$, $p<0.0001$), and (print and CD-ROM, $t = -6.43$, $p<0.0001$).

CD-ROM is perceived as the easiest for patrons to use ($x =$

7.88). Print sources are the second (x = 6.73), and online the hardest (x = 3.00). These differences are significant (CD-ROM and Online, t = 8.48, p<0.0001), (Online and print, t = -7.08, p<0.0001), and (print and CD-ROM, t = -2.80, p<0.01).

CD-ROM is perceived as the most ideal instrument (x = 8.21) for user. Print sources are second (x = 6.06), and Online databases are perceived as the least ideal (x = 4.23). These differences are significant (CD-ROM and online, t = 6.98, p<0.0001), (online and print, t = -3.03, p<0.005), and (print and CD-ROM, t = -5.64, p<0.0001).

Figure 2 depicts the result of the perceived advantages of the librarians from their libraries' viewpoint. In terms of convenient for library staff, CD-ROM is favored the most (x = 8.51). Print sources are the second (x = 7.26), and online systems are the least convenient (x = 6.51). The significant differences are: (1) CD-ROM and online, t = 4.64, p<0.0001, and (2) print and CD-ROM, t = -3.49, p<0.005. Online and print sources are not perceived significantly different.

Figure 2 About Here

CD-ROM is considered to be the most compatible with library service mission (x = 9.18). Print sources are the second (x = 8.54). Online systems are the least compatible (x = 8.19). The significant differences are: (1) CD-ROM and online, t = 2.95, p<0.01, and (2) print & CD-ROM, t = -2.20, p<0.05. Online and

print sources are not perceived significantly different.

CD-ROM is considered the most testable by staff before adoption ($x = 8.52$). Print sources are considered as the second ($x = 7.36$), and online databases are the least testable ($x = 6.46$). The significant differences are: (1) CD-ROM and online, $t = 4.70$, $p<0.0001$, and (2) print and CD-ROM, $t = -2.82$, $p<0.01$. Online and print sources are not significantly different.

In terms of the testability through end-user trials, CD-ROM is considered the most advantageous ($x = 6.36$). Print sources are the second ($x = 4.96$), and online databases are the least advantageous ($x = 2.47$). These differences are significant (CD-ROM and online, $t = 5.91$, $p<0.0001$), (online and print sources, $t = -3.74$, $p<0.005$), and (print and CD-ROM, $t = -2.55$, $p<0.05$).

Print sources are perceived as needing the least training ($x = 6.58$). CD-ROM is the second ($x = 6.21$), and online databases are perceived to require the most training ($x = 2.50$). The significant differences are: (1) CD-ROM and online, $t = 6.51$, $p<0.0001$, and (2) online and print, $t = -6.73$, $p<0.0001$. Print sources and CD-ROM are not perceived significantly different.

Print sources are perceived as costing the least to the library ($x = 6.29$). CD-ROM is the second ($x = 4.04$), and online, the most expensive ($x = 3.15$). These differences are significant: (1) online and print, $t = -5.33$, $p<0.0001$, and (2) print and CD-ROM, $t = 4.34$, $p<0.0001$). CD-ROM and online are not perceived significantly different.

CD-ROM is perceived as the most ideal information system for the library ($x = 7.96$). Print sources are the second ($x = 7.23$), and online, the least ($x=6.23$). The significant differences are: (1) CD-ROM and online, $t = 3.65$, $p<0.005$, and (2) online and print, $t = -2.11$, $p<0.05$. Print sources and CD-ROM are not perceived significantly different.

Correspondence analysis, which provides an overall picture of the perceived difference among the three information sources (Figure 3), reveals that the online system is placed close to both up-to-date and thoroughness. This means that online databases are perceived as relatively more up-to-date and thorough than the other two systems. Ideal for user and testability for end-user are the closest attributes to CD-ROM. Low cost is positioned in about the middle between CD-ROM and print sources. The only attribute close to print sources is low cost to library.

Figure 3 About Here

DISCUSSION

As purchase decision makers, librarians' perceived advantages of these three information systems certainly influence the future adoption of library technology. The survey results, as foreseen in the previous literature, showed that although in terms of up-to-dateness and thoroughness, librarians perceived online systems

to be more advantageous than CD-ROM, and CD-ROM was more advantageous than print sources to the patrons. However, regarding cost, and ease of use, CD-ROM was more preferable than print sources, and print sources were more favorable than online systems to the patrons. With respect to speed, CD-ROM was perceived as the fastest, faster than online; and online was faster than print sources. Ultimately, CD-ROM was considered to be the most ideal information system for the patrons. Print sources were the second, and online was the third.

With respect to the perceived advantages to the libraries, the results showed that in terms of convenience, compatibility and testability, online systems were perceived as less advantageous than print sources and print sources were considered as less advantageous than CD-ROM. With regard to training and cost, print sources were more beneficial than CD-ROM and CD-ROM was more beneficial than online systems. Overall, CD-ROM was perceived as the most ideal information system for the library. Print sources were the second, and online was the third. In summary, with all its perceived advantages, CD-ROM was the most favorable information search instrument, print sources are the second, and online the third.

Library technology should be made to assist libraries in better fulfilling their service mission--"accomplishing the tasks set for them by their users and by their governing bodies" (Beiser, 1991, p. 18). The results of this study confirm that **CD-ROM is the most compatible with library service mission.**

Print sources are the second, and online systems are the least. As reflected in prior literature, other relative benefits of using print, CD-ROM or online tools may vary according to different tasks. However, the results of current study strongly suggests that, in the *library environment*, CD-ROM would be the most favorable tool among all three because of its low price rate and ease of use.

This study has examined librarians' perceptions of CD-ROM, online systems, and print sources in terms of cost, speed, thoroughness, up-to-dateness, ease of use, ideality, convenience, compatibility, testability, and training requirement from both the patron's view point and the libraries' perspectives in academic libraries from New York State. The examination of perceived advantages for CD-ROM, online systems, and print sources reported by the librarians suggests that CD-ROM surpasses both online and print sources in terms of cost, ease of use, speed, convenience, compatibility, and testability. CD-ROM is perceived as the most ideal information system in libraries.

REFERENCE

Anders, V., Jackson, K. M. (1988). Online vs. CD-ROM-- The impact of CD-ROM databases upon a large online searching program. *Online*, 12, 24-32.

Barnett, G., Siegel, G. (1988). The diffusion of computer-assisted legal research systems. *Journal of the American Society for Information Science*, 39, 224-234.

Barnett, G. A. (1993). Correspondence analysis: a method for the description of communication networks. In G. Barnett & W. Richards, Jr. (Eds.), *Recent Advances in the Study of Communication Networks (Progress in Communication Science)*, 12, 135-164. Norwood, NJ: Ablex.

Barnett, G., Danowski, J. (1992). The structure of communication: a network analysis of the international communication association. *Human Communication Research*, 19, 264-285.

Beiser, K. (1991). Library technology through a wide-angle lens. *Wilson Library Bulletin*, 66, 48-49.

Bellardo, T. (1985). What do we really know about online searchers? *Online Review*, 9, 223-239.

Bristow, A. (1988). Reference sources on CD-ROM at Indiana University. *The Electronic Library*, 6, 24-29.

Demas, S. (1987). Comparing big bibliographies on CD-ROM. *American Libraries*, 18, 332-335.

Garman, N. (1990). Online is still online. *Online*, 22, 6-8.

Havener, M. (1990). Answering ready reference questions: print versus online. *Online*, 22, 22-28.

Hoffman, D. L., Franke, G. R. (1986). Correspondence analysis: graphical representation of categorical data in market research. *Journal of Marketing Research*, 23, 213-227.

Parker, S. (1991). What needs to change. *Wilson Library Bulletin*, 66, 51-52.

Peters, C. (1987). Databases on CD-ROM: comparative factors for purchase. *The Electronic Library*, 5, 154-160.

Pooley, C. (1987). The CD-ROM marketplace: a producer's perspective. *Wilson Library Bulletin*, 62, 24-26.

Rapp, B., Siegel, E., Woodsmall, R. M., Lyon-Hartmann, B. (1990). Evaluating MEDLINE on CD-ROM: an overview of field tests in library and clinical settings. *Online Review*, 14, 173-186.

Rogers, Everett M. (1983). *Diffusion of innovation*. (3rd ed.). New York: Free Press.

Salomon, K. (1988). The impact of CD-ROM on reference departments. *RQ*, 203-215.

TABLE 1:
MEANS OF THE PERCEIVED ADVANTAGES

	CD-ROM	Online	Print
1. Low Cost to User			
Mean	8.27	4.14	8.14
(SD)	(2.97)	(3.79)	(3.37)
2. Speed			
Mean	8.91	7.73	3.46
(SD)	(1.42)	(2.51)	(2.43)
3. Thoroughness			
Mean	6.98	8.11	6.65
(SD)	(1.99)	(2.13)	(2.62)
4. Up to Date			
Mean	7.77	9.14	5.86
(SD)	(1.95)	(1.99)	(2.44)
5. Easy for Patrons to Use			
Mean	7.88	3.00	6.73
(SD)	(1.92)	(3.30)	(2.47)
6. Ideal for User			
Mean	8.21	4.23	6.06
(SD)	(1.87)	(3.32)	(2.41)
7. Convenient for Library Staff			
Mean	8.51	6.51	7.26
(SD)	(1.77)	(2.80)	(2.34)
8. Compatible with Library Service Mission			
Mean	9.18	8.19	8.54
(SD)	(1.23)	(2.47)	(2.19)
9. Could Be Tested by Staff before Adoption			
Mean	8.52	6.46	7.36
(SD)	(2.33)	(3.43)	(3.00)
10. Could Be Tested through End-user Trials			
Mean	6.36	2.47	4.96
(SD)	(4.10)	(3.43)	(4.09)
11. Require Little Training of Patron End-users			
Mean	6.21	2.50	6.58
(SD)	(2.71)	(3.23)	(2.57)
12. Low Cost to Library			
Mean	4.04	3.15	6.29
(SD)	(2.94)	(3.05)	(3.16)
13. Ideal for Library			
Mean	7.96	6.23	7.23
(SD)	(2.14)	(2.74)	(2.64)

Perceived Advantages to Patrons

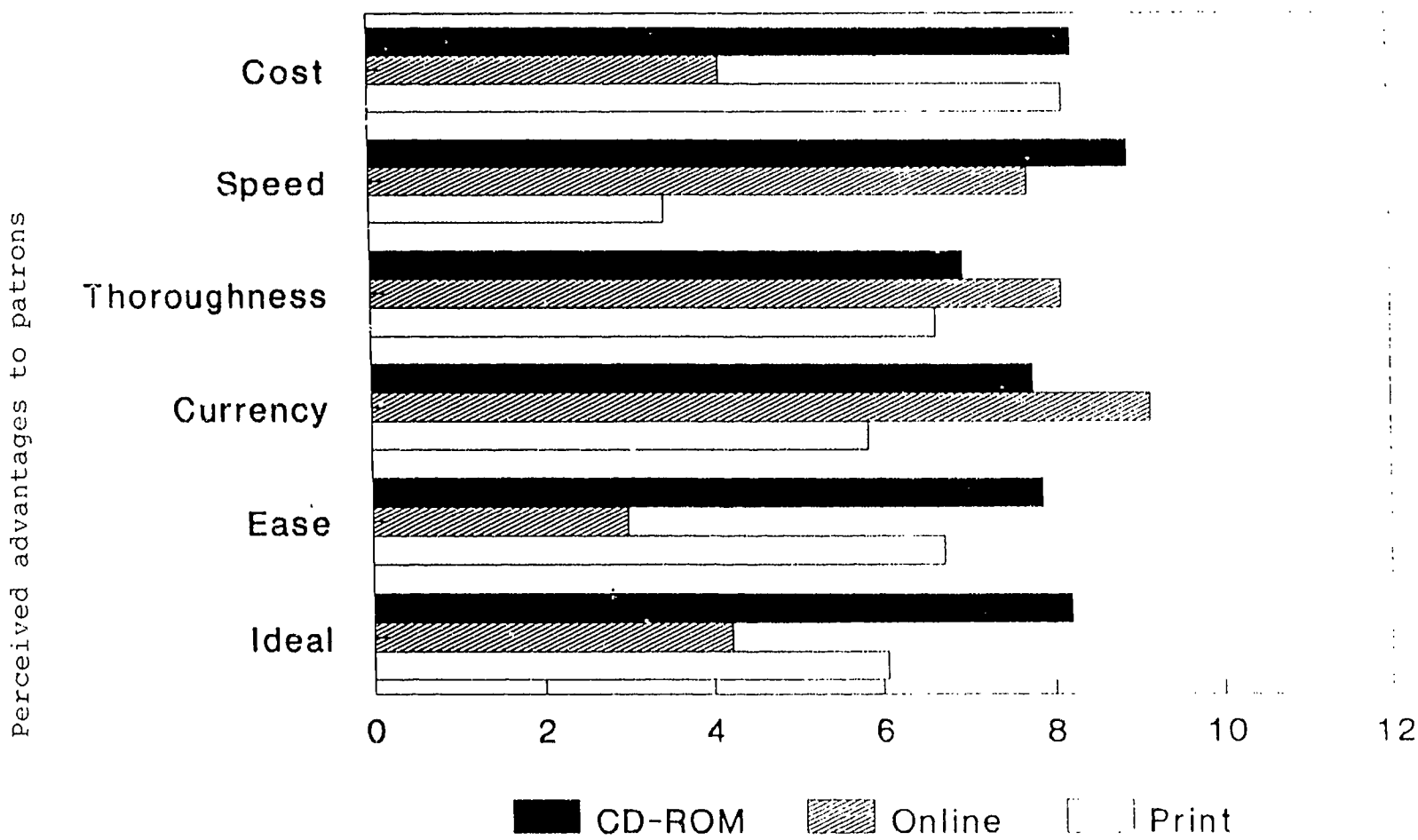


Figure 1

Perceived Advantages to Libraries

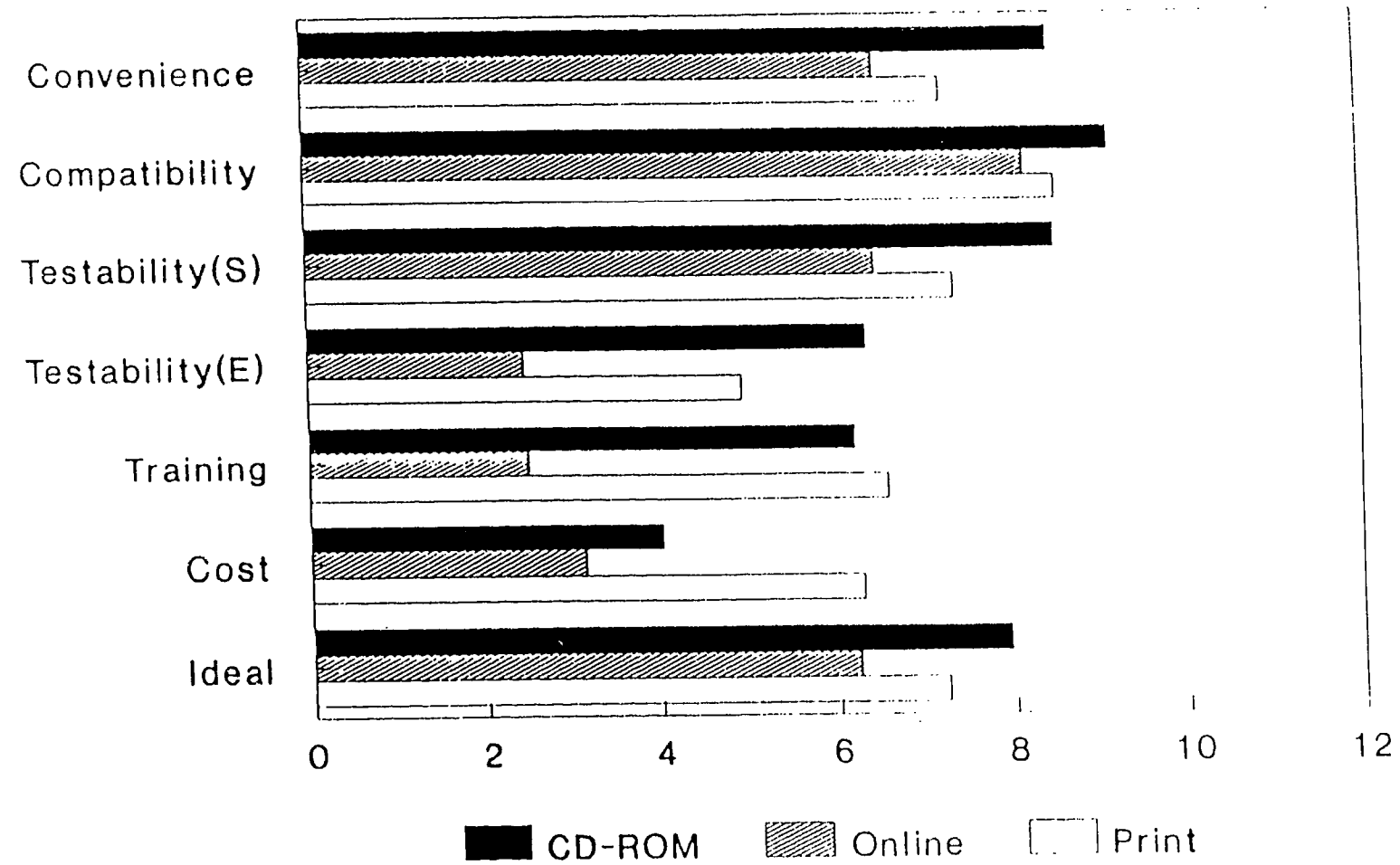
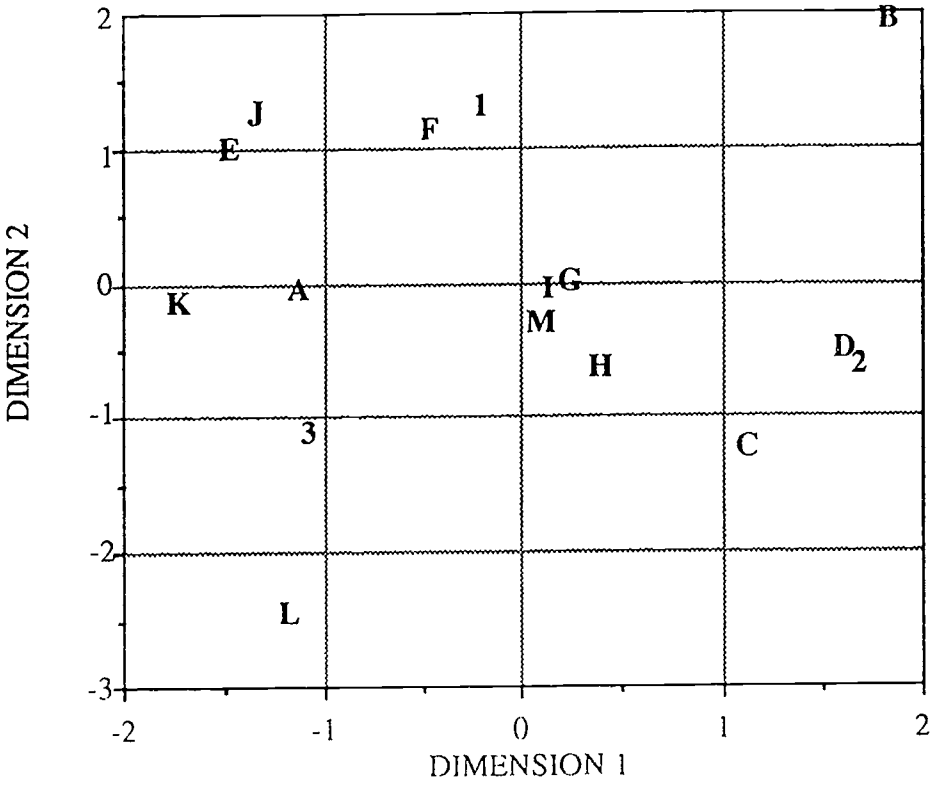


Figure 2
Perceived advantages to libraries

Figure 3

Correspondence analysis of perceived advantages



1: CD-ROM
2: Online
3: Print

A: Cost (User)
B: Speed
C: Thorough
D: Up-to-date
E: Easy
F: Ideal (User)
G: Convenient
H: Compatible
I: Testable (staff)
J: Testable (patron)
K: Training
L: Cost (Library)
M: Ideal (Library)