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# Are Bibliographic Management Software Search Interfaces Reliable?: A Comparison between Search Results Obtained Using Database Interfaces and the EndNote Online Search Function

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Fitzgibbons, Megan and Meert, Deborah, "Are Bibliographic Management Software Search Interfaces Reliable?: A Comparison between Search Results Obtained Using Database Interfaces and the EndNote Online Search Function" (2010). Western Libraries Publications. 25.

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# Are Bibliographic Management Software Search Interfaces Reliable?: A Comparison between Search Results Obtained Using Database Interfaces and the EndNote Online **Search Function**

by Megan Fitzgibbons and Deborah Meert

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The use of bibliographic management software and its internal search interfaces is now pervasive among researchers. This study compares the results between searches conducted in academic databases' search interfaces versus the EndNote search interface. The results show mixed search reliability, depending on the database and type of search performed.

### Introduction

The use of bibliographic management software packages, such as EndNote, RefWorks, BibTeX, and Zotero, is now firmly established among researchers and students as a time saving tool for writing academic papers. EndNote, in particular, is sold in most university bookstores in North America, as well as through independent distributors worldwide. As an illustrative sample, twelve of the top twenty-five universities in the United States<sup>1</sup> and four of the top fifteen Canadian universities<sup>2</sup> provide EndNote site licenses to their clients as a standard part of their services, and eight of these universities' library Web sites offer EndNote for purchase, while supporting other bibliographic management programs. This widespread access at major academic institutions and adoption by sophisticated users lends tacit approval to the effectiveness of the software as a bibliography management tool.

Citations management programs are continuously increasing in sophistication and have begun to add and promote new features like remote search capability. EndNote version X2 has recently emphasized its online search interface by moving it to the main page of the users' "library," apparently to increase its importance among the features available to the user.

Some librarians are uncomfortable with unvalidated engines for searching databases such as that of EndNote, particularly when used by graduate level students and faculty, and tend to promote caution. Despite such warnings, the proximity and apparent ease-of-use of such search features are proving to be very provocative to both researchers and students. EndNote is increasingly being cited as the only search tool used for conducting literature searches including for systematic reviews.

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"...EndNote is increasingly being cited as the only search tool used for conducting literature searches including for systematic reviews."

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The EndNote discussion forums<sup>3</sup> provided by Thomson Reuters 57 provide many examples of academic users attempting to employ the online search function of EndNote and encountering difficulty with their searches. It should be noted that this source is not representative in itself

Table 1
Number of Hits Retrieved for Question 1 in
Web of Science

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t1.2

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t2.1

t2.2

Search string	Web of Science topic field	EndNote Web of Science title/keywords/ abstract field
Zinc	>100000	>100000
Type 2 Diabetes	50,537	50,537
Zinc AND Type 2 Diabetes	182	182

as a metric of EndNote's effectiveness, as few if any would post about successfully retrieving a desired result. Of those who experienced difficulty, an illustrative example is found in a message posted on September 23, 2008 with the subject line "Search failure: multi-word terms on PubMed."4 The user, through EndNote search, received a message saying that no hits were retrieved for the two-word phrase "adaptation index" in the title field using the PubMed connection file, even though the PubMed search interface hosted by the National Library of Medicine retrieved several items for the same search string. In this case, EndNote does not support the exact phrase searching technique (i.e., using quotation marks) that the database itself employs.<sup>5</sup>

In another sample message, 6 an EndNote user described difficulties searching for a compound Library of Congress subject heading in a remote search of the Library of Congress catalog. One knowledgeable forum participant responded with instructions for modifying the connection file to retrieve the desired results.

Other messages illustrate that users often do not understand mechanics of Endnote's online search function. Some exhibit confusion when they are prompted for a password before connecting to an online search, not realizing that indirectly through EndNote they are attempting to search proprietary subscription-based databases.<sup>7</sup> Other users understand this, but still experience problems connecting because their institutions' subscriptions to the databases are not configured to permit authentication through EndNote.8

### LITERATURE REVIEW

EndNote is often praised for the convenience of its online search function.<sup>9</sup> The common retrieval interface is attractive to researchers

### Table 2 Number of Hits Retrieved for Question 2 in Web of Science

Search string	Web of Science topic field	EndNote Web of Science title/keywords/ abstract field
Socioeconomic Status	18,492	18,492
Physical Health	48,156	48,156
Children	>100000	>100000
Socioeconomic Status AND Physical Health AND Children	418	418

### Table 3 Number of Hits Retrieved for Question 3 in Web of Science

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t3.2

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t4.1

t4.2

Search string	Web of Science topic field	EndNote Web of Science title/keywords/ abstract field
	topic field 2870	<b>field</b> 2870
oyright Law		20.0
ternational Trade	11,588	11,588
opyright Law AND International Trade	12	12

because it conflates the steps of searching for materials and documenting citations in a single program. Moreover, it ostensibly eliminates the need for searchers to learn to use disparate databases, as many different resources can be searched from the EndNote interface.10

Indeed, some discussions of bibliographic software promote using remote search functions for literature searches. For example, Eapen's<sup>11</sup> review of EndNote 7.0, aimed at medical researchers, uncritically suggests that EndNote is a useful tool for both bibliography management and online literature searching, using PubMed as an example. He does not evaluate the effectiveness of the EndNote search interface, nor does he compare it to search results retrieved directly through PubMed.

Gall and Brahmi<sup>12</sup> undertook a methodological evaluation of EndNote's remote searching capabilities using version 7.0 of the software. Results were compared for searches conducted directly in Ovid Medline and PubMed versus searches using EndNote's connection files. The authors found some discrepancies across the platforms in the numbers of results retrieved by identical search strings. They often needed to experiment with the appropriate combination of fields searched via EndNote to achieve results that matched those of the native database interfaces. In their assessment, shortcomings of the EndNote interface included a lack of capabilities to limit and refine results, a confusing results display, a slow retrieval time, and potential confusion regarding the selection of a connection file. The EndNote software is now in version X3, but beyond Gall and Brahmi's paper, few comparative studies exist that evaluate the performance of interfaces within bibliographic software for searching databases in comparison to directly accessing the relevant databases.

### Table 4 Number of Hits Retrieved for Question 4 in Web of Science

Search string	Web of Science topic field	EndNote Web of Science title/keywords/ abstract field
Stress Management	13,660	13,660
Employee Productivity	968	968
Stress Management AND Employee Productivity	24	24

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### Table 5 Number of Hits Retrieved for Question 1 in Academic Search Premier

t5.3	Search string	Academic Search Premier <i>Subject Terms</i> field	EndNote Academic Search Premier <i>keyword</i> field	Academic Search Premier any field plus full text	EndNote Academic Search Premier any field
t5.4	Zinc	17,280	17,280	74 <b>,</b> 821	74,821
t5.5	Type 2 Diabetes	No hits	No hits	32 <mark>,</mark> 579	32,579
t5.6	Zinc AND Type 2 Diabetes	No hits	No hits	867	867

The EndNote search function uses the Z39.50 protocol, widely 118 implemented in library retrieval systems, to enable remote searching of online databases. Each databases; fields are configured differently, and in effect, the quality of a remote database search via EndNote is determined by the connection file's configuration in relation to the database's Z39.50 settings. Much has been written in library and information studies literature about the technology, theory, and importance of Z39.50, but less attention has been paid to non-library applications. One exception is East's 13 examination of limitations and problems found in the configuration of EndNote's connection files for 126 various products' Z39.50 protocols. These limitations are due to (1) inadequate documentation of the protocols, (2) incomplete implementation of connection files, (3) database indexing problems, and 129 (4) poorly configured search interfaces. Although he confirms that Z39.50 searching is widespread and potentially useful in personal bibliographic software, he does illustrate the pitfalls that end-users encounter with remote searching through EndNote. He states that there is room to modify connection files and improve their effectiveness, but that this requires a certain amount of technical expertise, a suggestion supported by Dell'Orso.<sup>14</sup>

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t5.2

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t6.1

t6.2

### **Purpose**

The purpose of this study is to assess the accuracy, reliability, and efficiency of EndNote's in-software search interface versus directly accessing the search interfaces of databases themselves. A sample of core databases used at North American academic institutions was selected for comparison, to be searched both from within the database's own search interface and with the EndNote online search interface using the appropriate connection files (i.e., the customized files that map EndNote's search fields to those of a specific bibliographic database). High-use resources in multiple subject areas were chosen to provide a representative view of typical search conditions in universities. Database selection was also determined by the availability of functional connection files. Direct comparison of the results obtained using EndNote's search function with the primary database will highlight the relative effectiveness of the EndNote search interface.

### **METHODOLOGY**

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The bibliographic management software EndNote, version X2.0.1 for Windows was used for all searches in this study except for searches in the database Academic Search Premier. For this particular search, EndNote version X1 was used due to software availability issues.

Four test questions were created and used to test the interfaces of EndNote and each database:

- 1. Does zinc help to prevent type 2 diabetes?
- 2. What is the impact of low economic status on physical health in children?
- 3. How are recent developments in copyright law affecting international trade?
- 4. Does stress management training increase employee productivity?

Each database search interface was tested with one or more of the questions, depending on subject relevance, and the corresponding EndNote interface was tested with the same search terms. The major concepts (in italics) in the questions were identified and used to search the databases as keywords or used to locate standardized subject headings, where allowed. The number of hits retrieved through each interface was compared.

# RESULTS

### Web of Science

All four test questions were used to assess the Web of Science (ISI) connection file provided by EndNote (updated to November 2008). Search terms were entered in the "title/keywords/abstract" field, using the AND operator from the drop-down list. In the Web of Science database, the "topic" field was searched, again with the AND operator from the drop-down list to combine terms. The two interfaces demonstrated the same phrase searching behavior; double quotation marks were required to retrieve an exact phrase in both. The Science Citation Index Expanded, Social Sciences Citation Index. and Arts & Humanities Citation Index were all searched in both interfaces, and identical results were retrieved. The numbers of hits are detailed in Tables 1-4.

# Table 6 Number of Hits Retrieved for Question 2 in Academic Search Premier

t6.3	Search string	Academic Search Premier Subject Terms field	EndNote Academic Search Premier <i>keyword</i> field	Academic Search Premier any field plus full text	EndNote Academic Search Premier any field
t6.4	Socioeconomic Status	No hits	No hits	32,971	32,971
t6.5	Physical Health	No hits	No hits	20,937	20,937
t6.6	Children	297,801	297,801	1,661,120	1,661,120
t6.7	Socioeconomic Status AND Physical Health AND Children	No hits	No hits	1543	1543

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# Table 7

### Number of Hits Retrieved for Question 3 in Academic Search Premier

t7.3	Search string	Academic Search Premier <i>Subject Terms</i> field	EndNote Academic Search Premier <i>keyword</i> field	Academic Search Premier <i>any field plus</i> <i>full text</i>	EndNote Academic Search Premier any field
t7.4	Copyright Law	93	93	12,190	12,190
t7.5	International Trade	17,444	17,444	57,782	57 <mark>,</mark> 782
t7.6	Copyright Law AND International Trade	1	1	294	294

### Academic Search Premier

t7.1

t7.2

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t8.1

t8.2

t8.3t8.4t8.5t8.6

The connection file supplied with EndNote X1 (updated to July 2008) was used to search Academic Search Premier (EBSCO). All four test questions were used to search this multidisciplinary database. Academic Search Premier records are indexed with controlled vocabulary terms that can be searched in the "Subject Terms" field. This was found to correspond to the "keyword" field in the EndNote connection file. The number of hits retrieved for the search strings is shown in Tables 5–8. When the correct correspondence of field names in the two databases was identified, the number of results was identical.

### **PsychInfo**

Two questions were tested in the PsychInfo (Ovid SP) database interface and compared with the EndNote online search function for PsychInfo (Ovid SP connection file).

The first question was, "What is the impact of low economic status on physical health in children?" The question was searched in the PsychInfo database in the Ovid SP interface (1806 to 2008) using both Subject Headings (autoexploded) and keywords separately. There was no option to search PsychInfo (Ovid SP) in the EndNote online search function using "subject headings," so searches were done using the "any field" and "keywords" options in EndNote. The questions were broken down into concepts, and the concepts were searched both separately and together. The number of hits retrieved for the first question can be seen in Table 9. All searches in both interfaces produced relevant results except for the EndNote keyword search; however, the results in the OVID SP "keyword" search were the most successful at producing relevant hits, even though it was necessary to sort through more hits in total to find them.

The second test question used for PsychInfo was, "Does stress management training increase employee productivity?" Again, this question was searched in the PsychInfo Ovid SP interface using both Subject Headings (autoexploded) and keywords, and in the PsychInfo (Ovid SP) EndNote online search function using the "any field" and "keywords" options. The questions were again broken down into concepts, and the concepts were searched separately and together.

The number of hits retrieved for the second question can be seen in

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Again, the Ovid SP keyword search gave the most relevant hits, picking up one relevant citation that the Subject Heading search did not retrieve. In this case, however, the EndNote search interface for PsychInfo did not retrieve any hits at all.

### **Medline**

One question was tested in the Medline Database using both the Ovid interface and the PubMed interface: "Does zinc help to prevent type 2 diabetes?" The same question was then tested with the EndNote online search for Medline with both the Ovid and PubMed connection files. In the Ovid interface, only a keyword search was performed because searching the Medline Ovid file through the EndNote search interface did not provide Medical Subject Headings (MeSH) as a search field, so they could not be compared. Both a "keyword" and "any field" search were performed in the Medline Ovid EndNote interface, with disparate results. In PubMed, however, both 241 MeSH and keyword searches were performed, as the EndNote Medline PubMed file allowed for MeSH, keyword, and "any field" searching. The question was broken down into concepts, and the 244 concepts were searched separately and together. The number of hits retrieved for the first question comparatively in the Ovid and EndNote interfaces can be seen in Table 11, and for the PubMed and EndNote interfaces in Table 12.

The EndNote search interface in the keyword field was ineffective when searching Medline Ovid SP. There were no matches found for Type 2 Diabetes, even variations of the term were tested. The search in the EndNote interface for Ovid SP using the "any field" option, however, gave nearly identical results to the Ovid keyword search.

The keyword searches in the PubMed and EndNote PubMed interfaces did not produce hits that were even remotely close in number, with the PubMed interface producing the same citations as the EndNote PubMed interface, plus many others. This is likely accounted for by the fact that a keyword search in the PubMed interface automatically includes a MeSH search as well, by default. The results for the "any field" search in the EndNote PubMed interface produced many more hits, most of which were not relevant. This, however, could be compensated for by adding another search term to

# Table 8 Number of Hits Retrieved for Question 4 in Academic Search Premier

3	Search string	Academic Search Premier <i>Subject Terms</i> field	EndNote Academic Search Premier <i>keyword</i> field	Academic Search Premier any field plus full text	EndNote Academic Search Premier any field
	Stress Management	2255	2255	9971	9971
	Employee Productivity	No hits	No hits	1388	1388
	Stress Management AND Employee Productivity	No hits	No hits	30	30

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Please cite this article as: Megan Fitzgibbons, Deborah Meert, Are Bibliographic Management Software Search Interfaces Reliable?: A Comparison between Search Results Obtained..., The Journal of Academic Librarianship (2010), doi:10.1016/j.acalib.2010.01.005

t9.1	Table 9
t9.2	Number of Hits Retrieved for Question 2 in PsychInfo

t9.3	Search string	Ovid SP PsychInfo Subject Headings	Ovid SP PsychInfo Keywords	EndNote PsychInfo (Ovid SP) <i>Keywords</i>	EndNote PsychInfo (Ovid SP) Any Field
t9.4	Socioeconomic Status	25,779	20,452	451	746
t9.5	Physical Health	812	7083	169	466
t9.6	Children	Limit used	289,698	22	9978
t9.7	Socioeconomic Status AND Physical Health AND Children	4 (3 relevant)	33 (16 relevant)	No hits	1 (1 relevant)

### Table 10 t10.1t10.2 Number of Hits Retrieved for Question 4 in PsychInfo

t11.1

t11.2

t10.3	Search string	Ovid SP PsychInfo Subject Headings	Ovid SP PsychInfo Keywords	EndNote PsychInfo (Ovid SP) Keywords	EndNote PsychInfo (Ovid SP) Any Field
t10.4	Stress Management	3101	4530	96	144
t10.5	Employee Productivity	1994	2037	44	49
t10.6	Stress Management AND Employee Productivity	5 (4 relevant)	6 (5 relevant)	No hits	No hits

# Table 11 Number of Hits Retrieved for Question 1 in Ovid SP Medline

t11.3	Search string	Ovid SP Medline Keywords	EndNote Ovid SP Medline Keywords	EndNote Ovid SP Medline <i>Any Field</i>
t11.4	Zinc	74,462	53,020	751,436
t11.5	Type 2 Diabetes	28,605	No hits (used various synonyms)	28,605
t11.6	Zinc AND Type 2 Diabetes	98	N/A	97

t12.1	Table 12
t12.2	Number of Hits Retrieved for Question 1 in PubMed Medline

t12.3	Search string	PubMed NLM Keywords	EndNote PubMed NLM Keywords	EndNote PubMed NLM Any Field	PubMed NLM MeSH Major Topic	EndNote PubMed NLM MeSH Major Topic
t12.4	Zinc	77,060	39,026	77,060	22,160	21,856
t12.5	Type 2 Diabetes	59,955	50,625	318,459	39,887	38,562
t12.6	Zinc AND Type 2 Diabetes	187	96	1278	56	56

narrow the results. The results from the MeSH searches in both the PubMed and EndNote PubMed interfaces produced the same number of hits.

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### Index to Legal Periodicals,

Two questions were tested in the Index to Legal Periodicals (Wilson) database and compared with the EndNote online search of the database: "How are recent developments in copyright law affecting international trade?" and "Does stress management training increase employee productivity?"

For both questions, the results from searching the Wilson Database directly and from the EndNote interface were identical. The "all fields" search option was available, and therefore used, in both interfaces, and identical results were retrieved (see Tables 13 and 14).

### Discussion

Generally, the EndNote search interface did an excellent job searching databases that use keyword searching. There are, however, a variety of ways in which databases use the words "text search," "keyword search," "smart search," "all fields," etc., interchangeably. Understanding of which search term is being used by EndNote, and how that search term equates to the original database, will directly affect the

### "Generally, the EndNote search interface did an excellent job searching databases that use keyword searching."

The database PsychInfo is a good example of this. In the Ovid interface for the database PsychInfo, it is possible to search by keyword or subject heading. If the keyword option is chosen, the interface actually searches the keyword or phrase in all of the fields that appear in the database record in Ovid, including abstract, article title, author, institution, and many others. It does not search the full text of the article. When PsychInfo is searched with the EndNote interface, there is also a keyword search available, but it is not the same kind of search as the keyword search in Ovid. To get the equivalent search in EndNote as the keyword search in Ovid, the "all fields" option must be selected in the EndNote interface.

Similarly, EndNote's online search function was capable of retrieving results that were identical to those retrieved in the EBSCO interface, but it was not immediately apparent how to obtain these results. The "any field" search via EndNote does indeed search all the fields in the database, including the full text of documents. However, in the EBSCO interface, an "any field" search does not search full text by default. Instead, it is necessary to click on the option to include the

### Table 13 t13.1Number of Hits Retrieved for Question 3 in Index to **Legal Periodicals** t13.2

13.3	Search string	Index to Legal Periodicals all fields	EndNote Index to Legal Periodicals all fields
13.4	Copyright Law	3917	3917
3.5	International Trade	8581	8581
13.6	Copyright Law AND International Trade	70	70

### Table 14

t14.1

t14.2

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### Number of Hits Retrieved for Question 4 in Index to **Legal Periodicals**

Search string	Index to Legal Periodicals all fields	EndNote Index to Legal Periodicals all fields	t14.3
Stress Management	42	42	t14.4
Employee Productivity	31	31	t14.5
Stress Management AND Employee Productivity	1	1	t14.6

full text of documents in the search. When this option was selected, the results were identical to the EndNote search. In other words, a search of "any field" or the "keywords" field via the connection file produced the same results as an EBSCO search for any field plus fulltext. EndNote's "keywords" field corresponds directly to EBSCO's "subject terms" field.

It is not surprising that results retrieved via the Web of Science connection file exactly replicated results from the database's own interface, given that both products are created by Thomson Scientific. However, the terminology given to the searchable fields does not directly correspond; the EndNote connection file searches "title/ keywords/abstract," while the database's general search interface uses the term "topic."

### Assessment and Future Plans

The users' manual that is distributed with an EndNote X2.0.1 installation (a PDF file) provides instructions for conducting Z39.50 command-line syntax searches. This method allows users to "enter a Z39.50 search which EndNote passes directly to the [database's] server without any translation,"15 which obviously requires knowledge of the database's Z39.50 attributes. This method of searching is useful for librarians and advanced EndNote users, particularly creators of connection files, but for the purpose of conducting searches for materials in a database, it is simply too complicated to be practical. Indeed, although this option is available, the fact remains that most users use the provided connection files to conduct simple searches.

It should be noted that some of EndNote's connection files are based on HTTP rather than Z39.50, notably PubMed and Web of Science. Thus, Z39.50 command-line syntax searches cannot be conducted in these databases. However, the HTTP-based connection files can be edited, and the set up of the connection is rather more transparent than with Z39.50 protocols. These files also demonstrate that EndNote's capability for remote searching extends beyond the somewhat esoteric world of Z39.50.

This study examined only five bibliographic databases, but the results showed that the effectiveness of EndNote's connection files varies even within the sample. It is expected that a similar variation would be found if more databases' connection files were tested in EndNote.

Moreover, subsequent comparison of connection files and database's own retrieval systems would result in different variations over time because new connection files are constantly modified and created anew to match the changing configurations of bibliographic databases. This constant change is simultaneously an asset and a frustration for users of the EndNote program. Searches conducted at different times on the same engine could potentially yield different 412 results.

Educating users about these variations when using the EndNote search interface can be carried out during training sessions. Librarians should continue to monitor the changes within the

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EndNote program, primarily with regard to users' most commonly searched databases, and share this information with their communities via online help pages and Frequently Asked Question lists, email assistance, and individual consultations. It is important that students writing academic papers, especially those with a desire to publish or produce a thesis, are made aware of potential variations in search results and how this could affect their literature reviews. This is a situation that requires librarians and academic institutions to be as diligent as possible when encouraging students and researchers to use bibliographic management software. Educating users on how to properly use the software to make searching and citation faster and easier, while still retaining the integrity of a comprehensive academic paper, is paramount.

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"...the results retrieved via EndNote versus direct searching of a database vary depending on both the database searched and the technique used to search it."

### **C**onclusion

The EndNote program, with its own search interface for querying bibliographic databases, has widespread use among librarians and researchers. But as this study illustrates, the results retrieved via EndNote versus direct searching of a database vary depending on both the database searched and the technique used to search it. Librarians and others who promote and provide technical support for citation management programs should be aware of the strengths and potential problems that users will face in using the program's search interface. It is clear that in spite of the capabilities of connection files to mirror native database searches, user education is needed to fully exploit and properly use this tool.

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