

The Researcher's Challenge: Building a Credible Literature Review Using Electronic Databases

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This study examined the accessibility of articles disseminated in mainstream business education periodicals during the three-year period from 1999 to 2001 in four representative electronic databases: ABI/INFORM, ArticleFirst, Education Abstracts, and ERIC. These results were compared with The Business Education Index listings. Information retrieval measures were then calculated. Precision rates varied among the databases. The recall rates for the databases were 90% or greater. Collection failure rates for the four databases exceeded 50%, while the collection failure rate for The Business Education Index was 42%. Adjusting the collection failure rate of The Business Education Index for only two years of actual publication, the collection failure rate dropped to 25%. Building a credible literature review using electronic databases has become problematic. The inability to consult The Business Education Index as a research launching point combined with the lack of accuracy and scope of electronic databases serve to diminish the reliability of electronic-based literature reviews.

Introduction

The propensity of humans to search has long been recognized. A quotation attributed to Sophocles pronounces, "What is to be taught, I learn; what is to be discovered, I seek." Modern thinkers have espoused the same idea. For example, Marchionini (1995) explained, "Much of human existence is characterized by the notion of search; we seek and pursue material objects such as food or shelter, sensual experiences such as adventure or ceremony, and ethereal objects such as knowledge or objects" (p. 5). So, too, business education researchers seek to expand the horizons of knowledge through information seeking in electronic databases and printed sources. But are the information seeking tools on which business education researchers rely really adequate?

Rationale and Need for the Study

This study was prompted by four factors. They include (a) the criticality of a substantive literature review, which is the basis for research endeavors (Walliman, 2001); (b) the nationwide decline in

library allocations, which results in fewer paper and more electronic library holdings (Weiner, 2001); (c) the cessation of *The Business Education Index* (Delta Pi Epsilon [DPE], 2001), which could adversely affect the retrievability of the business education literature; and (d) the concern about possible inadequacies of electronic databases, which arise from such things as database peculiarities and incorrect literature indexing (D. J. Green, personal communication, January 31, 2003).

Given these factors, thoughtful business education researchers wonder if they really have the necessary information seeking tools to "say something new while connecting what they say to what's already been said . . . in such a way that people will understand the point" (Becker, 1986,

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p. 141). A thorough search of the business education literature revealed that no business educator has addressed this important literature-retrieval matter that influences the viability of the business education discipline. As a result, a study investigating the ability of current information seeking tools, electronic databases, to access relevant business education literature was needed to begin the process of filling a major literature gap.

Purpose of the Study

The general purpose of the study was to explore the adequacy of electronic databases for retrieving business education literature for a literature review. More specifically, the study sought to uncover useful information about the precision rates and recall rates of representative databases, the collection failure rates of representative databases and *The Business Education Index*, the peculiarities of representative databases and *The Business Education Index*, and the accuracy of indexing within representative databases and *The Business Education Index*.

Limitations of the Study

Several limitations may be inherent in the reported study. The study is limited to works appearing in four leading mainstream business education publications over a three-year period. Further, fewer input errors may have occurred because of the researchers' familiarity with the names of the authors in this study. Novice researchers would probably have made a greater number of input errors when searching by author name. Also, keyword or subject searches would most likely have been more complex than author searches, although keywords provided by an author can aid in improving the precision of searches.

Literature Review

The literature review section discusses information retrieval effectiveness measures and the few prior studies that have evaluations of such measures, provides background information about *The Business Education Index* and the four

representative electronic databases used in this study, and discusses evaluations from and of the business education literature.

Background Information about Information Retrieval Effectiveness

Search failures occur when a researcher does not get a match for the item that is being sought through a database or an index and are a function of the effectiveness of the document retrieval system. Retrieval effectiveness measures can identify retrieval failures and can provide insights into the reasons for various types of search failures and the remedies that can be used to address them.

Does the perfect document retrieval system exist? Tonta (1992) observed, "Document retrieval systems do not retrieve ALL and ONLY relevant documents, and users may be satisfied with systems that rapidly retrieve a few relevant documents." (p. 6).

Among the various kinds of information retrieval measures are three types that are frequently mentioned in the literature. These include precision, recall, and collection failure.

Simply stated, *precision* is the number of relevant records retrieved from the database system divided by the total number of records retrieved from the database system (Marchionini, 1995). For example, if 100 records are retrieved from the database system and 90 records are found to be relevant, the precision is 90%. *Recall* is the number of relevant records found in the database system divided by the number of relevant records that exist in the database system (Marchionini, 1995). For example, if 95 relevant records are found in the database system and 100 relevant records actually exist within the database system, the recall is 95%. The measures of precision and recall are commonly used in gauging the effectiveness of online retrieval systems (Marchionini, 1995). *Collection failure* is the number of records sought that were not in the database system divided by the number of records sought in the database system (Marchionini, 1995). For example, if 100 records are sought from the database system and 75 of those records are not found in the database system, then the collection failure is 75%.

Failures or false positives (false hits) may occur because of common surnames and duplicate document retrieval in a particular database. Name changes of authors can also impact the retrievability of records (Blaszczynski & Scott, 2002).

Dickson (1984) studied online catalog search failures and found that approximately 23% of author searches retrieve nothing. The primary causes of the zero hit searches were errors in the search formulation and misspellings. Zink (1991) studied the transaction logs of over 6,000 searches of the online catalog of the University of Nevada. Most of the failures in author searches were caused by collection failures (58%), misspellings (18%), and placing the first name erroneously before the last name (15%).

Authors of refereed articles are concerned about the retrievability of their publications. "If you publish in an obscure journal, your article may be lost to posterity, not only because it has limited distribution, but also because it cannot be found in a reasonable literature search" (Garfield, 1964, p. 7). Article citation statistics are measures that are considered in some retention, tenure, and promotion decisions at research extensive universities. If an article cannot be located, citation statistics will be low. The only way of boosting the statistics would be self-citation (Burrell, 2002).

Electronic databases and websites, if used judiciously, can aid the viability of a discipline. For example, a digitization project involving 12,000 Yiddish books helped to make a dying literature available via a website that features print-on-demand technology (Goldschneider, 2002).

Should researchers expect to locate everything they desire on the Internet? Despite the myth that electronic information is widespread (Miller, 1997), one researcher believes that a fully virtual library will not be accomplished (Herring, 2001) for several reasons. Another researcher echoed this sentiment: "Despite many advances in the information world and the availability of numerous excellent information products, many users still struggle to get the information they want, when they want it" (MacLeod, 2002, p. 28). Furthermore, Marchionini (1995) observed, "In sum, the technology may evolve beyond anything we can now imagine, but information seekers will always be

required to think, make inferences and decisions, and develop confidence in these processes" (p. 195).

Background Information About The Business Education Index and the Databases

The Business Education Index began publication in 1940 (National Business Education Association, 2000), and the final issue included business education literature disseminated in the year 2000. Delta Pi Epsilon, the national honorary professional graduate society in business education, published *The Business Education Index* (DPE, 2001). The first sources scholars often consult when launching a research project are scholarly indexes (Rowland, 2000).

In the reported study, four representative online databases were accessed to find articles written by business education authors. These databases include ABI/INFORM, ArticleFirst, Education Abstracts, and the Education Resources Informational Center (ERIC). These online databases were selected for study because they are representative of those available and widely used throughout the United States.

ABI/INFORM includes 1,000 business journals and magazines. Full-text articles are available from 1997 to the present, while abstracts of articles are available from 1971 to the present. The database is updated monthly (ABI/INFORM, n.d.). Research-productivity patterns of marketing academicians were examined by Powers, Swan, Bos, and Patton (1998) using publications listed by ABI/INFORM with an observed error rate of less than 1%.

Online Computer Library Center (OCLC) provides ArticleFirst, a general database. ArticleFirst has more than 12,000 sources. With sources spanning from 1990 to the present, the database is updated monthly (OCLC ArticleFirst, n.d.).

Education Abstracts includes more than 550 sources, with abstracts of articles beginning in 1994 and listings from 1983 to the present. The database is updated monthly (Education Abstracts, n.d.).

ERIC includes more than 2,000 sources ranging from 1966 to the present from the Current

Index to Journals in Education (CIJE) and Resources in Education (RIE). The database is updated monthly (ERIC, n.d.). According to one estimate, the ERIC database is used to conduct about 18 searches annually for each of the 4.7 million people who are professors in colleges of education, students in colleges of education, and teachers located in the United States (Rudner, 2001).

Evaluations from and of Business Education Literature

The business education literature has been used by business education researchers to calculate institutional productivity, faculty productivity rankings, and business education periodical evaluations. Wayne, Clark, and Betley (1987) ranked institutions that offered business education programs based on the number of publications appearing in four business education periodicals: the *Business Education Forum*, *The Delta Pi Epsilon Journal*, the *Journal of Education for Business*, and the *NABTE Review*.

In the same vein, DuFrene, Joyce, and Zimmer (1990) asked department chairs of office administration departments about the quality of 72 periodicals selected from a review of *Cabell's Directory of Publishing Opportunities in Business and Economics*. According to the results of the study, the leading business education periodicals are *The Delta Pi Epsilon Journal*, the *NABTE Review*, the *Business Education Forum*, and the *Journal of Education for Business*.

A search of the literature revealed no study that focused on building a credible literature review using electronic databases for business education research. Thus, this study begins to fill that major gap in the business education literature.

Research Methodology

The research methodology section identifies the research questions and describes the sampling procedures and the study methods followed to select journals, to gather tallies, and to conduct database searches of the four representative electronic databases.

Research Questions

The following four research questions were posed for the purposes of the study:

1. What are the precision rates and recall rates for the four representative electronic databases used in the study?
2. What are the collection failure rates for the four representative electronic databases used in the study and *The Business Education Index*?
3. What are the peculiarities, if any, of the four representative electronic databases used in the study and *The Business Education Index*?
4. To what extent does incorrect indexing occur in the four representative electronic databases used in the study and *The Business Education Index*?

Sampling Procedures and Study Methods

The number of periodical articles from 1999 through 2001 was recorded for authors of works that appeared in four leading mainstream business education periodicals: the *Business Education Forum*, *The Delta Pi Epsilon Journal*, the *NABTE Review*, and the annual issues of the National Business Education Association (NBEA) yearbook. DuFrene, Joyce, and Zimmer (1990) concluded that the four periodicals that achieved the highest recognition and rating factors were *The Delta Pi Epsilon Journal*, the *NABTE Review*, the *Business Education Forum*, and the *Journal of Education for Business*. Since then, the content of the highly regarded *Journal of Education for Business* has broadened considerably so that now it far surpasses the boundaries of business education. For example, recent issues have regularly addressed such topics as business statistics, management and operations research programs, collegiate accounting programs, MBA programs, and the like. As a result, we excluded it as a leading mainstream business education publication for this study. Because the annual National Business Education Association yearbooks clearly focus on mainstream business education matters, and because they are highly regarded by professionals calling themselves

business educators, the yearbooks were used in place of the *Journal of Education for Business*.

A list of authors from the four leading mainstream business education publications was compiled for 1999 through 2001. The names of retirees and professional authors were then removed from that list of authors. The names of retirees were deleted since they were not actively practicing business educators throughout the entire three-year study period. The names of professional authors were also deleted since they were primarily writers and not actively practicing business educators. Using the modified list, one of the researchers electronically searched by author name for those business educators who had published at least three articles in the four leading mainstream business education publications from 1999 through 2001. Online searches were conducted on May 2, 2002, using four commonly available representative electronic databases: ABI/INFORM, ArticleFirst, Education Abstracts, and ERIC. Based upon the tallies, precision, recall, and collection failure rates were then calculated. The 187 articles located through the four representative electronic databases and *The Business Education Index* served as the basis for the calculations.

Results

The results section presents the outcomes from the precision, recall, and collection failure rate calculations as well as the collection failure rate for *The Business Education Index*. It also presents information about database peculiarities and incorrect indexing.

Precision rates were calculated for the four representative electronic databases used in the reported study. Three of the four databases had precision rates above 95%. Those databases and their respective percentages follow: ABI/INFORM, 100%; ERIC, 98%; and Education Abstracts, 96%. An incorrect initial letter appearing as a hit caused the ERIC mismatch, while the Education Abstract mismatches were caused by duplicate record listings. As shown in Table 1, the ArticleFirst database had a precision rate of only 58%. Common surnames caused hits that were not true

Table 1: Precision Among the Four Databases, 1999-2001

Source	Ratio	Precision
ABI/INFORM	9/9	100%
ArticleFirst	31/53	58%
Education Abstracts	82/85	96%
ERIC	52/53	98%

Note. Precision is the number of relevant records retrieved from the database system divided by the total number of records retrieved from the database system as a result of the database search.

matches for authors Bartlett, McPherson, Moore, and Smith in the ArticleFirst database.

Recall rates were calculated for the four representative electronic databases used in the reported study. Three databases, ArticleFirst, Education Abstracts, and ERIC, had recall rates of 100%. As shown in Table 2, the recall rate for ABI/INFORM was 90%. One article written by Bartlett was not found by an author name search because of a misspelled surname (Barlett). A check of the website of the Organizational Systems Research Association, which has links to the full text of articles from the *Information, Technology, Learning, and Performance Journal* from 1999 onward available in portable document file (PDF) format, revealed that the author's last name was spelled correctly in the published article. It appears that the error occurred during the citation's input into the ABI/INFORM database.

Collection failure rates were calculated for the four representative electronic databases used in the

Table 2: Recall Among the Four Databases, 1999-2001

Source	Ratio	Recall
ABI/INFORM	9/10	90%
ArticleFirst	31/31	100%
Education Abstracts	82/82	100%
ERIC	52/52	100%

Note. Recall is the number of relevant records located in the database system divided by the number of relevant records in the database system as a result of the database search.

reported study as well as for *The Business Education Index*. The four electronic databases had collection failure rates above 50%. Those databases and their respective percentages follow: ABI/INFORM, 95%; ArticleFirst, 83%; ERIC, 72%, and Education Abstracts, 56%. As shown in Table 3, *The Business Education Index* had a collection failure rate of 42%. This comparison is not valid, however. Since *The Business Education Index* was not actually produced for 2001 publications, the inclusion of 2001 publications in the denominator distorts the collection failure rate. The databases used in this study located 43 publications for 2001. If those 43 publications were subtracted from the numerator ($79-43=36$) and the denominator ($187-43=144$), the collection failure rate for *The Business Education Index* would be 25% ($36/144$).

Some peculiarities occurred with the databases. These included listings of authors, availability/nonavailability of full-text articles, changes in journal names, and indexing of publications on an inconsistent basis by the four electronic databases used in the reported study. One peculiarity was found with *The Business Education Index*, which did not index a leading journal during one year of the reported study.

In ABI/INFORM only the first author is listed on the first retrieval screen. To view the names of co-authors, the user must click on the title of the article. ABI/INFORM is the only database used in this study with full-text capabilities.

The Organizational Systems Research Association (formerly Office Systems Research Association) changed the name of its journal from the *Office Systems Research Journal* to the *Information Technology, Learning, and Performance Journal* commencing with the Fall 1999 issue. Although *The Business Education Index* picked up the name change in the 1999 volume, the journal name change was not picked up by all of the electronic database retrieval systems used in this study. However, in 2000 none of the *Information Technology, Learning, and Performance Journal* articles were included in *The Business Education Index*.

The Bulletin of the Association for Business Communication changed its name to the *Business Communication Quarterly* commencing with the

Winter 1995 issue. An article written by McPherson in the Summer 1999 issue of the *Business Communication Quarterly* was indexed in the ArticleFirst database as published in the *Bulletin of the Association for Business Communication*.

Another problem with the searches generated from the various electronic databases was inconsistent indexing. *The Delta Pi Epsilon Journal* was not consistently located throughout the three years of periodicals searched. Further investigation revealed that not all of the issues during those three years had been indexed. The same phenomenon was observed in the *Business Education Forum* indexing. Again, many issues during the three-year time span of the study were missing. Incomplete indexing caused retrieval to be sporadic.

Inconsistent indexing was not limited to the online databases. For example, the *Information Technology, Learning, and Performance Journal* was not indexed in the 2000 issue of *The Business Education Index*.

Conclusions and Recommendations

If research articles cannot be located, they cannot be cited. If business educators want their work to be

Table 3: Collection Failure^a Among the Four Databases and Index, 1999-2001

Source	Ratio	Failure Rate
ABI/INFORM	177/187	95%
ArticleFirst	156/187	83%
Education Abstracts	105/187	56%
ERIC	135/187	72%
<i>The Business Education Index</i>	79/187	42% ^b

Note: ^aCollection failure is the number of records sought that were not in the database system divided by the number of records sought in the database system. The calculation denominator was based upon the 187 articles that constituted the scope of the reported study.

^b*The Business Education Index* was not produced for 2001. A total of 43 publications during 2001 were located by the databases used in this study. If these 43 publications were subtracted from both the numerator and the denominator of the original ratio (79/187), the collection failure rate would fall to 25% (36/144) for the two years of the three-year period during which *The Business Education Index* actually existed.

cited, they should carefully consider showcasing their research in periodicals accessible to other researchers through online databases.

The precision of the ABI/INFORM, Education Abstracts, and ERIC databases was high and acceptable. The recall of the ArticleFirst, Education Abstracts, and ERIC databases was also high and acceptable. The collection failure of the ABI/INFORM, ArticleFirst, Education Abstracts, and ERIC databases was high and unacceptable. The collection failure of *The Business Education Index* was also high but much lower than that for any of the studied representative databases.

The collection failure rates exceeding 50% for the four representative electronic databases used in this study soundly dispel the myth that all—even most—business education literature is retrievable electronically. The collection failure rate for *The Business Education Index* was lower than the collection failure rates for the electronic databases, which demonstrates the value of having a database organized and disseminated by business educators. If business educators are not willing to serve as guardians of their own literature by producing yearly literature indexes and websites pointing to the location of their literature, then the business education literature and the business education discipline may be in jeopardy.

All four representative electronic databases and *The Business Education Index* had peculiarities and incorrect indexing.

The following recommendations are offered for business educators:

1. Researchers should know the strengths, weaknesses, and peculiarities of the various online databases. For example, with a collection failure rate of 95%, ABI/INFORM would not be the logical electronic database to use for building a credible business education literature review.
2. Business education professional associations should consider resurrecting *The Business Education Index* in electronic form. Various mechanisms could be used to spread the burden of the workload and to ensure the accuracy and retrievability of business education literature.
3. Business education professionals and business education professional organizations should consider working with database providers to increase the coverage of and improve the indexing accuracy for business education literature.
4. Editors of business education periodicals should consider making the contents of issues retrievable online. If full-text access via PDF format is not possible, the inclusion of abstracts and bibliographic information would help to ensure that the business education literature can be retrieved.

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