

Hidden Inequities of Access

Document Accessibility in an Aggregated Database

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ABSTRACT

Despite ongoing efforts to improve database accessibility, aggregated database vendors concede that they do not have complete control over document accessibility. Instead, they point to the responsibility of journal publishers to deliver articles in an accessible format. This may increase the likelihood that users with disabilities will encounter articles that are not compatible with a screen reader. To better understand the extent of the problem, a document accessibility audit was conducted of randomly selected articles from EBSCO's Library & Information Source database. Full-text articles from 12 library science journals were evaluated against two measures of screen reader compatibility: HTML format (the optimal format for screen readers) and PDF accessibility conformance. Findings showed inconsistencies in HTML format availability for articles in the selected journals. Additionally, the entire sample of PDF articles failed to meet the minimum standard of PDF Universal Accessibility of containing a tagged structure. However, all PDF articles passed accessibility permissions tests, so could be made accessible retroactively by a third party.

INTRODUCTION

Equitable access to information is a core mission of libraries around the world.¹ Yet, achieving equitable access to digital information remains a significant problem because numerous barriers persist, including affordable connectivity, digital literacy, and access to the right devices.² Even when such barriers are overcome, inequitable access to digital information for library users with disabilities is often overlooked.³ For example, while there is a growing awareness of the need to improve database accessibility by both database vendors and advocacy groups like the Library Accessibility Alliance, accessibility extends beyond database search interfaces to include access to information within the digital documents that are indexed in databases.⁴ Further complicating the matter, the aggregated database vendors EBSCO and ProQuest concede that they do not have complete control over document accessibility. Instead, they point to the responsibility of journal publishers to optimize PDF articles for accessibility prior to vendor delivery and/or provide ASCII full text in metadata files, a format used in HTML documents.⁵

There is little research in the library and information science literature on the state of document accessibility in aggregated databases, though one study examined the accessibility of journal articles from the field of disability studies.⁶ However, there are no known studies that have evaluated the accessibility of library and information science articles that are indexed in vendor research databases. Consequently, the purpose of this study was to audit a randomly selected sample of articles from a range of library and information science journals to determine the extent of document accessibility in an aggregated database.

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Defining Accessibility

According to the *Cambridge Dictionary*, accessibility is defined as the ability of something to be enjoyed, understood, reached, or easily obtained by anyone, including people with disabilities. The specific reference to people with disabilities also reflects laws such as the Americans with Disabilities Act, which provides standards and guidance for accessible design, including digital or electronic accessibility. Section 508 of the Americans with Disabilities Act references the international standard Web Content Accessibility Guidelines (WCAG) 2.0 Level AA, as a conformance requirement to make both web and non-web electronic content more accessible to people with disabilities.

WCAG 2.0 is guided by four principles of accessibility: content must be perceivable, operable, understandable, and robust. Perceivable content means that information must be “visible” to one or more of a user’s senses. Operable means that users with disabilities must be able to operate and navigate the components of the interface. Understandable means users with disabilities must understand the information presented and operate the interface. Robust means that a wide variety of users must be able to interpret the content reliably, including with the use of assistive technologies. Web and non-web electronic content must conform to all four principles of accessibility to be considered usable by people with disabilities.⁷

Considerations of accessibility for a database should address both its web-based search interface as well as the electronic documents that comprise the output of a search query.⁸ Furthermore, assumptions that text-based content is more accessible than image-based content should be set aside because text-based content does not always conform to the robust principle—it is not automatically accessible to assistive technologies.⁹ For example, text-based content in the Portable Document Format (PDF) must still be tagged to make it accessible to a screen reader. Therefore, the accessibility of a database should be determined by both the database interface and the accessibility of documents retrieved.

Database Accessibility

Database accessibility has long been of interest to researchers and practitioners in the library and information science field.¹⁰ This interest led to the formation of the Library E-Resources Accessibility Group in 2015 (libraryaccessibility.org). Now known as the Library Accessibility Alliance, the group’s mission is to advocate for the equitable access of library e-resources such as databases, e-books, and websites. The Alliance tests e-resources and posts reports on its website, regularly holds webinars and other events related to library accessibility, and provides resources on accessibility to the library community.

Findings from Library Accessibility Alliance e-resource reports consistently yield mixed results. Challenges in database accessibility continue to occur, particularly in the areas of color and contrast issues for visual design, keyboard navigation, lack of labeling, links and buttons, lack of alternative text for images, and accessible document formats.¹¹ Larger database vendors, especially, are responsive to the Alliance’s e-resource reports as evidenced in their response reports.

Older studies about library database accessibility show comparable results to the Alliance’s e-resource reports, suggesting that designing information retrieval systems for accessibility is a persistently difficult problem to solve.¹² One solution that Elsevier’s ScienceDirect implemented was the addition of user feedback through collaboration in the accessibility testing process. Doing so revealed vital issues such as the need to ensure keyboard support, offer both PDF and HTML

formats at a minimum, and integrate accessibility practices into the editorial stages of publishing.¹³ However, the latter issues may be much easier to implement for e-journal publishers like ScienceDirect than for aggregated database vendors like EBSCO and ProQuest because the latter companies index journals from multiple publishers but are not themselves publishers. As such, document accessibility should be treated as a separate concern than search interface accessibility in the discussion of equitable access to library e-resources.

Document Accessibility

Web-based content that correctly uses HTML elements (i.e., semantic HTML) gives screen readers the appropriate context to read page content aloud. Consequently, databases that include articles in HTML format increase equitable access to content for all users, including users of screen readers.¹⁴ This is particularly important when complex content is involved, like mathematical equations, larger tables, or complex visualizations.¹⁵ However, the advantage of HTML format for screen readers is not the only consideration when evaluating document accessibility because not all users of screen readers have vision disabilities. Screen readers can also improve access to information for people with cognitive, motor, and hearing disabilities, who may prefer the graphical and multidimensional layout advantages that PDF formatting offers.¹⁶

PDF Universal Accessibility (PDF/UA) requires that all meaningful content be tagged with standard structure types that represent the logical reading order of the document so that it may be interpreted by a screen reader. Additionally, no information should be conveyed by visual means alone and all meaningful non-textual elements should have alternative text.¹⁷ Few studies of document accessibility in library databases have evaluated PDF documents at this level. For example, Stewart et al. only define document accessibility as a text-based format, while Tatomir and Durrance include but do not succinctly define PDF accessibility in the Tatomir Accessibility Checklist.¹⁸ On the other hand, Browder does emphasize the importance of tagging PDFs for screen reader accessibility and Çakir, a former editor-in-chief of the journal *Behaviour & Information Technology*, recognizes the importance of PDF accessibility throughout the peer review and publishing process.¹⁹

The most comprehensive study to date about PDF accessibility in the library and information science literature is an examination of PDF article accessibility from four disability journals: Taylor & Francis's *Disability & Society*, Springer's *Journal of Developmental and Physical Disabilities*, SAGE's *Journal of Learning Disabilities*, and Elsevier's *Research in Developmental Disabilities*.²⁰ In total, 200 PDF articles from 2009 to 2013 were randomly selected from the four journals and retrieved through the Web of Science platform. Findings showed that 95.5% of the PDF articles were not tagged and 97% had no alternative text for non-text elements. However, 100% of the PDF articles provided accessibility permissions, so the articles could be made accessible by a third party. The author recommends that publishers create clear accessibility policies as a part of their submission guidelines and that they adopt accessibility conformant authoring tools so that PDF articles may be made accessible at the time of production.

METHODOLOGY

This study used the W3C Working Group's Website Accessibility Conformance Evaluation (WCAG-EM) Methodology as a framework to guide the document accessibility audit, along with the Department of Homeland Security's (DHS) *Section 508 PDF Document Accessibility Test Process* for testing PDF documents.²¹ WCAG-EM offers a standard methodology for evaluating websites and electronic content and is used by auditors and researchers alike. The DHS requires the use of

Adobe Acrobat Pro for conducting Section 508 compliance testing and sets parameters for ending PDF accessibility testing when an element is not compliant. For example, if a PDF is not tagged, then testing ends and the document is marked as not compliant.

Target Platform

EBSCO's Library & Information Science Source (L&ISS) was chosen as the target testing platform because it is the largest full-text aggregated database that indexes articles for the library and information science field. L&ISS indexes 248 journals and covers topics that range from cataloging and classification to copyright, censorship, publishing, rare books, and reference services. EBSCO is also the leading provider of research databases for libraries and often the starting place for research by educators and students, creating a higher likelihood that any accessibility issues uncovered in this study will be widely encountered.²²

Audit Sample

A random sample of full-text articles was selected from 12 scholarly and trade journals indexed in EBSCO's L&ISS. Journals were selected based on their professional recognition and representative coverage of library practice and/or library and information science research. Titles from various publishers were included, as shown in table 1. Ten full-text articles published between 2018 and 2023 were randomly selected from each of the journals listed in table 1 for a total sample size of $N = 120$.

Table 1. Journal titles and publishers in the audit sample

Journal name	Publisher
<i>College & Research Libraries</i>	American Library Association (ALA)
<i>International Journal on Digital Libraries</i>	Springer Nature Germany
<i>Journal of Education for Library and Information Science</i>	Association for Library & Information Science Education (ALISE)
<i>Journal of Library Administration</i>	Taylor & Francis
<i>Library Journal</i>	Media Source, Inc.
<i>Library Quarterly</i>	University of Chicago Press
<i>Library Trends</i>	Johns Hopkins University Press
<i>portal: Libraries and the Academy</i>	Johns Hopkins University Press
<i>Public Library Quarterly</i>	Taylor & Francis
<i>Reference Librarian</i>	Taylor & Francis
<i>School Library Research</i>	American Library Association
<i>Teacher Librarian</i>	El Kurdyla Publishing

Scope of Evaluation

Document accessibility was evaluated against two measures of screen reader compatibility: HTML format availability and PDF accessibility conformance. HTML is considered an optimal format for screen reader compatibility, while PDF documents have a longstanding reputation of being inherently inaccessible to screen readers, although measures can be taken to create accessible PDFs.²³ As such, it was important to determine both HTML format availability as well as the accessibility conformance of PDF articles.

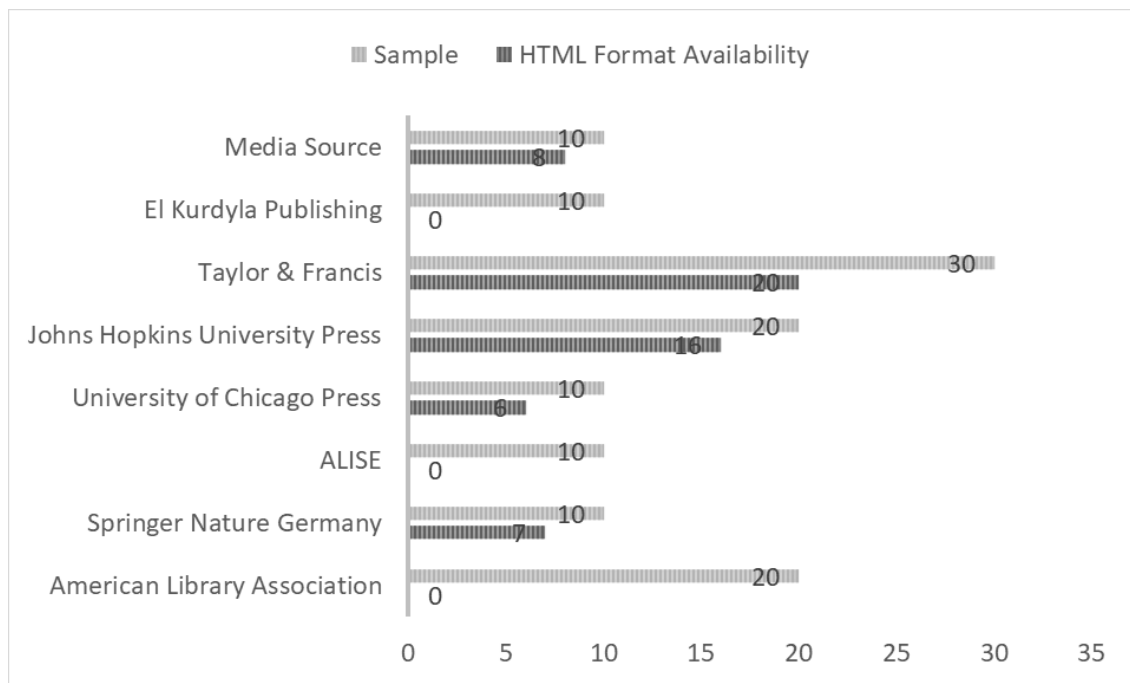
A PDF document must be tagged to be compatible with a screen reader because tagging defines the document’s structure. Additional measures of accessibility also include the use of alternative text descriptions for nontextual elements, document language and title identities, navigational aids like bookmarks, and extractable fonts. However, when a PDF document is not tagged, it is considered noncompliant in terms of 508 PDF document accessibility. At that point, other measures of accessibility become secondary.²⁴ Consequently, this study defined PDF document accessibility as the state of an article being tagged or not tagged. If a PDF document was tagged, it was then checked for secondary accessibility measures. If a PDF document was not tagged, accessibility permissions were determined. Accessibility permissions allow a third party to make the PDF accessible via tags, bookmarks, alternative text, and so forth.

RESULTS

HTML Availability

As shown in figure 1, articles in HTML format were available to varying degrees for five of the eight publishers represented in the study sample. However, fewer than half (48%) of the articles overall included an HTML format option in EBSCO’s L&ISS database. A major contributing factor was the finding that articles from four of the journals were entirely unavailable in HTML format.

Figure 1. HTML availability by journal publisher.



Represented by three publishers, these journals included the American Library Association's (ALA) *College & Research Libraries* and *School Library Research*; El Kurdyla Publishing's *Teacher Librarian*; and the Association of Library and Information Science Education's (ALISE) *Journal of Education for Library & Information Science*. For the remaining journal publishers in the study sample, inconsistencies in HTML format availability were notable among the sampled articles.

While a universal lack of HTML format availability reflects the policies or processes of the journals' respective publishers, the inconsistencies in HTML availability identified across the remaining journals warranted further investigation. As such, the entirety of full-text articles from each issue of a journal that showed inconsistencies in HTML availability were manually checked to determine HTML availability status dating back to 2018. Findings are shown in table 2.

Table 2. HTML status of journal articles in full-text issues, 2018–2023.

Journal	Article Count	HTML Availability (%)
<i>Library Quarterly</i>	208	80.77%
<i>Library Trends</i>	190	84.74%
<i>Reference Librarian</i>	88	88.64%
<i>portal: Libraries and the Academy</i>	203	89.16%
<i>Public Library Quarterly</i>	147	92.52%
<i>International Journal on Digital Libraries</i>	112	86.61%
<i>Journal of Library Administration</i>	261	75.86%
<i>Library Journal</i>	22,316	95.58%

As a percentage of full-text articles published between 2018 and 2023, there was a wide range of HTML format availability in issues of the journals listed in table 2, from 75.86% of articles for the *Journal of Library Administration* to 95.58% of articles for *Library Journal*. Though *Library Journal* had the highest percentage of articles with HTML availability among the journals from that date range, a significantly larger number of articles were missing HTML format ($n = 986$) than other journals in the sample, which ranged from 10 articles in *Reference Librarian* to 63 articles in the *Journal of Library Administration*. This significant difference was due to the sheer size of *Library Journal* in terms of articles per issue and issues per year as compared to the other journals in the audit sample.

It should also be noted that in every case, the lack of HTML format availability occurred at the journal issue level. In other words, when one article in an issue was missing the HTML format option, all other articles within the issue lacked the HTML format as well. On the other hand, there were no discernable patterns for determining which issues of each journal would be missing the HTML format. Those findings appeared to be random.

PDF Accessibility

Findings from the audit of PDF accessibility showed that 100% of the PDF articles ($N = 120$) from this study's original sample failed the minimum standard of PDF/UA accessibility of containing a tagged structure. However, all PDF articles passed the accessibility permissions test, so they could potentially be tagged and made accessible by a third party. While tagging is the minimum standard by which PDF accessibility is measured, the sample articles also failed by other measures of PDF accessibility. Notably, 100% of the articles were missing a primary language assignment, 100% of the articles were missing a descriptive metadata document title, and 96.7% of the articles contained no alternative text for nontextual elements. On the other hand, 73.3% of the articles contained bookmarks, though it should be noted that bookmarks are only an accessibility requirement for larger PDF documents.²⁵

DISCUSSION

Because HTML is considered an optimal format for screen readers, the inconsistencies in HTML availability both within and across journals in this study reveals inequitable access to information for screen reader users of EBSCO's L&ISS. A driving factor for these findings stems from the complete absence of HTML format for four of the journals in the sample. Interestingly, the American Library Association's journal *School Library Research* does not offer an HTML format at all, even on its own platform. However, *College & Research Libraries* does include articles in HTML format on its open access journal platform, though only for issues published within the last five years. To improve the equity of information access for these journals, HTML format should be made available in EBSCO and other database platforms where they are indexed.

Neither *Teacher Librarian* nor *Journal of Education for Library & Information Science (JELIS)* provide HTML format in EBSCO. *JELIS* does make the full-text of its articles available in HTML on its e-journal platform, University of Toronto Press (UTP) Journals. However, UTP Journals is subscription-based at the journal title level, making most users reliant on locating articles within aggregated databases. *Teacher Librarian* is not available on an e-journal platform, though it was previously available as a print subscription. As such, these two journals are the least accessible in the study sample in terms of HTML availability and general access. Screen reader users with vision disabilities would require articles in these journals to be retroactively tagged and tested for PDF accessibility by a third party.

The starkest finding was the universal inaccessibility (100%) of PDF articles from the study's sample, which reveals a profoundly overlooked problem regarding equitable access to the retrieval of information. While there may be cases where an HTML version can be located for an article that is only available in PDF format within EBSCO, this still creates time lag for the database user between access to the source record and access to the source. Time lag is an important evaluation criterion for information retrieval.²⁶ This demonstrates that the quality of information retrieval in EBSCO is lacking in terms of accessibility, despite ongoing efforts to improve the search interface.

Implications

The implications of this study are compounded by the complexities of how aggregated database platforms work. The nuances of accessibility that exist within aggregated systems like EBSCO reveal key differences between database accessibility and document accessibility. This study's findings demonstrate that even if the search interface of a database is accessible and compatible with assistive technologies, barriers may remain for users with disabilities in accessing the documents retrieved when searching. Unreliable HTML availability—even when a journal

publisher provides articles in HTML format—combined with reliably inaccessible PDF articles means that database users who require or prefer to use screen reader technology may experience a critical time lag between locating a desired article and being able to access the information in it.

Furthermore, the issue of inequitable access to information in library databases is a longstanding one that still lacks a resolution, largely because there are many players involved in the responsibility of making information accessible. Database vendors like EBSCO and ProQuest are only responsible for the accessibility of the systems that they design, manage, and provide to customers. For example, in a high-level Library Accessibility Alliance audit of EBSCO's Academic Search database, it was noted that the example PDF document was not tagged.²⁷ In response to the audit, EBSCO stated that it is “working with publishers to promote adoption of tagged PDFs and accessible content generally,” but they have “limited control over accessibility of full text content.”²⁸ Journal publishers are responsible for ensuring document accessibility at the point of vendor delivery. However, large database vendors like EBSCO have the power to yield leverage in pressuring journal publishers to provide accessible content as a requirement of their service.

Limitations

The primary limitation of this study is that it only examined the accessibility of a sample of journal articles from a single aggregated database, which may or may not reflect the broader accessibility experience of library database users. However, two factors provide evidence that this study's findings may be generalizable to other domains and other aggregated databases. First, a random accessibility check of ProQuest's Nursing & Allied Health Premium database yielded an example record with an untagged PDF article for the journal *BMC Nursing*, which suggests that the problem lies with aggregated database vendors in general and results from the reliance on journal publishers to provide accessible PDFs at the point of delivery. Since several of the publishers in this study—including Taylor & Francis, Springer Nature, Johns Hopkins University Press, and University of Chicago Press—publish journals in numerous disciplinary domains, similar findings should be expected when examining document accessibility from those publishers' journals within aggregated databases. Ngangi's study supports this conjecture.²⁹ Second, because EBSCO is the largest database vendor for many libraries, accessibility issues such as inconsistent HTML availability are experienced universally by all types of users of EBSCO databases.

Recommendations

The responsibility for document accessibility lies at the creation point with journal publishers. However, all groups advocating for equitable access to information can play a role in promoting document accessibility. Aggregated database vendors should work to persuade journal publishers to adopt practices that ensure the availability of both HTML text and accessible PDF documents for all indexed journal articles within their databases. Authors also play a role in advocating for accessible journal articles at the point of article submission to a publisher. Even in the absence of publisher document accessibility policies, authors can still submit their work in an accessible format, adopting accessible practices like the use of heading styles and alternative text.

However, until publishers adopt more rigorous document accessibility practices that create consistently equitable access to full-text articles, librarians play a key role in ensuring that library users are universally able to access both source record and source in a manner that is “fully inclusive of all members of their community.”³⁰ Academic and school librarians should be aware of their legal obligations for providing screen reader compatible materials to students with disabilities who have a documented need for such accommodations as written in their 504 plan or letter of accommodation.³¹ The legal obligations are less clear for public librarians because 508

compliance—a federal standard for the accessibility of websites, software, and other electronic content—only applies to federal agencies, as well as any organization that receives federal funding. Public libraries may or may not receive federal funding, which includes E-Rate funding and LSTA grants.³²

In addition to becoming more aware of the issue, librarians may be interested in learning how to remediate PDF documents for accessibility. While the original formatting of a document can sometimes make the task of remediation time consuming, organizations like the International Association of Accessibility Professionals (accessibilityassociation.org) offer training that eases the efficiency of this process. As such, libraries may wish to consider document remediation as part of their accessibility services, with services staffed by individuals who are familiar with the compliance standards of Section 508 of the Americans with Disabilities Act. Table 3 outlines the key requirements of Section 508 PDF document accessibility and explains what it means when a document has passed or failed an accessibility check. Testing requires the use of Adobe Acrobat Pro. See the footnote citation in table 3 for more information.

Table 3. Key requirements of Section 508 PDF document accessibility.¹

Key Requirements	Passed	Failed
Is the PDF flagged for accessibility permissions?	The PDF can be made accessible if it contains textual content.	The PDF cannot be made accessible.
Is it an image-only PDF?	The PDF contains textual content.	The PDF is image-only (or scanned) and not accessible.
Is the PDF tagged?	The PDF is accessible. Further testing is needed to verify that the tags accurately represent the document’s structure.	The PDF should be manually tagged to accurately represent the document’s structure.
Does the PDF contain a logical reading order?	This is a manual check. Logical reading order is typically defined as reading from left to right and top to bottom.	If the reading order is not correct, then verify accuracy of heading levels, paragraphs, tables, figures, etc.
Is the document’s language property set to its native language?	The document is compliant.	The document’s language property enables a screen reader to pronounce the language correctly.
Do images and figures contain an equivalent text description?	The document is compliant.	Alternative text descriptions should be added to all images, figures, and non-textual elements.
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CONCLUSION

To be successful in the mission to provide equitable access to information for all library users, libraries must recognize the complex nature of the systems that create barriers to the universal accessibility of digital information. As this study highlights, discussions about database accessibility must incorporate understandings about document accessibility with the added acknowledgement that aggregated database vendors like EBSCO and ProQuest have limited capacity to resolve all problems related to the accessibility of the full-text articles that they index. Ideally, all publisher-provided full-text articles should be delivered to vendors in an accessible format. However, document accessibility still remains the responsibility of journal publishers—preferably at the point of document creation where decisions about the selection of PDF/UA compliant software tools for document creation or the development of accessibility guidelines for authors at the journal level are more easily made. Finally, libraries should be aware of any or all legal obligations that they may have for ensuring equitable access to information for their users with disabilities. In doing so, they should consider making document remediation an integral part of their accessibility services.

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