

Accessibility Analysis of Academic Library EPUBs

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The European Accessibility Act requires accessible ebooks as of June 28, 2025, and the Americans with Disabilities Act requires digital content used by Title II educational institutions to be accessible, with a strong emphasis on course content, as of April 2027 and 2028. It is therefore increasingly important for librarians and others who select digital collections that may be used as course material to understand the current landscape of full-text accessibility.

The EPUB specification has promise because it includes accessibility features tailored to ebooks, is generally easier to make accessible than PDF, and allows content to be downloaded. However, the extent to which the accessibility features in the specification are implemented by publishers and vendors has not been widely examined in the literature.

The first part of this study assessed nineteen EPUBs from four vendors and eleven publishers. The evaluation included visual, manual checks in Thorium e-reader; automated checks using Ace by DAISY; and manual spot-checks in Calibre ebook manager. The study assessed whether tables of contents, references, notes, and indexes were linked; whether alt text and extended descriptions of images were present where needed; whether headings were appropriately structured; whether MathML was used for mathematical content, if any; whether Ace identified significant specification violations; how thorough publisher-provided accessibility metadata was; and the degree of alignment between publisher metadata and observed accessibility features. In the second part of the study, accessibility metadata for five books each from nine publishers was analyzed. This paper also includes a brief summary of publicly available accessibility information from several library EPUB vendors. The findings indicate substantial inconsistencies among accessibility potential, actual implementation, and reported metadata.

Introduction

The European Accessibility Act (EAA) required accessible ebooks as of June 28, 2025, and the Americans with Disabilities Act (ADA) requires digital content used by Title II educational institutions to be accessible, with a strong emphasis on course content, as of April 2027 and 2028.¹ EPUB, short for “electronic publication,” is a standard for reflowable ebooks and other digital publications. The EPUB specification includes accessibility requirements that build on the Web Content Accessibility Guidelines (WCAG).

Although the EAA does not explicitly reference the EPUB standard, its wording and criteria closely align with EPUB accessibility requirements. Authors of the EPUB specification describe how the standard can be used to fulfill EAA requirements.²

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The ADA requires digital content to meet WCAG 2.1 Level AA and explicitly declines to require conformance to EPUB.³ However, it states that “public entities could still choose to comply with additional standards or guidance related to ... digital textbooks to the extent that the standard or technique used provides substantially equivalent or greater accessibility and usability.” Additionally, under the ADA, ebooks must provide “effective communication, reasonable modifications, and an equal opportunity to participate in or benefit from their services, programs, and activities.”⁴ It might be argued that features such as accessible page numbers, which are outlined in the EPUB specification but not addressed in other guidance such as WCAG or Portable Document File/Universal Accessibility (PDF/UA), are necessary for effective communication in classroom contexts.

PDFs of journal articles and typical course reading formats are widely understood to be problematic for accessibility in that most are not fully accessible and they are difficult to remediate.⁵ Websites avoid the potential for misrecognized text present in PDFs and tend to be easier to remediate for accessibility. Pitfalls for websites include that the website on which the ebook is located may be complex to navigate or have accessibility problems; saving and organizing books or chapters posted as websites can be complicated or unfamiliar to users; and the accessibility specification for websites, WCAG, does not include important accessibility features specific to books. The EPUB specification has promise in that it includes accessibility features tailored to books, is easier to make accessible than PDFs, and can be downloadable. Especially because of potential accessibility advantages of EPUBs, the implementation of accessibility features in EPUBs among library vendors and publishers is important to understand.

A brief overview of accessibility of several library EPUB vendors, based on the vendor’s publicly available information, is included in this study. The overview incorporates critical accessibility issues such as use of digital rights management (DRM). The Accessible Publishing knowledge base for EPUBs says, “The most important of these [distribution] issues is to not apply digital rights management schemes to a publication that limit access to the content. When this occurs, a perfectly accessible publication might no longer be readable at all if, for example, assistive technologies are prevented from reading out the text.”⁶ However, this study selected only titles that were DRM-free and downloadable because that was necessary to allow the books to be examined.

This study assessed nineteen EPUBs for conformance to certain accessibility criteria. The EPUBs were from four library vendors and eleven publishers. The study used visual, manual checks in Thorium e-reader, automated checks in Ace by DAISY, and spot checks in Calibre ebook manager to identify accessibility issues. Additionally, publishers’ reported accessibility metadata was compared with accessibility criteria observed.

Besides the nineteen EPUBs assessed, this study examined accessibility metadata for a separate five books each from nine publishers. The thoroughness, or lack thereof, of the metadata offers some indication of the publishers’ attention to EPUB accessibility.

By examining both implementation and metadata, the study aims to illuminate gaps between accessibility standards, actual practice, and user-facing representations of accessibility. The findings

indicate substantial inconsistencies between accessibility potential, actual implementation, and reported metadata.

What Is an Accessible EPUB?

EPUBs are created using “Open Web Platform technologies like HTML and CSS.”⁷ EPUBs are required, by the EPUB specification, to meet WCAG 2.0 Level A but are encouraged to meet the most current version of WCAG at level AA.⁸ EPUB extends WCAG by including accessibility features that are uniquely necessary for document-specific and book-specific content, such as “accessibility metadata, page navigation, audio-text synchronization and Digital Rights Management guidance.”⁹ As the DAISY Accessible Knowledge Publishing Base explains, “Unlike the general web, where each site’s design often brings its own unique [accessibility] issues, books are more often composed of the same sets of building blocks, making accessibility mappings useful to a broad range of publishers.”¹⁰ In comparison with WCAG, the EPUB Accessibility specification offers a more specific way to make ebooks work for people with disabilities, including assistive technology (AT) users who need to be able to locate and navigate to the features of a book. Speaking at a 2018 Charleston Conference panel, Kasdorf and colleagues explained, “EPUB 3 uses the markup that publishers and vendors routinely use: HTML 5 is the structural semantic foundation; WAI-ARIA augments it for Web accessibility; and DPUB-ARIA adds publication-specific terms like ‘doc- chapter’ and ‘doc- footnote.’ This is spelled out in EPUB Accessibility 1.0, which specifies EPUB features for accessibility; proper navigation and structure so AT can find things and skip to them (e.g., going straight to Chapter 5), or skip over them (for example, choosing not to bother reading the footnotes); and accessibility metadata describes how accessible the pub is (using the identical accessibility properties in schema.org).”¹¹ EPUB Accessibility 1.1 is now current, but Kasdorf’s explanation is still relevant.

Further requirements and recommendations for aspects of accessible EPUBs that are relevant to this study are described here.

Required Metadata

Accessibility metadata is intended to help users determine whether a publication meets their needs prior to accessing it. The EPUB Accessibility 1.1 specification identifies schema.org accessibility metadata that publishers must include:

- A list of all accessibility features
- The modes in which the content is expressed and modes that are sufficient to consume the book
- Any potential physical hazards presented by the content¹²

The specification offers an extensive list of “accessibility features” that can be included, such as alt text, extended descriptions, described math, MathML, reading order, structural navigation (accurate headings), index, and more.¹³

The “access modes” that can be listed are auditory, textual, tactile, and visual.¹⁴ This lets users know whether a book is accessible to their senses. For example, a Deaf person would not want to select a book with an exclusively auditory mode of expression. The access modes of “textual” and “visual” are relevant to the EPUBs in this study. Textual is used for “a publication [that] contains information encoded as text character data,” not images of text that must be read visually.¹⁵ Visual “indicates that the resource contains information encoded in visual form,” such as images that are necessary to understand the content, not only images like cover art or corporate logos.¹⁶ More than one access mode is often included.

The specification states metadata should also include “sufficient access modes” for the book. This is defined as “a set of one or more access modes sufficient to consume the content without significant loss of information. An EPUB publication can have more than one set of sufficient access modes for its consumption depending on the types of content it includes (i.e., unlike access modes, this property takes into account any alternatives for content that is not broadly accessible, such as the inclusion of transcripts for audio content).”¹⁷ A sufficient access mode of “textual” ensures that the whole publication can be consumed through the text alone, meaning that screen readers will be able to provide all the information to a blind user.

The potential hazards include flashing, motion, and sound, which could trigger seizures.¹⁸ It is also recommended to include a “brief, human-readable summary of any information that cannot be expressed through the other schema.org metadata.”¹⁹

Besides metadata required by EPUB Accessibility 1.1, recommendations for displaying metadata are offered by the publication “Accessibility Metadata Display Guide for Digital Publications 2.1,”²⁰ put out by a W3C Community Group. These are not requirements, but Community Group recommendations sometimes evolve to become standards.²¹

Pagination

EPUB Accessibility 1.1 requires identifying the source of the pagination in the EPUB metadata in many situations, such as when the EPUB is a recreation of a print book or can reasonably be expected to be used as such.²² The relevant technique explains, “A student in a classroom, for example, needs to know whether the pagination was derived from the same version of a print book that the rest of their class is using.” If the EPUB is not a recreation of another source, “none” can be listed as the source.²³

EPUB Accessibility Techniques

As noted earlier, meeting WCAG 2.0 or better is required by EPUB Accessibility. The EPUB Accessibility specification and techniques do not repeat the success criteria or techniques provided by WCAG.²⁴ However, particular WCAG techniques that tend to be relevant for EPUBs are summarized by EPUB Accessibility Techniques 1.1.²⁵ Both WCAG and EPUB separate their specification from their “techniques.” Techniques are examples of ways to meet the requirements, although other methods are also allowable.

The WCAG techniques summarized by EPUB and relevant to this study include EPUB Accessibility 4.2.2, which mentions the requirement for a table of contents and encourages providing an index in order to meet WCAG Success Criterion 2.4.5 regarding “more than one way to locate a web page within a set of web pages.”²⁶ Linked indexes are convenient for everyone, but it can be especially time-consuming for blind readers to locate relevant sections from a table of contents or index if they are not linked. Furthermore, EPUB Accessibility 4.4 describes methods to meet the requirements for headings, and 4.5.1 offers resources about creating the required alt text and extended descriptions.

EPUB Accessibility Techniques points to the DAISY Knowledge Base for additional guidance. The latter document describes ways to meet the WCAG Success Criteria related to color contrast and using alternatives to color to convey meaning.²⁷ It also explains how to make footnotes and endnotes identifiable, and prescribes backlinks, which are links from notes back to the related location or locations in the text.²⁸

Finally, “links to reference marks,” such as endnotes or footnotes, are explained: “two-way linking is also beneficial as many reading systems lack a back button, so once a user has followed a link, the only way they can return to where they were is manually.” This is inconvenient for everyone, but blind AT users must listen to extensive content to find the place in the text they were reading when they left to follow a reference.²⁹ However, there is now an effort to make this backlinking unnecessary by promoting e-readers with a back button.³⁰

Besides the WCAG techniques summarized by the EPUB Accessibility specification and techniques, accessible math and extended descriptions are important. Math is often challenging for accessibility because mathematical notation is sometimes conveyed by images or LaTeX and is not interpretable by text-to-speech technology. Accessible math is required by several related WCAG Success Criteria, including 1.1.1, which requires “providing a text equivalent for nontext content.” MathML is one way of rendering accessible math, and the DAISY Accessible Publishing Knowledge Base explains that this is the preferred method.³¹

Extended descriptions are required by WCAG if a short alt text does not fully describe the information conveyed by an image. For example, a complex diagram may be impossible to explain briefly. An extended description can be skipped by the reader, if desired, more easily than alt text can be skipped.³²

Literature Review

In 2020, Zhang et al. performed a systematic review of accessibility in Open Educational Resources (OERs). Although many EPUBs are OERs, they did not mention EPUB specifically.³³ In 2019, Schindler reviewed DRM use and ebook platform accessibility. These are important and related issues for the present study, but they do not examine the accessibility of ebooks or EPUBs themselves.³⁴ In 2018, Reed and Turner examined the accessibility of open-access ebooks from several established OER publishers but mentioned the EPUB format only once and did not focus on it.³⁵

Two studies examining accessibility of ebooks that included EPUBs were located. A 2024 poster by Hellman and Snijder examined 1,144 EPUBs and 36,000 open-access ebooks for accessibility. They found that only 156 of the EPUBs had useful descriptions of images in alt text, 226 had “accessibility data but no useful alt text.” They did not include an explanation of what they considered to be “accessibility data.” It is possible that they were referring to metadata. Their poster did not describe their methods in any detail, but their findings indicate the remaining 785 EPUBs were more problematic for accessibility.³⁶ A 2021 article by Azadbakht, Schultz, and Arellano also tested open-access ebooks, including EPUBs, for accessibility. Theirs was the most in-depth analysis located. They found that “Overall, most of the books did not meet basic accessibility requirements, such as including alternative text for any images, properly coding/tagging any tables and following a logical heading order structure.”³⁷ For EPUB titles, the maximum number of failures was nine of fourteen rubric criteria. Two EPUBs received no failures. Regarding specific criteria, 71.60 percent of EPUBs failed for alternative text, 58.72 percent failed for content order (“is the content ordered to make sense for someone tabbing through the document?”), and 73.39 percent failed for ordered headings (“are headings properly ordered, such as a Heading 2 falls under a Heading 1, a Heading 3 falls under a Heading 2, and so on?”).

They found a higher percentage of alt text (28.4 percent) than Hellman and Snijder (14 percent), but this likely reflects methodological differences. Azadbakht, Schultz, and Arellano assessed whether any nontext content had alternative text, whereas Hellman and Snijder evaluated whether the alt text was useful. This study counted useful alt text and found a somewhat higher percentage of relevant alt text (26 percent) than Hellman and Snijder (14 percent). Due to this study’s small sample size, however, these findings should not be considered representative.

This study examined heading structure but looked at different criteria than Azadbakht, Schultz, and Arellano. The latter studied whether headings were properly nested, whereas this study looked at whether heading levels corresponded to the hierarchy visually presented in the table of contents. Because this criterion extends beyond proper nesting, the findings are not directly comparable.

This study did not examine content order and other criteria used by Azadbakht, Schultz, and Arellano. Although content order is important, it was not feasible to examine all aspects of WCAG conformance.

Another difference between the studies is that Hellman and Snijder examined books from OAPEN, whereas Azadbakht, Schultz, and Arellano focused on criteria that “were most likely to be under a textbook author’s control as opposed to a web developer’s or publisher’s.” Both of these samples are more likely to include works published by individual professors than those in this study. In contrast, implementation of the criteria examined in this study is more likely to be controlled by publishers because the books analyzed here were produced by commercial publishers, both large and small. This study also differs in the data examined: it is the only one that examined both publisher-supplied accessibility metadata and library vendor accessibility metadata, when available, and compared those claims with findings from direct examination of the books. It is also the only one that examined links

for tables of contents, references, and indexes; backlinks for references; and indications of math accessibility.

The author also located several articles addressing ebook and EPUB accessibility from the perspective of publishers. Carey discusses industry debate regarding the EAA's application to previously published ebook titles.³⁸ Enis reports publishers' views regarding accessibility practices and challenges. Enis notes that "according to surveys of more than 1,400 academic publishers conducted in 2020 and 2023 by EBSCO Information Services, 'For ebooks with publication years 2022–2023, 77 percent were provided in EPUB, contrasting with 68 percent of ebooks with publication years 2020–2021,'"³⁹ which is movement in an accessible direction, suggesting increased adoption of EPUB. However, he also reports that only 30 percent of survey respondents indicated that their organization had a dedicated "accessibility program," and 42 percent were not aware of the EAA.⁴⁰ Stacy Scott, accessibility lead at Taylor & Francis, describes the company's efforts to improve accessibility, including avoiding DRM and converting some ebooks to EPUB3 "to improve the structural integrity and navigation of these files, with accessibility in mind."⁴¹

Vendors' Accessibility and Selection

This study examined ebooks from four major academic library ebook products or vendors: EBSCO Ebooks, Ebook Central (ProQuest), Springer Nature, and Taylor & Francis. Some vendors provide extensive accessibility information online, including accessibility statements, Voluntary Product Accessibility Templates (VPATs), sometimes called Accessibility Conformance Reports (ACRs), information for users and librarians, and recordings of presentations about accessibility. Others provide relatively limited publicly available information, although this does not always reflect a lack of attention to accessibility. Accessibility reviews by the Library Accessibility Alliance (LAA) also provide useful information about certain vendors' platforms. These reviews tend to focus primarily on platform accessibility rather than full text.⁴²

EBSCO and ProQuest both provide extensive information about their accessibility. A concern with both vendors is the use of DRM. Both offer alternatives for users with disabilities who are excluded by DRM restrictions, but it is unclear whether these workarounds fully meet requirements to provide "substantially equivalent ease of use" and "equally effective" access,⁴³ as the alternatives can be burdensome.

For downloaded books, ProQuest uses Adobe Digital Editions (ADE), which manages DRM. Until April 2026, EBSCO did as well. Inclusive Publishing, an initiative of the DAISY Consortium, states, "Our evaluators found [Adobe] Digital Editions on Windows to be unstable and it struggled with larger books. Reliability issues are also reported on iOS and Android. Navigating the table of contents with a screen reader was unsatisfactory."⁴⁴ Users with and without disabilities may find installing and using ADE cumbersome.

ProQuest offers a “text-only mode” for users with disabilities to access their PDF format DRM-protected titles. ProQuest says its EPUB format does not need “text only mode” and is natively accessible.⁴⁵ Text-only mode provides text but does not necessarily include markup necessary to meet WCAG, such as headings, alt text, and more. Lack of this markup introduces significant accessibility barriers. ProQuest also states, “If the existing content does not meet the needs of users, remediation options are available and can be requested via the Support team.”⁴⁶ No time frame for responses was identified. It is unclear whether ProQuest could create a fully remediated, WCAG-compliant ebook or only a DRM-free file. A DRM-free file allows a library or disability office to remediate the ebook, but this is time-consuming. ProQuest indicates that end users with disabilities can contact them and they will “work with you [end users] to identify the best option for remediation, subject to content licensing restrictions and technical capability.”⁴⁷ ProQuest does not appear to have contact information dedicated for accessibility or remediation requests but offers its general contact information.

In April 2026, EBSCO rolled out Radium LCP, a DRM system that is more compatible with AT than ADE. Radium integrates with the Thorium e-reader, which is free e-reader software for Windows, Mac, and Linux. Thorium’s website states that “massive efforts are ... made to make Thorium Reader highly accessible for visually impaired and dyslexic people.”⁴⁸ EBSCO also offers to provide a DRM-free version for users or librarians, who can obtain these by using the “Accessibility Support” button on the ebook interface. This is typically available in three to five business days, according to EBSCO, but occasionally can take up to thirty days if files have to be requested from a publisher.⁴⁹

The author requested one ebook for two students with disabilities in fall 2025. She was routed from the EBSCO email, to its form, and then to Bookshare because the publisher of that book deposits its books in Bookshare. Bookshare is a service that provides more accessible versions of ebooks to users who register with a disability through Bookshare or through their school so that the school can distribute the Bookshare books. Finally, Bookshare routed her to her school’s accessibility office, where the book was eventually obtained for the students. The accessibility office then added the author as a sponsor on the school’s Bookshare account. This allows the author to search Bookshare, view book files, and make them available to users who have been added to Bookshare by the disability office. This reduces the delay in getting books to users. Now she checks Bookshare either before or at the same time as requesting through EBSCO. In May 2026, the author communicated by email with a director from EBSCO who said that typically EBSCO has access to the remediated files of EBSCO ebooks that Bookshare would have.⁵⁰ Therefore, if she was routed to Bookshare, the author might email accessibility@ebSCO.com to request EBSCO’s copy if it would be preferable to the Bookshare copy. If a user did not yet have a Bookshare account, this could be an additional minor impediment or delay, although she finds many students do have a Bookshare account. She finds Bookshare books tend to be fairly accessible but do not always entirely meet WCAG and sometimes need further remediation.

It is not entirely clear whether EBSCO will fully remediate an ebook to meet WCAG. However, in the experience of the author and others at her school, EBSCO does fully and quickly remediate journal

articles using the same Accessibility Support request form as is available to request ebooks. This vendor remediation is extremely valuable in reducing the delay for users.

Taylor & Francis offers to provide more accessible alternative formats and uses DRM infrequently. Per their platform's accessibility documentation:

When a work is unavailable for purchase in a suitable format, we aim to provide one within three working days....The texts we provide are Digital Rights Management (DRM)-free and are mostly available in searchable PDF format. This works with most screen reading software. We can also supply texts in Word, EPUB, or XML format....Some content in PDF format may not have been designed for accessibility. For example, older archive content reproduced from original printed sources may be presented as scanned PDFs, or images of text. We will always attempt to supply an OCR PDF (with optical character recognition) for screen reading, but this may not always be possible.⁵¹

Taylor & Francis provides a VPAT, a detailed accessibility statement, and reports improvements such as incorporating alt text for all relevant images in some of their books, including all books published from June 2024 forward.⁵²

Springer Nature provides an accessibility statement, a VPAT, and an option to request alternative format for accessibility reasons.⁵³ A 2023 LAA evaluation was fairly positive, saying, "There are very few WCAG 2.1 compliance issues with the platform. Those identified are very minor overall....The evaluation of the PDF documents, however, did reveal major accessibility issues."⁵⁴ Notably, Springer Nature does not use DRM on its ebooks.⁵⁵

Additional vendors at the author's institution were considered but not included. ACLS Humanities E-books has given extensive attention to accessibility, but its EPUBs are not downloadable for analysis. Ovid was excluded because its EPUBs are not downloadable. Although no information about accessibility in Ovid was found online, a third-party review from LAA gave Ovid Medline a relatively positive review in 2024. The review said, "There are very few WCAG 2.1 compliance issues with Ovid Medline and they are very minor overall with the most pressing issue being with ARIA implementation and a few color issues."⁵⁶ Based on the screenshots in the review, Ovid Medline seems to use a separate section of the same interface as its ebooks, so the review may be partially relevant to its ebooks. Gale, JSTOR, and APA were examined but do not offer EPUB; all are DRM-free.⁵⁷

The selected vendors meet two criteria: they are available through the author's institution, and they offer EPUBs that are downloadable without DRM, allowing examination using Ace by DAISY, Thorium, and Calibre. These were typically open-access EPUBs.

EPUB Selection

This study focuses on books because adoption of EPUB format is more common for books, although the specification is intended for other professional publication formats as well. "The expectation is that

publishers will utilize the EPUB 3 format for a broad range of content, including books, magazines, and educational, professional, and scientific publications.”⁵⁸ For example, Sage publishes journal articles in EPUB format. Because several criteria examined in this study are not relevant to journal articles, however, the analysis focuses exclusively on ebooks.

For the first part of the study, EPUBs were selected from each vendor based on several criteria. Only titles in English were examined because this is the author’s only fluent language. Titles had to be downloadable without DRM for the reasons described above. At the time the study was conducted, all vendors in the study except Springer offered some EPUBs that were either restricted to online viewing or protected by a version of DRM that limited the ebook to use within ADE. After the study was completed, EBSCO changed from ADE to Radium LCP for DRM. The number of titles that were downloadable and without DRM limited the selection considerably.

Titles were chosen to represent a range of publishers available through the vendor at the author’s institution. When multiple titles were available from a publisher, an effort was made to select the most recent publication because newer titles may reflect more current accessibility practices. When possible, titles in math and science were included to allow examination of accessibility features relevant to mathematical content, complex images, and tables.

For the second part of the study, which examined only metadata, EPUBs were again limited to those that were in English and available through the author’s institution. Then EBSCO’s filter by publisher option was used to view how many books by each publisher were available. Because EBSCO’s filter by publisher option was especially useful to focus on publishers, only EBSCO was used. The publishers that had the most results were prioritized. Five of the most recent EPUBs for each publisher were selected.

Methods for Examining Books

The author selected Thorium Reader to examine the books because accessibility features within the EPUB were unlikely to be blocked by the reader’s functionality. She also examined some books within the vendors’ ebook viewers. She used either Thorium or the vendor viewer to check the following:

- Linked table of contents
- Linked in-text citations or footnotes
- Links from references back to in-text citations or footnote numerals
- Linked indexes, where present

Ace by DAISY is an automated, open-source tool designed to assist in evaluating conformance with the EPUB Accessibility Specification.⁵⁹ Ace reports violations of WCAG 2.0, EPUB, and issues it categorizes at “best practices.” It displays a table listing the violations of each specification and of Ace’s list of “best practices.” It classifies the violations as serious, moderate, or minor. The number of violations should not be interpreted as a direct measure of a book’s overall accessibility. In Ace, the following issues were examined:

- Presence and adequacy of alt text

- Appropriateness of headings compared with the table of contents
- Violations identified by Ace
- Metadata violations identified by Ace
- Accessibility features reported in publisher metadata
- Accessibility hazards reported
- Publisher accessibility summaries in metadata

The author documented discrepancies between publisher metadata and findings from manual or automated examination. For EBSCO books, she recorded the vendor's "Ace by DAISY" score; for Springer titles, she noted accessibility descriptions on the Springer interface.

For books in which mathematical notation was observed visually, mentioned by Ace, or indicated in metadata, Calibre was used to examine the EPUB code for the presence of MathML. Calibre can expose the ebook code, which was searched for indicators of MathML such as the `<math>` element. Calibre was also used to check for extended descriptions that may not have been visible through other methods. At least one chapter requiring an extended description was examined for code indicators such as `aria-describedby`, `desc`, `details`, `summary`, or `longdesc`, and for relevant hyperlinks near images. The list of sections outside the chapter was also reviewed for files such as `descriptions.xhtml`.

In addition to direct examination of EPUB files, accessibility metadata available via EBSCO was examined for five books each from nine publishers.

Findings and Discussion

Tables of Contents and Access Modes

Findings are shown in [Spreadsheet 1](#), EPUB Analysis. All of the books the author examined included linked tables of contents, which supports accessibility, as noted earlier. All books also reported an "access mode" of "textual, visual." This indicates that the default modes of consuming the book is reading text—either visually, via text-to-speech AT, or through refreshable Braille—and perceiving visual content such as images.

In the "access mode Sufficient" field, seven of the books examined listed sufficient access modes of both "textual, visual" and "textual" alone, indicating that they claimed to be fully accessible without vision. One additional book listed "textual" alone as a sufficient access mode.

Of these eight books that claimed full accessibility without vision, three were judged by the author to provide adequate alt text or extended descriptions. One of these three included alt text that duplicated figure captions; although this practice is not ideal, it would still allow access without vision. The remaining five books that claimed full accessibility without vision were judged to require additional extended descriptions, as discussed further below.

Eight books listed "textual, visual" as the only sufficient access mode, indicating that not all nontext content was described and that the books were therefore not fully accessible to users without vision. In

four of these cases, alt text was missing for some or all relevant images, and the metadata accurately reflected this limitation. In two cases, alt text likely would have duplicated figure captions and therefore may not have been necessary. In one case, the only images identified were a cover image and logos. In these three cases, it is possible that the books could have claimed “textual” as a sufficient access mode, meaning that they would comply with WCAG in this respect. However, because this study did not examine every image in each book exhaustively, it remains possible that some nontext content was not accessible without vision. In the remaining case, detailed alt text was present, but additional extended descriptions were judged to be necessary; the metadata therefore appeared to report this limitation accurately because the book was not fully accessible without that.

Three books did not include any accessibility metadata, making assessment of metadata accuracy inapplicable.

Table 1. Access Mode Sufficient

Publisher metadata	Reported accurately?	Reported inaccurately?	Not applicable
Textual, visual; textual (vision not necessary)	2	5 Extended descriptions were needed or possibly needed	
Textual (vision not necessary)	1		
Textual, visual (vision necessary, does not meet WCAG)	4 Some or all alt text was missing	2 Possibly not accurate, alt text likely would have duplicated captions and so not needed. Possibly could have claimed textual, visual; textual (meets WCAG) 1 Possibly not accurate, no meaningful images were located; possibly could have claimed textual, visual; textual (meets WCAG)	
Textual, visual (vision necessary, does not meet WCAG)	1 Alt text was present but extended descriptions needed		
No accessibility metadata present (violates EPUB specification)			3
Totals	8	8	3

Alt Text and Extended Descriptions

Alt text in the books examined was marked “Yes” in [Spreadsheet 1](#) when it was present for most images where relevant and provided a meaningful description. Five books met this criterion. Of these, three were marked “yes, detailed,” indicating that comparatively rich alt text was provided. In one of these cases, the author judged the alt text to be clearer and easier to understand than the diagram it described. One book was marked “Yes, but duplicative,” indicating that alt text was present but repeated information already conveyed in figure captions. In this case, null alt text likely would have been more appropriate so that screen reader users would not hear the same description twice.

One book was marked “Yes, detailed but not adequate,” reflecting the presence of a comparatively lengthy description of a complex image that nevertheless failed to convey the image’s full meaning. Three additional books were marked “Yes, but may not be adequate,” where it was unclear whether the alt text sufficiently conveyed the information presented in the images.

Seven books were marked “No” for alt text when descriptions were missing or not meaningful, such as cases in which random strings of characters appeared in the alt attribute. Three books were marked “Not applicable” when alt text was not present but also not needed, such as when figure captions fully described the images and additional alt text would have been improperly redundant. Further detail for each book is provided in [Spreadsheet 1](#).

Extended descriptions provide a mechanism for conveying information about complex images that cannot be adequately described using short alt text alone. Extended descriptions were identified in only one book. Of the remaining nine books that included alt text, additional extended descriptions were judged to be necessary in three books, potentially necessary in three additional books, not necessary in two books, and in one book the images were too complex for the author to determine whether extended descriptions were needed. Books that lacked alt text entirely were marked “not even alts” in the extended-description column and were not examined further for the presence of extended descriptions.

Table 2. Alt Text and Extended Descriptions

Alt text	Number	Extended description needed?	Extended description present if needed?
Present and descriptive/ relevant	6 Total 2 of them had detailed alt text 1 of them had duplicative alt text	2: Needed 1: Possibly needed 2: Not needed 1: Unsure/Image too complex for author to determine	1: Yes 2: None found
Not present and not needed	2	2: Not needed	N/A
Present and detailed, but not adequate	1	1: Needed	1: None found
Present but may not be adequate	3	1: Needed 2: Possibly needed	3: None found
Not present or relevant for all images when needed	7	1: Not needed (most images in this book had adequate descriptions in fig captions, but some images needed alt text) 6: Did not even have any alt text, so were not examined for extended descriptions	N/A

Notes, Indexes, Headings, and Math

References, footnotes, and endnotes—referred to here collectively as *notes*—should be hyperlinked to the portions of the text to which they refer. Fifteen of the books examined included notes, whereas four did not. None of the books that included notes were missing hyperlinks from the text to the corresponding notes.

In addition to links from the text to notes, accessible navigation requires a mechanism for users to return to their original location in the text after following a note reference. Backlinks are a common solution. Six books included backlinks from notes to the text. In four books, selecting a note reference opened a callout box rather than navigating to a different location; in these cases, users could close the callout box to return to their place in the text, and a backlink was therefore unnecessary. This is a feature of Thorium reader and might not work as well in other readers. Two books contained multiple sets of notes, with some sets implemented using callout boxes and others using links and backlinks. Five books did not include any mechanism to return readers to their place in the text after accessing a note. As mentioned, efforts to create an e-reader with a “go back” button might obviate the need for backlinks in the future.⁶⁰

Table 3. Return mechanism for references, footnotes, endnotes

Mechanism to return to user’s place in text	Number
Backlinks	6
Callout boxes	2
Backlinks and callout boxes	2
No mechanism to return	5
Not applicable, No references, footnotes or endnotes in book	4

Indexes should be similarly linked to the portions of the book to which they refer. Fourteen of the books examined included indexes. Of these, ten provided links from index entries to the relevant content, whereas four did not.

Headings play a critical role in navigation for blind readers and other AT users. Headings should be marked using appropriate heading levels so that screen readers can identify section structure and hierarchy. To assess heading quality, the headings identified by the Ace checker were compared with the corresponding tables of contents. Six books included more heading levels than appeared in their tables of contents, which is likely to support more granular navigation. Eight books included heading structures that corresponded adequately to their tables of contents. Four books included fewer headings or fewer levels of headings than their tables of contents suggested, indicating insufficient structural markup. Two books used separate headings for chapter numerals and chapter titles, which is unnecessary and duplicative. In one case, the headings were otherwise adequate, and in the other there were fewer headings than needed. One book included headings that differed substantially from its table of contents, suggesting inaccurate or inconsistent heading structure.

Mathematical content was identified in three books. Two of these included MathML, as required for accessible math; however, the author is unable to assess the accuracy of MathML. One book contained only one short equation and did not have MathML. In cases involving simple equations, it is sometimes possible to provide accessibility by describing the equation in alt text; however, no such description was provided in this instance.

Violations Found in Ace Checker

Violations of relevant accessibility specifications identified by Ace are summarized for each book in [Spreadsheet 1](#). The total number of violations reported by Ace should not be interpreted as a direct measure of a book's overall accessibility. Like other automated checkers, Ace reports the same issue repeatedly when it occurs multiple times within a publication. For example, if a book's standard link text has insufficient color contrast, Ace reports a separate violation for each instance of that link. As a result, books with many repeated instances of a single issue may appear to have more violations than books with fewer but more substantive accessibility problems.

In addition, Ace cannot always interpret contextual factors that affect the practical severity of violations for ebook users. For these reasons, the author's assessment of the significance of the reported violations is summarized alongside Ace's findings in [Spreadsheet 1](#). For example, in five books accessed through EBSCO, Ace reported numerous violations related to a small link regarding EBSCO terms and conditions that appears at the end of book sections. Although these violations increased the total count, the author judges them to be unlikely to have a meaningful impact on most users. These issues appear to be vendor related rather than indicative of publisher attention to EPUB accessibility.

Six books had no violations reported by Ace. Four additional books were judged by the author not to have significant accessibility issues based on Ace's findings because they contained very few violations and those present were unlikely to substantially affect user experience. The remaining nine books were judged by the author to have more significant accessibility concerns.

Seven of the books with more significant issues had problems identifying the source of pagination. In instructional or classroom contexts, this can pose a serious barrier when users need to locate the same page numbers as peers using a print version of the same text or when citing the book. Six books had color-contrast issues, which may make content difficult or impossible to perceive for users with certain visual disabilities. Three books did not specify a language, which can impede AT's ability to interpret and present content correctly. Three books were missing all accessibility metadata, which presents a substantial barrier for users who need to determine whether a book will be usable before purchasing or spending time to obtain it.

Publisher's Metadata

Ace reports specific violations related to accessibility metadata requirements in addition to content-level issues. Aside from cases in which all accessibility metadata was missing, the only metadata-specific violation identified by Ace concerned a single book that lacked an accessibility summary. Because that same book also incorrectly reported the presence of alt text when no alt text was found, the publisher's metadata for that title appeared to be unreliable.

Most books reported "none" for accessibility hazards. Four books are marked "not applicable" in [Spreadsheet 1](#), EPUB Analysis, because they did not include any accessibility hazard metadata. One anomalous case involved the ebook *Flowing Progress* by Purdue University Press, for which ProQuest's

hazards field stated, “Accessibility Hazards: No California Proposition 65 hazard warning necessary.” California Proposition 65 concerns exposure to toxic substances and is not relevant in this context. However, the publisher’s hazard metadata embedded in the EPUB itself was more substantive than most, specifying “noFlashingHazard,” “noSoundHazard,” and “noMotionSimulationHazard,” whereas many other books simply listed “none.”

The content of accessibility summaries varied widely across books, as shown in [Spreadsheet 1](#). Many, but not all, summaries claimed conformance with a version of WCAG, EPUB, or both. In several cases, summaries explicitly acknowledged accessibility limitations, but most did not. For example, one Springer book stated, “This publication is missing alternative text for complex diagrams. The publication otherwise conforms to the EPUB Accessibility specification at WCAG Level A.”⁶¹ Another Springer book acknowledged the absence of backlinks. A Taylor & Francis Group book summary noted that “some images and tables may appear on pages different from the print version,” information that may be especially relevant to readers working alongside others using print copies.

Some accessibility summaries listed certain aspects of accessibility, whereas others did not, even if such features were present. For instance, Amsterdam University Press stated, “When necessary, short alt texts and/or extended longer descriptions are provided.”⁶² A Purdue University Press summary described a range of features, including alternative text, tables of contents, page lists, landmarks, structural navigation, indexes, and semantic structure.”⁶³ Several summaries mentioned the presence of structural markup and others did not, even when such markup was observed.

Beyond summaries, the accessibility features fields also varied substantially. These are displayed in [Spreadsheet 1](#). In at least four cases, information listed in the features field was largely duplicated in the summary, limiting its usefulness. Some books listed structural markup, alt text, tables of contents, and other accessibility features, whereas other books with similar features did not report them. Although the EPUB Accessibility specification does not require standardized content for these fields, at the present stage of adoption it may be helpful for publishers to describe accessibility elements explicitly in either the summary or features fields because many EPUBs still lack required accessibility elements and users cannot assume their presence.

Discrepancies between publisher-supplied metadata versus accessibility findings based on Ace and manual examination are summarized in [Spreadsheet 1](#). For four books, no discrepancies were identified. For three books that lacked publisher metadata entirely, discrepancies could not be assessed. The remaining twelve books all exhibited some form of inconsistency. In one case, alt text was reported but not found. More commonly, publishers claimed conformance with a version or level of WCAG or EPUB Accessibility while the book lacked alt text, extended descriptions, appropriate heading structure, or sufficient color contrast, any of which means it does not fully meet the version or level of WCAG claimed. Several books were missing page source metadata, which is a violation of EPUB Accessibility 1.1, while the publishers claimed to meet it. Two books from one publisher listed a print page source as an accessibility feature in the summary but did not correctly enter it into the relevant metadata field, causing Ace to identify pagination source violations.

Vendor Metadata

Several vendors provide book-level accessibility-related metadata in their platform interfaces. In EBSCO eBooks, each title is given a score labeled “EPUB [×]% pass (provided by Ace by DAISY).” EBSCO developed its own automated checker based on the DAISY Consortium’s Ace tool. In the seven EBSCO books examined in this study, reported pass rates ranged from 98 to 99 percent. No explanation of how these percentages are calculated was located. The scores appear potentially misleading, as one book with a reported 99 percent pass rate lacked alt text, had heading problems, omitted accessibility metadata, and did not specify a language. Based on the author’s sampling, EBSCO’s “Ace by DAISY” score does not appear to be a reliable indicator of overall accessibility.

On the positive side, EBSCO provides access to publisher-supplied accessibility metadata through a “view all metadata” link on each title’s record. This allows users who seek accessibility information to locate it without opening the ebook itself. However, some metadata elements are presented in a technical format that may be difficult for readers to interpret. For example, “schema:accessMode: textual, visual” is unlikely to be meaningful to most users without additional explanation. In comparison, Thorium’s user-facing explanations of EPUB accessibility metadata—such as “all content can be read as read-aloud speech or dynamic Braille”—are clearer. Thorium’s explanation conforms with the guidance of “Accessibility Metadata Display Guide for Digital Publications 2.1.”⁶⁴

In Ebook Central, ProQuest provides its own accessibility-related fields for each title, which differ from the metadata required by the EPUB specification. Not all fields are populated for every book. Titles with more extensive metadata may include fields such as:

- “Screen Reader Friendly,”
- “Accessibility Summary,”
- “Accessibility Information,”
- “No reading system accessibility options actively disabled (except),”
- “Table of contents navigation,”
- “Single logical reading order,”
- “Short alternative textual descriptions,”
- “Use of color is not sole means of conveying information,”
- “Use of high contrast between text and background color,”
- “Next / Previous structural navigation,”
- “All non-decorative content supports reading without sight,” and
- “Publisher contact for further accessibility information.”

One concern identified is that, for all eight books examined in Ebook Central, ProQuest listed “Accessibility summary: not provided by publisher,” even when the publisher’s EPUB metadata did include an accessibility summary. Even if ProQuest means that the summary was not provided through a separate metadata exchange process, the presentation is misleading because it ignores information embedded in the EPUB itself. Another concern is the use of the phrase “screen reader friendly,” which

is not clearly defined. Many accessibility criteria specified by WCAG and EPUB affect screen reader behavior, and without further explanation users are left to guess which features are included.

Springer's platform provided a notably detailed accessibility description for one ebook, covering both the PDF and EPUB versions. The EPUB description stated that the ebook was designed to meet EPUB Accessibility 1.0 AA and WCAG 2.2 Level AA, highlighting navigable tables of contents, structured headings, alternative text for images, reflowable and resizable text, sufficient contrast, and Springer's email address for accessibility queries. However, the metadata embedded in the EPUB itself stated that the publication "conforms to EPUB Accessibility specification at WCAG 2.2 Level AA," a stronger claim than the platform's phrasing of "aiming to meet." This distinction between intent and conformance is significant. In addition, Springer's platform description did not mention accessible math features that were present in the book, whereas the ebook metadata did. Another Springer title with more accessibility issues simply indicated that accessibility information was forthcoming.

In Taylor & Francis's platform interface, accessibility information on search results was limited to an icon labeled "Global Certified Accessible by Benetech EPUB Accessibility 1.1 WCAG 2.1 level AA." This certification applies to the publisher's workflow rather than to individual books. Publishers certified under this program may include Benetech-certified metadata in each EPUB, but certification is awarded for one year⁶⁵ and does not guarantee that every title meets the stated criteria. The author learned from Taylor & Francis that its Taylor & Francis eBooks, Reference Works and Collections product does have detailed accessibility information on its interface for each book; however, that was not the case for the product to which the author has access.⁶⁶

Rather than vendors wrestling with these issues and inventing their own metadata, using the "Accessibility Metadata Display Guide for Digital Publications 2.1" would likely be effective. Avenues for recommending changes to these guidelines are available.

Additional Books' Metadata Examined by Publisher

[Spreadsheet 2](#), Metadata Analysis by Publisher, and [Spreadsheet 3](#), Publishers with No Metadata, present data for five books each from nine publishers. Metadata was collected from EBSCO's display for each book. To account for the possibility that metadata practices have improved over time, the most recent titles available to the author through her library were selected. These titles ranged in publication year from 2019 to 2022, and the most recent year examined for each publisher is indicated in [Spreadsheet 2](#).

For six of the nine publishers, none of the five books examined included any accessibility metadata. Three publishers included accessibility metadata for the majority of the books examined: Routledge; University of North Carolina Press; and University of Nebraska Press and its imprint, Potomac Books. In the case of the University of Nebraska Press, identical accessibility metadata was reported across all five books examined. Four of these titles were also included in the first book analysis and were found to have multiple discrepancies between publisher metadata and accessibility findings based on Ace and manual examination. This pattern suggests that metadata may have been reused across titles without verification against the actual accessibility of individual books.

Routledge's and the University of North Carolina Press's metadata varied. The University of North Carolina Press's "summary" fields metadata offered lists of features mostly the same as what they listed in the "features" field. Routledge's "summary" fields, however, offered more robust and human readable descriptions than what was in their "features" field.

Conclusions

It is positive that most of the books in the first analysis—sixteen of nineteen—included accessibility metadata; however, the examination of additional titles by the publisher did not bear this out, as only three of nine publishers had any accessibility metadata, and one of the three appeared to be unreliable. Of the books in the first analysis, slightly more than half accurately reported their "access mode sufficient" so that users with disabilities could predict whether the books would work for them. At this level of accuracy, it seems unlikely that users with disabilities would want to rely on this information. Less than half of the books examined had adequate alt text, and only one book was found to include longer descriptions, so improvement seems to be needed in this area.

In the first analysis, all of the books had linked tables of contents and notes, if they contained notes, and the majority contained linked indexes if they had indexes. More than half of the books that had notes included a mechanism for readers to return to their place in the text after accessing a note. Almost two-thirds of the books had adequate headings. Just over half of the books were found to have either no errors as detected by Ace or no significant errors. Areas for improvement in the remaining books included color contrast, specifying language, and identifying the source of pagination. Most books did not report any hazards. Although this type of content is probably not extremely common in academic EPUBs, it is important to identify hazards for those impacted.

It would be useful for publishers to increase their identification of accessibility features in metadata or summaries because many EPUBs still do not include these features, even though they are often required; therefore, users cannot yet take them for granted. Publishers' self-reported metadata claiming conformance with WCAG or EPUB accessibility criteria was not found to be fully reliable.

Generally, vendors' interfaces seemed less reliable than ebook metadata, with the exception of EBSCO's direct display of the publisher's metadata itself. EBSCO's Ace by DAISY score did not seem helpful, and ProQuest's metadata was misleading at times. Springer's interface seemed hesitant to mention accessibility features in one case. Taylor & Francis did not have any metadata on its search results interface that was unique to each book in the product to which the author has access. Use of the "Accessibility Metadata Display Guide for Digital Publications 2.1" could improve vendor display of metadata.

The examination of metadata by publisher revealed some patterns. Routledge and the University of North Carolina consistently included accessibility metadata. However, one University of North Carolina title in the first analysis did not include accessibility metadata. Routledge and its parent company, Taylor & Francis, were found to have consistently robust accessibility metadata in three books in the

first analysis. The other seven publishers examined consistently did not include accessibility metadata, or the metadata seemed unreliable in the case of the University of Nebraska Press.

Although there are many areas for improvement in EPUB accessibility, it is encouraging that some features of the accessibility specifications were used in more than half of the books examined. It is reasonable to hope that, with the European Accessibility Act and the new regulations under the ADA, future studies will find further improvements. Additional studies examining larger numbers of EPUBs and publishers would be useful so that reliable generalizations could be made.

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