
Legal and cultural landscape of mathematics accessibility in the United States: 2024

Jeffrey Kuan

In April 2024, the United States Department of Justice released new guidelines, which will mandate that all state and local institutions of higher learning comply with WCAG2.1AA standards by either April 2026 or April 2027. This survey will briefly summarize the context of these guidelines, and how they affect mathematics accessibility in the United States.

Disclaimer: this paper should not be construed as legal advice.

1 Introduction

In the United States, accessibility (for persons with disabilities) has many legal requirements. For the purposes of this paper, I will quote the National Center on Accessible Educational Materials [1] for a definition of accessibility:

“... accessibility really is individualized. In fact, according to the Office for Civil Rights, accessibility is happening anytime a person with a disability can acquire the same information, engage in the same interactions, and enjoy the same services as a person without a disability in an equally effective, equally integrated manner, and with substantial equivalent ease of use.”

From this definition, one may immediately note that it is not possible for educational material to be “100% accessible”, due to different individuals having different needs. At the same time, however, it must be possible for educational material to be compliant with legal requirements that protect the civil rights of persons with disabilities. Otherwise, there would exist a law that would be impossible to follow.

A common set of accessibility guidelines are the Web Content Accessibility Guidelines (WCAG) published by the World Wide Web Consortium (W3C). These technical guidelines are often used as a benchmark for accessibility in a legal context. Most recently, announced Department of Justice rules have mandated WCAG2.1AA standards for all state and local entities in the United States, including public universities and colleges. This survey will briefly discuss the context of these rules, as well as its expected impact on accessibility in mathematics education and research.

2 WCAG

Shortly after the founding of the W3C in 1994, the first web accessibility guidelines began to be developed in 1995. The WCAG have undergone several

versions, with WCAG3.0 under development and version 2 being current. Each version has three levels, denoted A, AA and AAA, with AAA levels including all AA levels, and AA levels including all A levels. The highest level, AAA, is generally considered difficult to follow. For instance, success criterion 1.2.6 (“sign language interpretation is provided for all pre-recorded audio content in synchronized media”) is under level AAA and usually is not met, with the movie *Barbie* being a notable exception.

The WCAG2.0AA standards contain 38 success criteria, while WCAG2.1AA includes an additional 12. Notable success criteria are 1.3.4 (orientation) and 1.4.12 (text spacing). It is beyond the scope of this paper to delve into the specifics of all the criteria, but I will note that the guidelines are summarized under the acronym POUR (Perceivable, Operable, Understandable, Robust), corresponding to the first digit in each success criterion.

The timeline of the WCAG release dates fits awkwardly in the history of American laws and regulations (which is unsurprising, given that W3C is an international organization). The most influential federal civil rights legislations, the Rehabilitation Act of 1973 and the Americans with Disabilities Act of 1990, were both passed before the development of the internet. Next, I will summarize the various laws passed prior to the Department of Justice rules.

3 Federal laws

3.1 Rehabilitation Act of 1973

The Rehabilitation Act of 1973 is a United States federal law protecting the civil rights of people with disabilities in the federal sector. For most American mathematicians, the most relevant section of that act is Section 504:

“No otherwise qualified individual with a disability in the United States . . . shall, solely by reason of her or his disability, be excluded from the participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving federal financial assistance or under any program or activity conducted by any Executive agency . . .”

As a large portion of mathematical research programs receive federal financial assistance from the National Science Foundation, such programs are under the jurisdiction of section 504.

In 1998, Congress passed an amendment to the Rehabilitation Act, titled section 508. According to the section 508 webpage [5]:

In 1998, Congress amended the Rehabilitation Act of 1973 to require federal agencies to make their electronic and information technology (EIT) accessible to people with disabilities. The law . . . applies to all federal agencies when they develop, procure, maintain, or use electronic and information technology. Under Section 508, agencies must give disabled employees and members of the public access to information comparable to the access available to others.

Beginning in January 2018, the U.S. Access Board has required WCAG2.0 standards for Section 508. Only a few months later, W3C released WCAG2.1 standards in June 2018.

3.2 Americans with Disabilities Act of 1990

The Americans with Disabilities Act of 1990, or ADA, is a civil rights law that prohibits discrimination based on disability. For colleges and universities, the most relevant parts are:

- Title II of the ADA requires “state and local governments to make sure that their services, programs, and activities are accessible to people with disabilities.”
- Title III of the ADA “prohibits discrimination on the basis of disability in the activities of places of public accommodation.”

For students at American colleges and universities, the distinction between public and private universities usually is irrelevant, although they are technically governed under different titles of the ADA. Title I of the ADA prohibits employment discrimination, but this title affects faculty and staff more than students. Unless the reader is currently involved in an employment dispute at their college or university, it is less likely that Title I is relevant to them.

4 Recent developments

In more recent years, there have been several legal developments relevant to accessibility in mathematics.

4.1 State laws

Following the 2018 rule that section 508 use WCAG2.0 standards, many states passed relevant laws.

- In the state of Texas (where the author is currently employed), Texas Administrative Code section 206.70 requires all new and changed websites to meet WCAG2.0 Level AA (excluding Guideline 1.2 Time Based Media), in reference to Section 508; effective April 18, 2020. A

more educational-specific provision is in section 213.39, which states that the president or chancellor of each institution of higher education shall ensure appropriate staff receives training necessary to meet accessibility-related rules.

- California Assembly Bill 434 requires state websites (including institutes of higher education) to comply with WCAG2.1AA by July 1, 2019, again referencing Section 508. The law was signed in 2017. It should not be confused with California Assembly Bill 1757, which applies to businesses subject to California’s Unruh Civil Rights Act.
- Colorado House Bill 21-1110 requires all web content, including internal content, produced by institutions of higher education to be WCAG2.1AA compliant. A separate house bill, HB24-1360, created a Disability Opportunity Office to support residents with disabilities.

Even from these three examples, one can notice the piecemeal nature of accessibility laws for public institutes of higher education.

4.2 Captioning of videos

In 2015, the National Association of the Deaf filed legal cases against Harvard and MIT, alleging that their publicly posted course content violated section 504 of the Rehabilitation Act and Title III of the ADA, because the captions were not sufficiently accurate. In 2019–2020, the cases were settled in favor of the National Association of the Deaf. During this same time, the University of California, Berkeley (a public institution, and therefore under Title II) removed 20,000 free videos in 2017 and placed them behind university login.

5 Department of Justice rules

In April 2024, the Department of Justice released new rules for the interpretation of Title II of the Americans with Disabilities Act in the context of web accessibility. The rules were posted following a time for open comments. Below, we highlight some of the new rules, as it relates to local and state institutions of higher education. Note that these rules do not apply to private institutions (and businesses), which are covered under Title III. All page numbers below refer to the page numbers in the final rule on the PDF posted on the Federal Register [4].

5.1 WCAG2.1AA compliance

According to the ADA factsheet:

Requirement: The Web Content Accessibility Guidelines (WCAG) Version 2.1, Level AA is the technical standard for state and local governments’ web content and mobile apps.

Interestingly, this requirement includes “password-protected course content in elementary, secondary, and postsecondary schools” (page 31360). This is analogous to the Colorado law, and thus “hiding” educational content behind institutional passwords does not exempt it from the new rules.

5.2 Timeframe

Public institutions serving populations of less than 50,000 have until April 26, 2027 to comply with the rule. Public institutions serving populations of 50,000 or more have until April 26, 2026 to comply with the rule. Community or city colleges in small populations could have until 2027; every state college or university has two years.

5.3 PDF/UA-1

Because most mathematicians produce \TeX -generated PDFs, there is a unique interest in PDF accessibility standards. The Department of Justice did consider PDF/UA-1, but ultimately found that WCAG2.1AA would both “enhance” (page 31344) the accessibility of PDFs, while maintaining the “balance” with administrative costs (p. 31350). In part to address concerns that public entities would simply “remove” content, the Department of Justice pointed out (pages 31346–31347) that many states had already been using WCAG2.0AA, and therefore public entities were likely familiar with the 38 guidelines of WCAG2.0AA, needing only an additional 12 guidelines to meet WCAG2.1AA.

5.4 Conforming alternative versions

Under WCAG, a “conforming alternative version” is allowable. For example, a non-accessible PDF may be posted if the reader can access the same information and functionality via a MathML webpage. However, the Department of Justice now states (section 35.202, page 31382):

“... a public entity may use conforming alternate versions of web content ... only where it is not possible to make web content directly accessible due to technical or legal limitations.”

The question of legal issues related to intellectual property law (such as textbooks) is addressed briefly on page 31377, and offers little clarification.

5.5 Exceptions

There is a notable set of exceptions [3] to these rules. At this time, I am unwilling to publicly comment on these rules.

6 Implications for mathematics

Needless to say, mathematics provides unique challenges for accessibility. At this point, I can only conjecture on what will come next.

6.1 Technical restrictions for PDF

Due to the clause that conforming alternative versions are allowable only under technical or legal limitations, there will likely be legal disputes about the technical limitations of PDFs. Currently, there is a great deal of public confusion concerning accessibility of \TeX -generated documents. For instance, a well-respected accessibility resource run by Penn State University [2] falsely claims that

“A PDF file created from a .tex file is always inaccessible.”

Perhaps as a result, an accessibility advocate at the arXiv Accessibility Forum in 2023 suggested banning PDFs as a file format. Likely this question will be litigated in 2026 or 2027.

6.2 Removal of material

Some research universities may follow Berkeley’s lead and remove all course content, while ordering grade inflation to compensate. Ultimately, this is legally allowable and difficult to fight without providing additional resources for accessibility.

6.3 Federal funding

More optimistically, some funding agencies have offered increased funding for accessibility. As just one example, I received \$1,860 in salary to improve the accessibility of the Texas A&M Math REU webpage (software was covered with my accessibility company, Tailor Swift Bot). Furthermore, some Department of Education funded projects, such as Ximera, have budgeted for accessibility.

6.4 Instructional designers

To support accessibility in mathematics, some colleges and universities may invest in instructional designers to support faculty. At Texas A&M during Spring 2024, there were no instructional designers to support the 18 departments in the College of Arts and Sciences, despite being the largest public university in the country. However, this is perhaps more specific to Texas A&M University.

6.5 AI

Some colleges and universities may believe that AI can automatically create accessible documents. However, given that this issue was already litigated in the National Association of the Deaf vs. Harvard and MIT, this is very unlikely to be legally allowable, given the current state of AI.

References

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- [2] Penn State. Equation format and accessibility. accessibility.psu.edu/math/equations/
- [3] US Department of Justice. Fact sheet: New rule on the accessibility of web content and mobile apps provided by state and local governments. ada.gov/resources/2024-03-08-web-rule
- [4] US Department of Justice. Nondiscrimination on the basis of disability; accessibility of web information and services of state and local government entities. govinfo.gov/content/pkg/FR-2024-04-24/pdf/2024-07758.pdf
- [5] US General Services Administration. IT accessibility laws and policies. section508.gov/manage/laws-and-policies/

◇ Jeffrey Kuan
jkuan (at) tailorswiftbot dot com