# Experiential Learning and Open Education: Partnering with Students to Evaluate OER Accessibility

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## Introduction

Providing internship opportunities to students is a high-impact practice that can positively impact student retention and engagement (Kuh, 2008). In Spring 2017, the University of Texas at Arlington (UTA) Libraries partnered with administrators of the university's Minor in Disabilities Studies to initiate a series of experiential learning opportunities for undergraduate students pursuing the minor. The partnership established UTA Libraries as an internship site for Disabilities Studies students who express interest in education and/or publishing.

This form of experiential learning, which is defined as learning by doing, also supports the Maverick Advantage, a campus-wide initiative that encourages students to participate in experiential learning via five "distinguishing activities." The activities focus on career development, community engagement, global connections, leadership, and undergraduate research. The internship described in this chapter advances career development goals defined in the Maverick Advantage by providing real-world opportunities for disability studies students to apply knowledge gained during their coursework.

Our chapter focuses on an open textbook evaluation project completed by the first intern to work with the Libraries on open education initiatives. The results highlight accessibility strengths, expose problematic exclusion of students with disabilities in higher education, and demonstrate the ways in which some open textbooks, intended to be "open" for all, fall short of that promise. We will outline best practices for designing accessible, open textbooks and describe the process used to evaluate the accessibility of existing resources. We will also discuss the engagement of

the student intern with open education on our campus and the potential for future projects.

## Background

UTA is a four-year public research university located in northeast Texas. Total global enrollment for the 2016–17 academic year was 58,664, making it the largest institution in the University of Texas System. Established in 1895 as Arlington College, UTA was designated a Hispanic-Serving Institution by the U.S. Department of Education in 2014. The university is frequently recognized for its diverse student population and for its affordability. *U.S. News & World Report* ranked UTA as fifth in the nation for undergraduate diversity, third largest destination for transfer students, and second for lowest average student debt among U.S. universities. Additionally, the university is frequently ranked as a top school for veterans.

The Minor in Disability Studies, started by Dr. Sarah Rose in Fall 2013, is offered through the university's Department of History. Since the 1980s, UTA has been an exemplary university for accessibility, the disability community, and equal educational opportunities. Since the creation of the minor, the disability presence at UTA has increased. Disability awareness has spread as the minor has attracted over 85 students from nearly every discipline represented at UTA. Students on campus also have the opportunity to explore disability history and learn about the disability experience through events on campus, such as panel speakers, film viewings, and lectures on disability history and culture.

Students wishing to complete the Minor in Disability Studies must take several disability studies courses and ultimately undertake a 117-hour internship. In these courses, students learn about important disability studies concepts, such as the social and medical model of disability, disability identity and culture, and the intersection of disability with race, gender, and ethnicity. In these courses, students form a better understanding of the role of disability in history and in their current culture. The minor leaves students with a new perspective on the human body and ability, and the final internship and capstone assignments allow students to practice applying the concepts in a real-world professional setting. Students partner with nonprofit organizations or related business sites and

use the insight gleaned during their coursework to complete projects with these organizations.[1]

In early 2017, UTA Libraries' Open Education Librarian partnered with Dr. Rose to provide such an opportunity to an undergraduate student enrolled in the minor. The Libraries began developing outreach and educational programming focused on open education with the hire of an Open Education Librarian, a new position, in Fall 2016. The position was created as the result of a library reorganization initiated in 2015. As the Libraries reassigned over one third of its staff to work within its Scholarly Communication Division, it also began seeking new opportunities to promote and support open systems for sharing information. The Open Education Librarian was tasked with developing programming to support the university's strategic goal of increasing affordability while advocating for open practices. To this end, the Libraries joined the Open Textbook Network (OTN) and hosted an Open Textbook Workshop in February 2017. Approximately 25 teaching faculty and staff were recruited to attend the workshop, where they were introduced to open educational resources (OER) and encouraged to review an open textbook indexed in the Open Textbook Library (OTL). Attendees who completed a review of an open textbook received a $200 stipend. During the signup process, workshop attendees were encouraged to identify at least one open textbook relevant to their discipline that they might be interested in reviewing.

The resulting list of resources was given to the disability studies intern for the textbook evaluation project. In addition to providing a hands-on learning experience for the student, the evaluation project identified the strengths and weaknesses of existing open textbooks being considered for adoption by teachers at UTA and informed the Libraries' long-term goal of creating high-quality, accessible OER. The Open Education Librarian, who served as internship supervisor, drafted the following objectives to guide the intern's work on the project over the course of the Spring 2017 semester:

- Investigate accessibility standards for electronic books (ebooks); this may involve communicating via email or in person with local experts.

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[1] For more information, see: https://utadisabilitystudies.wordpress.com/

- Investigate accessibility guidelines and best practices used by established OER publishers (e.g., OpenStax, BCcampus, University of Minnesota Libraries Publishing, Open SUNY Textbooks).
- Identify or create an assessment rubric based on common accessibility standards.
- Evaluate a prioritized list of OTL resources using the rubric, draft a statement about each resource to accompany rubric evaluation, and identify areas for improvement.
- Maintain formal notes in Google project folder about the process of identifying and applying evaluation criteria.
- Draft accessibility guidelines and best practices for OER creation at UTA.

## Methods

### *Researching Best Practices*

The primary goal of the project was to evaluate the accessibility of open textbooks being considered for adoption by UTA faculty and staff and to determine whether these texts aligned with critical accessibility standards. To accomplish this goal, the project team conducted research on online publishing, accessibility, universal design, and OER. Additionally, the intern interviewed students on campus about the struggles they faced when reading textbooks online. Through the semester, the team experienced firsthand the issues students with disabilities face when using open textbooks and discovered the pressing need for a focus on accessibility in discussions about OER.

The student intern made efficient and educated contributions to the project by building on foundational knowledge derived from her coursework (specifically from courses on universal design and the history of disability). However, the intern's previous exposure to OER and publishing was limited. Therefore, readings and training around the purpose, goals, and role of OER in higher education were integrated into the research process. The intern learned about OER and Creative Commons licensing using resources such as "Models of OER" (Margulies, Sinou, & Thille, 2005) and "7 Things you should know about OER" (EDUCAUSE Learning Initiative, 2010). Although resources about OER tend to note the importance of achieving openness by proactively communicating "5R"

permissions to users (i.e., revise, remix, reuse, redistribute, and retain), many do not mention accessibility or accommodation of OER. This common omission highlighted the importance of the project team's work in raising awareness of accessibility problems in open textbooks.

Research on the application of universal design principles to create inclusive OER also informed our work. Universal design is a disability studies and design concept that advocates for the conscious design of products that have equitable use for all people. Seven basic principles of universal design guide the creation of products and spaces to ensure they are universally usable (Burgstahler, 2012):

- Equitable use
- Flexibility in use
- Simple and intuitive use
- Perceptible information
- Tolerance for error
- Low physical effort
- Size and space for approach and use

When creating OER one goal should be usability by all students, and these seven principles help ensure that resources created benefit a wide range of students with varying mental and physical abilities. We used the principles to guide our approach to the evaluation process, as they go hand-in-hand with best practices in accessible design. OER created with these principles in mind tend to be the most accessible to all students.

### *Key Resources*

Numerous resources provide useful overviews about designing with a focus on accessibility. The following resources were particularly helpful in guiding our work:

**BCcampus Open Education Accessibility Toolkit:** Originally published as BC Open Textbook Accessibility Toolkit, this is a valuable resource for those learning about accessibility and its role in OER. The Toolkit walks readers through BCcampus' best practices for accessibility and explains why various accessibility standards are important. The Toolkit identifies several ebook elements that demand special consideration (e.g., images, color contrast, and multimedia) and teaches readers

how to design these elements so they are accessible to all students. It also suggests different methods of testing for accessibility in these areas. The Toolkit can be accessed at https://opentextbc.ca/accessibilitytoolkit/ (Coolidge, Doner, & Robertson, 2015).

**Flexible Learning for Open Education (Floe):** Floe is a grant-funded project managed by the Inclusive Design Research Centre at OCAD University. The website lists recommended practices for online publishing and offers tools for developers that show what accessible and inaccessible publications and sites look like. The resource is available at https://floeproject.org/ (Treviranus, Mitchell, & Clark, n.d).

**WAVE Web Accessibility Evaluation Tool:** WAVE is an online accessibility checker that helps complete accurate accessibility evaluations by analyzing webpages for inaccessible content. The tool came in handy when evaluating HTML versions of texts and can scan for missing headers, missing alternative text on pictures, and inaccessible buttons on the webpage that can be easily overlooked during manual evaluations. We used the accessibility checker to perform an initial scan of each OER for formatting and textual errors. The WAVE accessibility checker can be found at http://wave.webaim.org (Web Accessibility In Mind, n.d.).

**Web Content Accessibility Guidelines (WCAG):** WCAG served as a master list of requirements and accessibility references during the evaluations. These guidelines outline the current accessibility standards in online publications and informed the creation of our evaluation rubric. WCAG should be considered when conducting accessibility evaluation on HTML versions of ebooks. It can be accessed at https://www.w3.org/WAI/intro/wcag (Henry, 2017).

### *Developing a Rubric*

To assess the accessibility of the open textbooks in our sample, we created an evaluation rubric with eight accessibility standards. We evaluated each of the textbooks based on the eight standards listed below and gave them a passing or failing score based on their adherence to each accessibility standard. We found that most failed to meet the accessibility standards for images and tables whereas other standards, such as color contrast and content organization, almost universally passed. Below is a discussion of the eight standards we evaluated and an explanation of how we tested them.

1. **Content organization:** Evaluating the open textbooks for clear organization and structure ensures the text is usable by a variety of students. When checking the books for content organization, evaluate headings and titles, the table of contents, chapter and page numbers, and general reading layout and order.
   A. Heading and titles: Open textbooks are generally organized into sections and chapters. These should be created with specific markup (header 1, header 2, title 1, title 2) and should always be distinct from body and footnote text. Chapter titles and section headers that are in bold or in larger font are not distinguishable by VoiceOver and other assistive technology (AT). All chapter headers and titles should remain in their correct location during text reflow, which is when a document's contents change shape and shift position on a screen (e.g., following magnification).
   B. Table of contents with navigation: A table of contents should be present and functioning in the ebook. Students using open textbooks should be able to "flip" to certain chapters and specific page numbers as they would if reading a traditional book. The table of contents should be compatible with screen readers. It is necessary to check each table of contents with a screen reader to ensure that students requiring use of a screen reader have complete access to the table of contents. It is also important that the table of contents is created as an *ordered list* so that students using a screen reader or keyboard-only navigation can easily navigate through the table of content list and into the text.
   C. Working page numbers: Ebook page numbers should correspond to the print version of the book. It is important for the digital version to have working page numbers so students opting to use it are able to follow along with those in the course using the print version. HTML versions often omit page numbers and show each chapter's content on a single web page. This numbering style is more accessible for students reading the text online as they do not have to refresh each page and can scroll through the chapter. PDF and epub version of ebooks, however, should have traditional page numbers.

   D. Reading layout and order: All chapters and chapter subsections of the ebook should be logically ordered and easily followed by users and screen readers. All content should be displayed left to right as well as up and down the page. It is vital for ebooks to follow the same structure and organization as traditional texts. When checking reading layout, use various screen readers to read through portions of the text to verify that content can be accurately read to students. Also, check to ensure that non-textual elements of the ebooks, such as images and graphs, are read in the correct order and in line with the text.

2. **Images**: Many textbooks include images that are informative and provide vital information that supplements the text on the page. Images are a common accessibility problem area and are often inaccessible to students using screen readers or screen modifications. Students with low vision or auditory preference use screen readers to "read" texts. Without proper markup, images are not detected by screen readers. Students with dyslexia, colorblindness, and other learning disabilities may use a colored display or other screen modification when using ebooks. As with screen readers, many images are rendered inaccessible when used with these types of AT. To assess images in an ebook, choose a minimum of 20 non-decorative and decorative images from random chapters and analyze each one individually before passing or failing the standard.
   A. Non-decorative image alternative text: Images of examples, charts, and graphs or images that contain other vital information should have written alternative text in the form of an alt tag or image description. These images are essential elements of the text and should be created to be accessible for all students. A text tag accompanying the image allows students with low vision using screen readers to access images by providing a written description of the image that can be read by screen readers. Alternative tags also allow students using color overlays or monochrome displays to view the image.
   B. Decorative images are marked with null text: Images that do not contribute any new educational information, or decorative images, should be marked with "null" alternative text. These images

are not vital elements of the text and do not have to be accompanied by a text tag.

C. Complex images have descriptions: Images such as graphs, tables, or equations that require interpretation should have a caption that includes a description of the image and the data it presents. This helps students using screen readers to fully understand graphs, equations, etc., but also ensures that all data are presented in two ways. Students who do not perceive color or choose to listen to their ebook also benefit from image descriptions.

D. Compatibility with magnification and color contrast AT: All images should be compatible with magnification software. Test selected images with browser plug-ins, such as Zoom for Chrome, to determine whether images are compatible with this type of software. Images should be able to reflow when magnified. Additionally, all images should be viewable when magnified up to 200 percent. It is also important to test images with various screen modifications to determine whether content is viewable in alternate color schemes and display options. Images should be viewable in grayscale, with monochrome displays, and on high- and low-contrast screens.

3. **Tables:** Similar to images, tables require captions and textual descriptions, and they should be created to be compatible with assistive and non-assistive technologies. To test tables in ebooks, select a minimum of 20 tables throughout the text and check them for simplicity and viewability. Although tables are generally accessible to all, there are two main accessibility standards to consider when evaluating this element.

   A. Simple tables that are compatible with AT: Tables should be simple in the sense that they are clean, single-celled, and clearly labeled. Tables should be created with a specific markup, and all information should be entered as ordered lists. All tables need to have titles and labeled rows and columns. Split cells are discouraged. When tables are not created in a simple, ordered way they are indecipherable to screen readers. Use screen readers, such as NVDA and Kurzweil, to test tables in PDF versions of open textbooks and browser plug-ins, such as Reader for Chrome, to test those in HTML versions.

   B. Tables compatible with magnification AT: all tables should be compatible with magnification software and should maintain structure during text reflow. Students with low vision and certain learning disabilities need to manipulate the text size and font. Ensure tables maintain their structure and viewability when the surrounding text is reflowed. Magnify tables with plug-ins, such as Zoom for Chrome, and other magnification AT to ensure all information in the tables can be magnified to 200 percent.

4. **Hyperlinks:** Though specific only to the digital version of a text, hyperlinks are a vital part of the textbook and need to be accessible to all students. Students using screen readers or altered displays are often unable to distinguish hyperlinks from the rest of the body text. To evaluate accessibility, check up to 40 different hyperlinks throughout each text with screen readers and high- and low-contrast screens to test their universal usability.
   A. In-book links function: In-book links are hyperlinks that connect to another location in the text, such as links in a table of contents that connect to specific images or locations in a chapter. These links should be a distinct color from the body text and should connect to their correct location when clicked. Test at least 20 in-book links from different locations in the chapter by clicking to check functionality and by reading them with a screen reader. Links should be created with specific markup so the link title, rather than the URL, is read by the screen reader. Often, hyperlinks are inconsistently marked, so it is important to test links from throughout the text.
   B. Live hyperlinks function: Live hyperlinks are links that connect to outside webpages, usually for additional information, examples, or videos. Any content linked in an ebook should be assessed for accessibility standards. When testing links that connect to external videos and webpages, check videos for captions and webpages for compatibility with different AT. As with in-book links, live hyperlinks should be a distinct color from the text, even when underlined or italicized. All links should have a descriptive title that is not the URL. Links should be created with specific markup that allows screen readers to recognize them as links.

   C. All links are descriptive: Links should be obvious and distinct from the rest of the text. Links should be descriptively titled, as noted above (e.g., "Examples of UD" vs. www.universaldesign.com/7principles/example/110). They should be underlined and in a different color than that of the body text. Evaluate the contrast of links with a color contrast analyzer to ensure they are visible for students using screen modifications or high/low-contrast screens.
5. **Multimedia:** Some ebooks include videos, interactive diagrams, or links to websites with interactive elements, videos, and other multimedia content. This content must be accessible by all students.
   A. Open or closed captions: Any video included or linked in the text should be fully captioned, complete with action captions when necessary. Check all videos in the text for proper captioning to ensure all content is accessible to students with low vision and low hearing or to English as a Second Language (ESL) students requiring translation.
   B. Transcript: Transcripts should be easily accessible for all videos linked in the text. Additionally, transcripts should be compatible with screen readers and provide a complete transcription of all multimedia content. This is helpful both for students with disabilities and those wishing to access the video without using headphones or watching a screen.
   C. Audio/video media player is compatible with AT: The platform and player presenting videos and other multimedia content should be compatible with all screen readers, magnification software, and color contrast modifications.
   D. Flickering: There should be no flickering content in the text. Any content that flashes more than three times per second is dangerous and inaccessible to some users. Check all parts of the text including videos, animations, and all interactive content for flickering.
6. **Formulas:** Math and engineering textbooks use formulas throughout the text. It is important that these formulas are created with a specific equation editor to ensure they are compatible with screen readers and "select and speak" functions. Test formulas from various chapter locations in the text to check for consistent markup and viewability for all students.

   A. STEM (science, technology, engineering, and math) formulas and equations are created with a compatible equation editor such as LaTeX or MathML: Formulas should be created and inserted in the text with an equation editor. Formulas typed directly into text along with other body text are not distinguishable by screen readers. To test for accessibility, choose a number of formulas from different chapters and read them with a screen reader. Each should be recognizable by the reader as a formula and read in a way that makes sense to student only able to hear the formula.
   B. Images of equations with alternative tags: Alternatively, equations can be inserted into the text as images with accompanying text descriptions.
7. **Font:** All body and header fonts should be compatible with assistive and non- assistive technology. It is important to check the reflowability of fonts to ensure students may adjust fonts and visibility settings to their own preferences when using open textbooks.
   A. Font is adjustable and compatible with screen readers: In all ebook formats, font size and style should be adjustable. If font, color, or page background color are not adjustable with non-assistive technology, check that they are compatible with other AT. All textual information should be visible in grayscale and on high/low-contrast screens and should be compatible with screen readers and "select and speak" functions.
   B. Zoom capabilities (up to 200%): Fonts should be compatible with magnification AT and capable of zoom to 200 percent. Text should be compatible with reflow. Test several locations of text to ensure when text, images, or pages are resized the text restructures and holds its original shape.
   C. Standard font (12 pt. body, 9pt. footnote): Check that all body and footnote text adheres to WCAG AA size guidelines. Traditional body text should be no larger than 12 pt., and footnotes should be no larger than 9pt.
8. **Color contrast:** Color is an important element of ebooks that is often overlooked. All information presented in color should also have a text or shape alternative. For example, a graph with information represented in color should also mark data points with circles, diamonds, or

squares. Use a color contrast analyzer to test contrast ratios in the text and confirm all components of the text (e.g., images, chapter headers, section titles, interactive elements, links) are accessible to students viewing the textbook with various screen modifications. All color elements should adhere to WCAG standards.

A. All information presented with color is also conveyed in a way understood by those who do not perceive color: Any information in images or graphs presented in color must also have a textual description in order to be accessible to students with low vision or students with learning disabilities, such as dyslexia.
B. Contrast for headers passes WCAG AA standards: Headers should meet WCAG AA contrast ratio requirement of 4:4:1. Use a color contrast analyzer to check this requirement.
C. Contrast for body and footnote text passes WCAG AA standards: Contrast for text must also meet required standards.

## Results

We completed 20 open textbook evaluations using the eight criteria and gained valuable insight to the usability of open textbooks and their biggest accessibility problem areas. With few exceptions, most of the open textbooks we evaluated were not universally accessible to all students. Some of the open textbooks were generally accessible, with only a few problem areas, while others managed to pass only one or two of the eight accessibility standards. The evaluations were telling, and the project team was able to identify accessibility problem areas common to most of the open textbooks in our sample.

**Standard 1: Content organization.** Eighteen out of the 20 open textbooks evaluated passed this standard. Many of the books were missing specific elements of this standard, such as clear headings and titles or a table of contents with navigation, but on the whole, many open textbooks were accessible in terms of organization and navigation. This standard is important as it gauges how easily a student will be able to navigate a textbook. Well-designed organizational elements benefit all students wishing to navigate through the text via keyboard-only or through an assistive technology such as VoiceOver or NVDA. Open textbooks that do not pass this standard are likely unusable for such stu-

dents. Proper header and title markup are essential for easy navigation through the text.

**Standard 2: Images**. Eight out of 20 open textbooks evaluated passed this standard. Our project revealed images to be a huge accessibility problem area for OER. In many texts, images are central to the information and should be viewable by all students, regardless of ability. Most open textbooks that failed this standard had non-decorative images throughout the text with no alternative text. When images are not accompanied by alternative text, students with low vision are not able to access them. Additionally, students with learning disabilities that require them to listen to the text are also unable to easily "view" the image. Many of the images throughout the text were inconsistently marked with alternative tags. Such a practice suggests that the creators had some knowledge of accessibility and the need for accommodation but approached the task of integrating alternative text with carelessness.

**Standard 3: Tables.** Ten out of 20 open textbooks evaluated passed this standard. Tables are another accessibility problem area in the texts we analyzed. Like images, tables are often a central element of textbooks. Especially with STEM books, it is critical that tables are compatible with assistive technology and readable by all students. Many of the open textbooks we tested had complex tables, with multiple sets of information per cell. This makes it impossible for a screen reader or browser extension to decipher the table and read it to the student. Tables were also disorganized, lacked titles, and did not have clearly labeled rows and columns. Some disorganized tables are difficult to follow by able-bodied students and are impossible to navigate when reading with assistive technology. Many tables are also not adaptive to reflow, so they lose structure and viewability when the page or font is resized. Students with low vision and students requiring screen modifications are unable to properly view tables when they are not formatted correctly and inserted into the text without proper markup.

**Standard 4: Hyperlinks.** Seventeen of 20 open textbooks evaluated passed this standard. In general, most of the open textbooks we looked at had accessible hyperlinks that were usable by students with a wide range of abilities. Most of the texts had both in-book and live hyperlinks that functioned, connected to the correct location, and were distinct from the

rest of the text. The open textbooks that did not meet this standard failed to distinguish hyperlinks from the informational body text through color or italicizing. This makes it impossible for students of all abilities to distinguish links from text. Others that failed this standard used colors that did not meet contrast requirements to distinguish links. Students who do not perceive color or who use screen modifications for other learning disabilities are not able to access the links that do not meet contrast requirements as they are not visible on their screens.

**Standard 5: Multimedia.** Nineteen of 20 open textbooks evaluated passed this standard. Almost all of the open textbooks we evaluated had little to no multimedia content and none had any flickering content. Like hyperlinks, as most multimedia is web-based, videos and other online content are generally compatible with different assistive technologies and usable by many students.

**Standard 6: Formulas.** Fourteen of 20 open textbooks evaluated passed this standard. Most of the STEM books analyzed that failed these standards are completely unusable by low vision students, despite passing other accessibility standards. In STEM books, elements like equations and formulas are central to the book and must be usable by all students if incorporated in the classroom. Many of the books tested inserted equations and formulas as text lines that are only accessible to an able-bodied student reading the ebook as a traditional book. Any student wishing to use any accommodation, or students with specific learning and physical disabilities, would be unable to access equations. Screen readers are unable to read equations correctly unless created with MathML or LaTeX. Many equations are also images without alternative text and cannot be magnified or adapted in any way to fit high- and low-contrast screens.

**Standard 7: Font.** Nineteen of 20 open textbooks tested passed this standard. Most versions of the open textbooks passed this standard. Font in most of the open textbooks was compatible with screen readers, high- and low-contrast screens, and magnification AT. Many books allowed for adjusting font size and style, background color, lighting, and page size with no issues. Open textbooks that do not pass this standard are difficult to use for students with specific reading preferences when using open textbooks.

**Standard 8: Color contrast.** Nineteen of 20 open textbooks analyzed passed this standard. Most of the open textbooks easily passed this stan-

dard, as most creators seemed to abide by WCAG AA contrast standards. Although some books failed certain requirements of this standard, color use as a whole was found to be accessible by a wide range of students and compatible with various AT.

## Discussion

The results of our evaluations not only revealed common accessibility problems but also highlighted harmful assumptions about disability and higher education. As we completed the reviews, it became clear that many of the open textbooks were created with a specific student in mind: a fully able-bodied student with no physical or learning disabilities. Though often overlooked, the design of products, such as public spaces and textbooks, perpetuate common social biases against people with disabilities. In many of the open textbooks, images were inserted without captions, assuming the reader would be able to view the image with no issue. Equations were inserted as text, assuming a traditional reading of the textbook rather than one requiring a screen reader. Headers and links were created in colors and fonts that do not adhere to accessibility standards, assuming all readers fully perceive color and do not use modifications. These problem areas show the widespread and deep-reaching exclusion of people with disabilities from higher education.

These accessibility problem areas in open textbooks represent a larger problem in colleges and universities across the nation. When OER are created with faulty assumptions of students' mental and physical abilities, OER become part of a larger social problem that systematically excludes students with disabilities from equal education. Though licensed openly, many of the OER we reviewed were completely closed to students with disabilities and students wishing to access texts through nontraditional accommodations.

In order to gain a better understanding of the issues these students face when using ebooks for university courses, the disability studies intern met with students to discuss the problem areas identified in our evaluations. The practice of treating accessibility and accommodation as an ongoing conversation revealed additional aspects of ebook accessibility that should be considered. By the end of the semester we reworked the evaluation rubric to include two additional standards, Interactive Ele-

ments and Accessibility Documentation. Interactive elements in ebooks (e.g., animations, quizzes and knowledge checks, calculators) should also be checked for accessibility. Like photos and tables, interactive functions should be compatible with adaptive and nonadaptive technologies. The revised rubric is included in the Appendix. It is now used at UTA to guide, evaluate, and revise (if necessary) OER creation projects that are currently underway. Future projects could refine rubrics further to evaluate OER for accessibility for a specific set of students or for compatibility with a specific AT.

Finally, the intern expressed gratitude for the experiential learning opportunity and noted the value of speaking with students on campus about their struggles in confirming the importance of this project. Her summative reflection also demonstrated an increased understanding of issues surrounding access to information and of student behaviors in response to access barriers. Additionally, our work revealed that students use accommodations and AT for a multitude of reasons and that universal accessibility benefits all students and not just those with physical and learning disabilities. The experience shed light on student frustrations and invisible barriers that hinder students' education and provided a useful perspective to the intern as a prospective teacher. It also provided her the opportunity to share her expertise and scholarship publicly through co-authorship of this chapter.

## Conclusion

The partnership between the two UTA units was a win for all stakeholders. The Libraries benefited by being able to contribute to experiential learning at UTA and by growing expertise on accessibility and universal design; the student benefited from the opportunity to apply coursework in a real-world setting and reference the experience in résumés, portfolios, and future applications; and the program administrators benefited from having a reliable site to recommend to students with an interest in publishing, education, or other relevant fields.

The results of the evaluation project, however, demonstrated that there is significant room for growth in OER and in how we as a community discuss and prioritize accessibility. Future interns matched with the UTA Libraries will be asked to contribute to this growth by con-

ducting similar evaluations of both existing resources and OER currently under development by UTA faculty and staff, by providing remediation assistance as necessary to improve the accessibility of OER, and by investigating strategies for sharing findings and best practices in order to benefit the greater OER community and the students we serve. Open education coordinators and project managers at other institutions are encouraged to explore similar partnership opportunities with students and staff with expertise in disability studies in order to expand their own knowledge of the subject, provide meaningful learning experiences for students, and ensure that the open resources we create are truly open to all.

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## Appendix: Accessibility Evaluation Rubric

Open Textbook:

Format:
Accessibility Standards Passed:
Accessibility documentation:

1. The organization providing materials has a formal accessibility policy.
2. The organization providing materials has an accessibility statement.

| **Pass/Fail:**<br>**Additional Information:** |
|---|

Content organization:

1. Chapter titles and section headers should be marked as headers and distinct from body text.
2. Table of contents should be present and allow navigation.
3. Page numbers should be present and correspond with print numbers.
4. Content should remain organized after user 'reflows' page.

| **Pass/Fail:**<br>**Additional Information:** |
|---|

Images:

1. Non-decorative images should be marked with alternative text.
2. Images should be compatible with screen reader and magnification software.
3. Decorative images should be marked with null alternative text.

| **Pass/Fail:**<br>**Additional Information:** |
|---|

Tables:

1. Tables should be simple and compatible with screen readers and magnification software.
2. Tables should be single celled and contain ordered lists.
3. Tables should include markup that identify their rows and columns.

**Pass/Fail:**
**Additional Information:**

Hyperlinks:

1. In-book links should function and connect to their correct location in the text.
2. Hyperlinks should connect to a working webpage. Hyperlinks should open pages in the same window or alert the reader that a new tab is open.
3. All links should be distinct from body text. They should be descriptively titled and a different color or italicized.

**Pass/Fail:**
**Additional Information:**

Multimedia:

1. Closed captions should be provided for any video content.
2. Descriptive transcripts should be provided for any video content.
3. Audio or video player used for multimedia content should be compatible with assistive technology.
4. No content should flash more than 3 times per second.

**Pass/Fail:**
**Additional Information:**

STEM Content

1. STEM formulas and equation should be created with an editor compatible with screen readers such as LaTex or MathML.
2. If equations are inserted as images they should be described in an alt tag.

**Pass/Fail:**
**Additional Information:**

Font

1. Font should be adjustable and compatible with screen readers, magnification software, and colored displays. Text must remain accessible when any font size is selected.
2. All font should have zoom capabilities to 200%.
3. Font should meet standard size requirements (12 pt. body, 9 pt. footnote).
4. Alternative color and line spacing adjustments should be available.

| **Pass/Fail:**<br>**Additional Information:** |
|---|

Color Contrast:

1. All information presented in color should also be conveyed in text or other images.
2. Headers should meet WCAG AA contrast standards.
3. Body text should meet WCAG AA contrast standards.
4. Simple images should meet WCAG AA contrast standards.

| **Pass/Fail:**<br>**Additional Information:** |
|---|

Interactive Elements:

1. Interactive elements (such as menus, examples, practice questions) allow keyboard only operation with and without assistive technology.
2. All instructions, error messages, and prompts are in text and compatible with assistive technology.
3. Text should allow for keyboard only operation.
4. Text should be accessible on mobile devices.

| **Pass/Fail:**<br>**Additional Information:** |
|---|

Notes:

Recommendations: