



California Open Online Library for Education & Accessibility

COOL4Ed (the California Open Online Library for Education) was created so that faculty can easily find, adopt, utilize, review and/or modify free and open etextbooks for little or no cost. The COOL4Ed accessibility open textbook evaluations can inform faculty, staff, and students how the free and open etextbooks meet 15 accessibility “checkpoints” that could impact the learning of learners with a range of disabilities.

SUMMARY OF ACCESSIBILITY EVALUATION:

Textbook: Biology (OpenStax)
Format of Textbook: ePUB

Assistive Technology (AT) Evaluation Score: Overall	7.0 (Maximum score = 10)
<p>Assistive Technologies (AT) Evaluations applies specialized tools and software in the accessibility evaluation process. These specialized assistive technologies, see list below, are typically not used or available by the general public into the accessibility evaluation process.</p> <ul style="list-style-type: none"> • Accessibility features of desktop operating systems (e.g. high-contrast display themes, settings from the Keyboard and Mouse control panels) • Accessibility-related software included with desktop operating systems (e.g. VoiceOver, Microsoft Narrator) • Third-party accessibility software and hardware: • Screen readers (e.g. JAWS, Window Eyes) • Magnification software (e.g. ZoomText Magnifier/Reader, MAGIC Pro with Speech) • Reading software for users with learning disabilities (e.g. Read and Write Gold, Kurzweil 3000) • Refreshable Braille displays 	
Non- Assistive Technology (NAT) Evaluation Score: Overall	6.6 (Maximum score =10)
<p>Non-Assistive Technologies (NAT) Evaluations applies only native or basic tools and software such as the keyboard and Narrator in the accessibility evaluation process. These non-assistive technologies are readily available and used by the general public.</p>	



COOL4Ed Accessibility Evaluation Methods:

The California State University [Accessible Technology Initiative](#) and [MERLOT](#) (Multimedia Educational Resources for Learning and Online Teaching) developed the rubric or “checkpoints” for the accessibility evaluation. [CAST](#), a nationally recognized organization with expertise in accessibility and UDL, reviewed and affirmed the appropriateness and value of the accessibility evaluation rubric and contributed the references and support resources to help people learn how best to design, evaluate, and remediate the learning materials to maximize the accessibility of the learning resources for all. The “checkpoints” have been built upon the Section 508 technical standards and has been organized and tailored to the typical characteristics of digital resources used in higher education courses.

The accessibility evaluations were performed by the [Center for Usability in Design and Accessibility](#) at California State University, Long Beach; faculty and graduate students with expertise in human factors, usability, and accessibility performed the evaluations of over 150 free and open etextbooks. COOL4ed.org has published the accessibility evaluation rubric and provides a detailed description of the methodology used to evaluate the accessibility of the etextbooks in COOL4ed.

LOOKING FOR DETAILED ACCESSIBILITY REPORTS?

[See Detailed Accessibility Evaluation Report using Assistive Technologies](#)

[See Detailed Accessibility Evaluation Report using Non-Assistive Technologies](#)



DETAILED ACCESSIBILITY EVALUATION REPORT using Assistive Technologies

Assistive Technologies (AT) Evaluations applies specialized tools and software in the accessibility evaluation process. These specialized assistive technologies, such as Kurzweil and NVDA, are typically not used or available by the general public into the accessibility evaluation process.

1. Accessibility Documentation

A. The organization providing the online materials has a formal accessibility policy.	Fail
Additional Information:	Could not find this information.
B. The organization providing the online materials has an accessibility statement.	Fail
Additional Information:	Could not find this information.
C. An Accessibility Evaluation Report is available from an external organization.	Fail
Additional Information:	Could not find this information.

2. Text Access

A. The text of the digital resource is available to assistive technology that allows the user to enable text-to-speech (TTS) functionality.	Pass
Additional Information:	Kurzweil read all the text on pages 41- 215.

3. Text Adjustment

A. Text is compatible with assistive technology.	Pass
Additional Information:	Used Kurzweil to check pages 41-128 and font size was adjustable on all pages.
B. The resource allows the user to adjust the font size and font/background color (or is rendered by an application such as a browser, media player, or reader) that offers this functionality).	Fail



Additional Information:	Used Kurzweil to check pages 41-128 and the background color changed but the text color always remained black.
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4. Reading Layout

<p>A. Text of the digital resource is compatible with assistive technology that allows the user to reflow the text by specifying the margins and line spacing (or is rendered by an application such as a browser, media player, or reader that offers this functionality).</p>	Pass
Additional Information:	Used Kurzweil to check pages 41-128 and text reflowed on all pages.
<p>B. If the digital resource is an electronic alternative to printed materials, the page numbers correspond to the printed material.</p>	Fail
Additional Information:	Used Kurzweil and Adobe Digital Editions to check if page numbers on the EPUB matched the actual book pages on the PDF. Pages 41-128 on Kurzweil were actually pages 17-112 on the PDF and there were no page numbers on the Kurzweil version but the PDF had page numbers in either the upper left or right hand corners.

5. Reading Order

<p>A. The reading order for digital resource content logically corresponds to the visual layout of the page when rendered by assistive technology.</p>	Pass
Additional Information:	Used Kurzweil to check pages 41, 71, 73, 85, and 87 and the reading order logically corresponded to the page layout.



6. Structural Markup/Navigation

<p>A. The text of the digital resource includes markup (e.g. tags or styles) that allows for navigation by key structural elements (chapters, headings, pages) using assistive technology (or is rendered by an application such as a browser, media player, or reader that offers this functionality).</p>	<p>N/A</p>
<p>Additional Information:</p>	<p>Kurzweil cannot check for this.</p>
<p>B. The text of the digital resource includes markup for bullets and numbered lists that is compatible with assistive technology (or is rendered by an application such as a browser, media player, or reader that offers this functionality).</p>	<p>N/A</p>
<p>Additional Information:</p>	<p>Kurzweil cannot check for this.</p>
<p>C. If the text of the digital resource is delivered within an ebook reader application, a method is provided that allows users to bypass the reader interface and move directly to the text content that is compatible with assistive technology.</p>	<p>N/A</p>
<p>Additional Information:</p>	<p>Kurzweil cannot check for this.</p>

7. Tables

<p>A. Data tables include markup (e.g. tags or styles) that identifies row and column headers in a manner that is compatible with assistive technology (or are rendered by an application such as a browser, media player, or reader that offers this functionality).</p>	<p>N/A</p>
<p>Additional Information:</p>	<p>Kurzweil cannot check for this.</p>



8. Hyperlinks

<p>A. In-book links take you to a location within the textbook. For example, the table of contents would be considered in-book links and embedded links take you to the correct location in the book.</p>	<p>Fail</p>
<p>Additional Information:</p>	<p>7/30 in-book links functioned, however, only 2 of those links actually went to the correct page in the book. Checked the in-book links on pages 2, 3, 4, 5, 6, 7, 800, 827, 847, 870, 873, 1700, 1701, 1702, and 1703.</p>
<p>B. Live hyperlinks take you to any website or webpages external to the book.</p>	<p>Fail</p>
<p>Additional Information:</p>	<p>2/20 live links functioned and 10/20 live links had an acceptable description. All other live links used the URL. Checked the live links on pages 2, 34, 49, 50, 73, 75, 801, 802, 804, 807, 809, 810, 1716, 1717, 1718, and 1719.</p>
<p>C. Live links take you to the correct webpage that is functioning properly.</p>	<p>Fail</p>
<p>Additional Information:</p>	<p>2/20 live links functioned. Checked the live links on pages 2, 34, 49, 50, 73, 75, 801, 802, 804, 807, 809, 810, 1716, 1717, 1718, and 1719.</p>
<p>D. Live links are descriptive enough for the users to know where it should take them.</p>	<p>Fail</p>
<p>Additional Information:</p>	<p>10/20 live links had an acceptable description. All other live links used the URL. Checked the live links on pages 2, 34, 49, 50, 73, 75, 801, 802, 804, 807, 809, 810, 1716, 1717, 1718, and 1719.</p>

9. Color and Contrast

<p>A. All information within the material that is conveyed using color is also available in a manner that is compatible with those that do not perceive color, and information conveyed by color is also conveyed in other ways.</p>	<p>Fail</p>
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Additional Information:	Used Kurzweil to check for color redundancy on pages 41-128. When color was used to indicate something was a link it was also underlined, showing good color redundancy. However there was a lot of inconsistency because some links were black instead of blue. There were also multiple instances in the book where color was used, for example the text is blue instead of black on pages 106-136 and this occurs again 175-202.
B. Information is conveyed from the sub-categories for contrast.	Pass
Additional Information:	Checked pages 41-215.
C. Contrast for headers passed WCAG AA standards for large texts (contrast ratio 3:1).	Pass
Additional Information:	All headers passed color contrast requirements.
D. Contrast for text passed WCAG AA standards for normal texts (contrast ratio of 4.5:1).	Pass
Additional Information:	All text passed color contrast requirements.
E. Contrast for simple images (for example, images of atoms) passed WCAG AA standards (contrast ratio of 4.5:1).	Pass
Additional Information:	The simple images on pages 51 and 117 do not pass color contrast requirements but all other simple images pass.

10. Language

A. The text of the digital resource includes markup that declares the language of the content in a manner that is compatible with assistive technology.	N/A
Additional Information:	Kurzweil cannot check for this.
B. If the digital resource includes passages in a foreign language, these passages include markup that declares the language in a	N/A



manner that is compatible with assistive technology.	
Additional Information:	Kurzweil cannot check for this.

11.Images

A. Non-decorative images have alternative text that is compatible with assistive technology (or is rendered by an application such as a browser, media player, or reader that offers this functionality).	Fail
Additional Information:	Used Kurzweil to check pages 41-215 and Kurzweil skips over the non-decorative images (no explanation) and figure captions are not explanatory enough.
B. Decorative images are marked with null alternate text or contain markup that allows them to be ignored by assistive technology.	N/A
Additional Information:	No decorative images found.
C. Complex images, charts, and graphs have longer text descriptions that are compatible with assistive technology (or are rendered by an application such as a browser, media player, or reader) that offers this functionality).	Fail
Additional Information:	Used Kurzweil to check pages 41-215 and Kurzweil skips over the complex images (no explanation) and figure captions are not explanatory enough.

12.Multimedia

A. A synchronized text track (e.g. open or closed captions) is provided with all video content.	N/A
Additional Information:	No multimedia found.
B. A transcript is provided with all audio content.	N/A
Additional Information:	No multimedia found.



C. Audio/video content is delivered via a media player that is compatible with assistive technology. This includes support for all criteria listed in Section 15 below.	N/A
Additional Information:	No multimedia found.

13.Flickering

A. The digital resource content does not contain anything that flashes more than three times in any one-second period.	Pass
Additional Information:	No flickering found.

14.Science, Technology, Engineering, and Math (STEM)

A. STEM figures have appropriate markup that indicates that the image is a figure.	Pass
Additional Information:	10/10 figures had labels. Checked figures on pages 41, 42, 44, 45, 51, 52, 73, 74, 76, and 79.
B. STEM graphs have appropriate markup that indicates that the image is a graph.	Pass
Additional Information:	10/10 graphs had labels. Checked graphs on pages 208, 209, 212, 214, 316, 406, 809, 810, 1092, and 1094.
C. STEM equations have appropriate markup that indicates that the image is an equation.	Fail
Additional Information:	0/10 equations were labelled. Checked equations on pages 76, 77, 83, 204, 207, 211, 229, 230, 239, and 371.
D. STEM tables have appropriate markup that indicates the image is a table.	Pass
Additional Information:	10/10 tables had labels. Checked tables on pages 71, 72, 113, 119, 150, 177, 187, 242, 314, and 319.
E. STEM figures have appropriate notation markup that conveys both the notation	Fail



(presentation) and meaning (semantics) of the STEM content.	
Additional Information:	0/10 figures had acceptable descriptions. Checked figures on pages 41, 42, 44, 45, 51, 52, 73, 74, 76, and 79.
F. STEM graphs have appropriate notation markup that conveys both the notation (presentation) and meaning (semantics) of the STEM content.	Fail
Additional Information:	0/10 graphs had acceptable descriptions. Checked graphs on pages 208, 209, 212, 214, 316, 406, 809, 810, 1092, and 1094.
G. STEM equations have appropriate notation markup that conveys both the notation (presentation) and meaning (semantics) of the STEM content.	Fail
Additional Information:	0/10 equations had acceptable descriptions and all equations were not displayed correctly. Equations either contained question marks or had a black box over them. Checked equations on pages 76, 77, 83, 204, 207, 211, 229, 230, 239, and 371.
H. Assistive technology used can access the content from the STEM tables.	Fail
Additional Information:	0/10 tables had acceptable descriptions and tables were read in a confusing manner. The tables were read from left to right and did not indicate rows and columns. Checked tables on pages 71, 72, 113, 119, 150, 177, 187, 242, 314, and 319.

15. Interactive Elements

A. Each interactive element (e.g. menu, hyperlink, button) and function (e.g. annotations) allows keyboard-only operation both with and without assistive technology.	N/A
Additional Information:	No interactive elements found.



B. Each interactive element conveys information to assistive technology regarding the element's name, type, and status (e.g. "Play, button, selected").	N/A
Additional Information:	No interactive elements found.
C. All instructions, prompts, and error messages necessary to complete forms are conveyed as text to assistive technology (or are rendered by an application such as a browser, media player, or reader that offers this functionality).	N/A
Additional Information:	No interactive elements found.

DETAILED ACCESSIBILITY EVALUATION REPORT using Non-Assistive Technologies

Non-Assistive Technologies (NAT) Evaluations applies only native or basic tools and software such as the keyboard and Narrator in the accessibility evaluation process. These non-assistive technologies are readily available and used by the general public.

1. Accessibility Documentation

A. The organization providing the online materials has a formal accessibility policy.	Fail
Additional Information:	Did not find any information about OpenStax's Formal Accessibility Policy.
B. The organization providing the online materials has an accessibility statement.	Fail
Additional Information:	Did not find any information about OpenStax's Accessibility Statement.
C. An Accessibility Evaluation Report is available from an external organization.	Fail
Additional Information:	Did not find any information about OpenStax's Accessibility Evaluation Report.



2. Text Access

<p>A. The text of the digital resource is available to assistive technology that allows the user to enable text-to-speech (TTS) functionality.</p>	<p>Fail</p>
<p>Additional Information:</p>	<p>Narrator program was unable to read any pages in the textbook using the Adobe Digital Editions. Everytime it read the contents of the textbook, it would read "Book contents editing."</p>

3. Text Adjustment

<p>A. Text is compatible with assistive technology.</p>	<p>Fail</p>
<p>Additional Information:</p>	<p>All text adjusted properly in selection p. 1000 to p. 1108, but graphs don't change size and images overlapped text and/or eachother on pages 1000, 1032, 1045, 1062, 1069, 1073, and 1092 when zoomed out completely.</p>
<p>B. The resource allows the user to adjust the font size and font/background color (or is rendered by an application such as a browser, media player, or reader) that offers this functionality).</p>	<p>N/A</p>
<p>Additional Information:</p>	<p>Not using assistive technology in this evaluation, need assistive technology to evaluate.</p>

4. Reading Layout

<p>A. Text of the digital resource is compatible with assistive technology that allows the user to reflow the text by specifying the margins and line spacing (or is rendered by an application such as a browser, media player, or reader that offers this functionality).</p>	<p>N/A</p>
<p>Additional Information:</p>	<p>Not using assistive technology in this evaluation, need assistive technology to evaluate.</p>



B. If the digital resource is an electronic alternative to printed materials, the page numbers correspond to the printed material.	N/A
Additional Information:	Not using assistive technology in this evaluation, need assistive technology to evaluate.

5. Reading Order

A. The reading order for digital resource content logically corresponds to the visual layout of the page when rendered by assistive technology.	N/A
Additional Information:	Not using assistive technology in this evaluation, need assistive technology to evaluate.

6. Structural Markup/Navigation

A. The text of the digital resource includes markup (e.g. tags or styles) that allows for navigation by key structural elements (chapters, headings, pages) using assistive technology (or is rendered by an application such as a browser, media player, or reader that offers this functionality).	N/A
Additional Information:	No source code, cannot evaluate.
B. The text of the digital resource includes markup for bullets and numbered lists that is compatible with assistive technology (or is rendered by an application such as a browser, media player, or reader that offers this functionality).	N/A
Additional Information:	No source code, cannot evaluate.
C. If the text of the digital resource is delivered within an ebook reader application, a method is provided that allows users to bypass the reader interface and move directly to the text	N/A



content that is compatible with assistive technology.	
Additional Information:	No source code, cannot evaluate.

7. Tables

A. Data tables include markup (e.g. tags or styles) that identifies row and column headers in a manner that is compatible with assistive technology (or are rendered by an application such as a browser, media player, or reader that offers this functionality).	N/A
Additional Information:	No source code, cannot evaluate.

8. Hyperlinks

A. In-book links take you to a location within the textbook. For example, the table of contents would be considered in-book links and embedded links take you to the correct location in the book.	Pass
Additional Information:	0/10 links on p. 7 navigate. Entire table of contents needs to be checked for failed navigation links. 10/10 links to Figures on p. 500 to 515 all work appropriately. 10/10 "Return to Exercise" links from p. 940 and 941 work appropriately.
B. Live hyperlinks take you to any website or webpages external to the book.	Pass
Additional Information:	Average scores
C. Live links take you to the correct webpage that is functioning properly.	Pass
Additional Information:	17/20 links worked properly p. 400 to 561 . "Video Simulation" on p. 501 and "BioStudio Animation" both led to 404 errors and the "at this website" link on p. 561 led to a downed video.



D. Live links are descriptive enough for the users to know where it should take them.	Pass
Additional Information:	All links had appropriate descriptions p. 400 to 561.

9. Color and Contrast

A. All information within the material that is conveyed using color is also available in a manner that is compatible with those that do not perceive color, and information conveyed by color is also conveyed in other ways.	Pass
Additional Information:	No color redundancy issues in selection p. 600 to 708.
B. Information is conveyed from the sub-categories for contrast.	Pass
Additional Information:	Average scores
C. Contrast for headers passed WCAG AA standards for large texts (contrast ratio 3:1).	Pass
Additional Information:	All Headers p. 600-817 have adequate contrast.
D. Contrast for text passed WCAG AA standards for normal texts (contrast ratio of 4.5:1).	Pass
Additional Information:	Pages 600-817 have "Figure" links with poor contrast, and it seems to apply to the entire book.
E. Contrast for simple images (for example, images of atoms) passed WCAG AA standards (contrast ratio of 4.5:1).	Pass
Additional Information:	All simple images p. 600-817 have adequate contrast.

10. Language

A. The text of the digital resource includes markup that declares the language of the content in a manner that is compatible with assistive technology.	N/A
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Additional Information:	Not using assistive technology in this evaluation, need assistive technology to evaluate.
B. If the digital resource includes passages in a foreign language, these passages include markup that declares the language in a manner that is compatible with assistive technology.	N/A
Additional Information:	Not using assistive technology in this evaluation, need assistive technology to evaluate.

11.Images

A. Non-decorative images have alternative text that is compatible with assistive technology (or is rendered by an application such as a browser, media player, or reader that offers this functionality).	Pass
Additional Information:	43/43 images have adequate descriptions directly beneath them in selection p. 1000 to 1217.
B. Decorative images are marked with null alternate text or contain markup that allows them to be ignored by assistive technology.	N/A
Additional Information:	No decorative pictures were found in selection p. 1000 to 1217.
C. Complex images, charts, and graphs have longer text descriptions that are compatible with assistive technology (or are rendered by an application such as a browser, media player, or reader) that offers this functionality).	Pass
Additional Information:	78/108 figures have adequate descriptions. 30/108 Figures (27.6 on p. 1005, 27.8 on p. 1007, 27.14 on p. 1016, 27.19 on p. 1020, 28.3 on p. 1035, 28.6 on p. 1039, 28.8 on p. 1041, 28.9 on p. 1043, 28.10 on p. 1043, 28.12 on p. 1045, (28.14 on p. 1048 isn't visible), 28.15 on p. 1050, 28.17 on p. 1052, 28.19 on p. 1053, 28.20 on p. 1054, 28.29 on p. 1061, 28.31 on p. 1065, 28.33 on p. 1069, 28.39 on p. 1073, 28.41 on



	p. 1074, 28.44 on p. 1077, 29.2 on p. 1093, 29.20 on p. 1110, 29.22 on p. 1111, 29.35 on p. 1124, 29.41 on 1131, 30.13 on p. 1161, 30.16 on p. 1163, 30.21 on p. 1166, 30.27 on p. 1170, and 31.1 on p. 1216) have inadequate descriptions.
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12. Multimedia

A. A synchronized text track (e.g. open or closed captions) is provided with all video content.	N/A
Additional Information:	No multimedia content found.
B. A transcript is provided with all audio content.	N/A
Additional Information:	No multimedia content found.
C. Audio/video content is delivered via a media player that is compatible with assistive technology. This includes support for all criteria listed in Section 15 below.	N/A
Additional Information:	No multimedia content found.

13. Flickering

A. The digital resource content does not contain anything that flashes more than three times in any one-second period.	Pass
Additional Information:	No Flickering occurred throughout the document.

14. Science, Technology, Engineering, and Math (STEM)

A. STEM figures have appropriate markup that indicates that the image is a figure.	Pass
Additional Information:	10/10 images have adequate descriptions directly beneath them in selection Figures 29.10 to 29.20.
B. STEM graphs have appropriate markup that indicates that the image is a graph.	Pass



Additional Information:	7/10 Figures (8.13, 42.17, 44.26, 44.27, 45.2, 45.6, and 45.9 all have adequate descriptions; 39.15, 46.12 and 46.13 need better descriptions.
C. STEM equations have appropriate markup that indicates that the image is an equation.	Pass
Additional Information:	10/10 Equations (39.1 to 39.8, 45.1, 45.2) have adequate markup.
D. STEM tables have appropriate markup that indicates the image is a table.	Pass
Additional Information:	8/10 Tables (10.1, 10.2, 14.1, 16.1, 21.2, 21.2, 21.3, 22.1) all have adequate markup, but Figures 22.13 and 22.14 need better descriptions.
E. STEM figures have appropriate notation markup that conveys both the notation (presentation) and meaning (semantics) of the STEM content.	Pass
Additional Information:	10/10 images have adequate notation in selection Figures 29.19, 29.20, 29.21, 29.30, 29.32, 29.35, 29.40, 30.2, 30.3, and 30.4.
F. STEM graphs have appropriate notation markup that conveys both the notation (presentation) and meaning (semantics) of the STEM content.	Pass
Additional Information:	Figure 42.17 needs notation, 9/10 Figures (8.13, 39.15, 44.26, 44.27, 45.2, 45.6, 45.9, 46.12, and 46.13) have adequate notation.
G. STEM equations have appropriate notation markup that conveys both the notation (presentation) and meaning (semantics) of the STEM content.	Pass
Additional Information:	10/10 Equations (39.1 to 39.8, 45.1, 45.2) have adequate notation.
H. Assistive technology used can access the content from the STEM tables.	Pass



Additional Information:	10/10 Tables (10.1, 10.2, 14.1, 16.1, 21.2, 21.2, 21.3, 22.1, and Figures 22.13 and 22.14) all have adequate notation.
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15. Interactive Elements

A. Each interactive element (e.g. menu, hyperlink, button) and function (e.g. annotations) allows keyboard-only operation both with and without assistive technology.	N/A
Additional Information:	No Interactive Elements.
B. Each interactive element conveys information to assistive technology regarding the element’s name, type, and status (e.g. “Play, button, selected”).	N/A
Additional Information:	No Interactive Elements.
C. All instructions, prompts, and error messages necessary to complete forms are conveyed as text to assistive technology (or are rendered by an application such as a browser, media player, or reader that offers this functionality).	N/A
Additional Information:	No Interactive Elements.

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