

Slide 1

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Accessible and Universal Design for Learning in OER

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Slides, speaking notes, and links to resources: bit.ly/oerudl2021

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Hello everyone,

Thank you all for taking the time out of your day to listen to me talk about accessibility and universal design for learning in open educational resources.

First, I would like to point out our event code of conduct, which you would have agreed to when registering for the webinar. If you would like to review the code of conduct, my colleague will put a link to it in the chat.

Next, I would like to highlight that I've posted a link to a folder where you can download all resources related to this session on the slide. This link is bit.ly/oerudl2021. If you go to this link, you will find the PowerPoint file for these slides, which are accessible to anyone who is using a screen reader, a transcript of what I will be saying during this session, and a list of links to resources I will highlight during the session. My hope is that this will allow you to easily refer back to these slides, adapt them for your own purpose, and engage with the content in a way and at a time that works best for you.

While I speak, I will be reading out the content on my slides as well as describing any visuals that are there for anyone who cannot see the screen. In addition, we have enabled the automatic captioning in Zoom, and the recording will be properly captioned and then emailed out to everyone following the session. These are all examples of ways that I am trying to incorporate accessibility and universal design for learning into my presentation practices, which we will be digging more into in this session.

Before we get into the main topic of exploration today, I would like to take some time to introduce and situate myself in relation to the lands I live on as well as the topic of accessibility and universal design for learning in OER.

My name is Josie Gray and I use she/her pronouns. For those who can't see me, I am a thin, white woman in my mid-twenties with shoulder-length blond hair, glasses, and a septum piercing.

I am joining you today from the traditional and unceded territories of the Lkwungen-speaking peoples, now known as the Esquimalt and Songhees Nations, and the territories of the WSANEC Peoples. I have lived uninvited on these territories for eight years. I initially moved here to complete my undergraduate degree in history at the University of Victoria, and this is where I started my work in open education with BCcampus. And it is also where I completed my Masters degree while studying from home during this pandemic.

I grew up on unceded Tsimshian territory on the northwest coast, around the ocean, mountains, and rain forests. I also have ties to Treaty 6 territory, where most of my extended family lives. Growing up, I spent a lot of summers on my maternal grandparents' farm, which is on the traditional territories of the Blackfoot, Tsuu T'ina, Sioux, Metis, and Cree Peoples. I am extremely grateful for the privilege I have had to live and learn in each of these places.

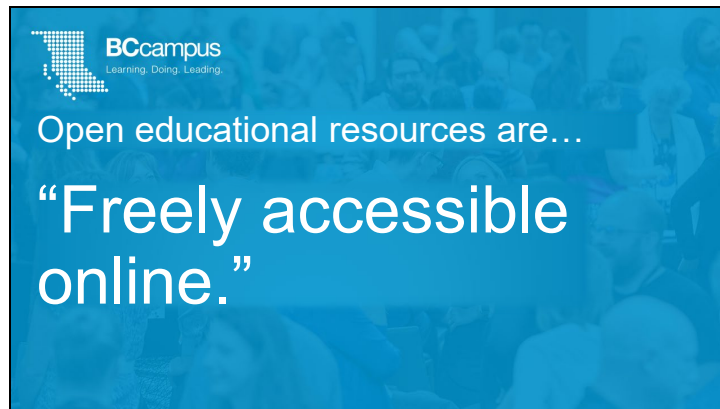
With that gratitude, I also want to take a moment to recognize that this country was built on genocide and violence that continues to this day. And as a settler, I have a responsibility to not turn away from that fact and recognize the ways I have benefited from it. And with that comes a responsibility to learn about Canada's colonial and genocidal history and the enduring inequities and injustices in their country and stand in solidarity with Indigenous peoples across this country who continue to fight for truth, justice, equity, safety, and rights to their own land.

I work for BCcampus, which is an organization in British Columbia, Canada, that supports all the public post-secondary institutions in the province in the areas of open education, learning and teaching, and other special projects. Specifically, I work on the open education team as the manager of production and publishing. In this role, I oversee the production and publication of OER projects that BCcampus funds and support faculty in creating OER that are well designed and accessible. I also manage the B.C. Open Textbook Collection, which is a collection of over 300 open textbooks.

I have been working in the area of digital accessibility in open textbook publishing for five years, and in that time my understanding of accessibility has evolved from a very specific focus on web accessibility guidelines and accessibility checklists to more a more complicated understanding informed by universal design for learning, the social model of disability, and inclusive design, all of which we will explore in this webinar. This past June, I graduated with a Master's of Design in

Inclusive Design from OCAD University, and that degree has also informed how I approach and understand this topic as well.

The things I will be sharing today come from my experience in making open educational resources more accessible to disabled students, and all that I have learned along the way. My hope is that I will be able to share a lot of concrete, actionable things that you can do to make your resources accessible and flexible for all students. However, it's important to recognize I am not a disabled person, and that disability is a huge category and there is a huge amount of diversity even among people with similar disabilities. I say this because I do not know everything of what it is to make something accessible to all people, and what may work for one person may not work for another. So I really want to encourage you to dig into all of the things we are going to talk about today, and then seek out and listen to the voices of disabled people, and disabled students in particular. Especially the ones on your own campuses and in your classes. Lived experience is so valuable, and I know I have learned so much from people with that lived experience.



Now I would like to talk a little bit about why we should be thinking about accessibility and open education together. In open education, there are a number of core values guiding the work we do. But one I want to highlight right now is “access.”

A statement that I quite often is that open educational resources are “freely accessible online.”

In my opinion, when people talk about OER as being “freely accessible online,” what they really mean is that the book is “freely *available* online.” Because when I see a statement like this beside a textbook, I check the book’s images for alt tags, I look for headings, and link text, and I am usually disappointed. Because although I’ve found a **great textbook** that is online with editable files and an open licence... it is not accessible for students with disabilities.

As I mentioned, part of my job at BCcampus is to manage the B.C. Open Textbook Collection. And as such, I’ve reviewed a lot of open textbooks from a lot of different publishers and authors. When I add a new book to the collection, there is a check that asks “Is this textbook accessible?” It is rare that I get to mark that checkbox as a yes.

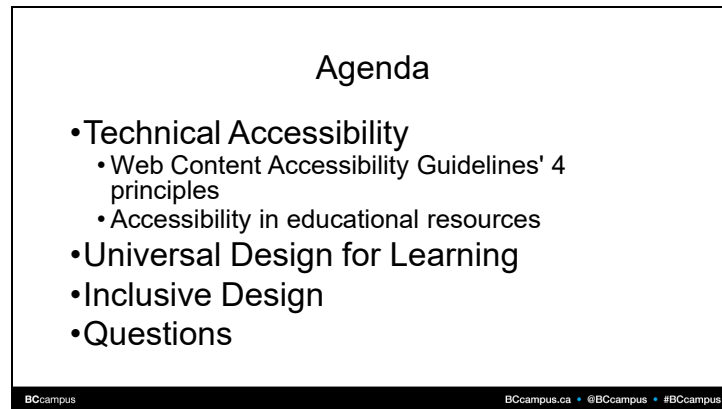
And this isn’t surprising. Digital accessibility is not something most of us – if any of us – were taught in school. It may not be a default practice for you to be thinking about the accessibility of every digital document that you create. We get comfortable in our own ability, which produces a bias that makes it easy to take for granted that what may work for me, may not work for someone else.

If thought of at all, accessibility is still coming in as an afterthought in OER design. And this can cause a lot of problems. Not only can it cause problems in the design of the resource, but it can make people less likely to ever take any steps to ensure a resources is accessible. When a

resource is created without accessibility in mind, it often takes A LOT of work to come in after to make it accessible, and often once you get to the end of a long project, going back and spending a bunch of time fixing the accessibility might not feel worth it.

As someone who started her work in digital accessibility by remediating inaccessible open textbooks, I am absolutely sympathetic to this point of view. Remediation takes a lot of work, and it can be a frustrating process to have to go back and find a way to fix things.

But universal access to education is something that we say we value in the open education movement, and ultimately there is more to “access” than just putting a resource up for free online. For open, the “available for free online” does wonders for access when we understand access in a general sense, without looking too closely at the experience of individual students with a particular resource. But in a movement that wants to make education open for **everyone**, including students with disabilities, we have to do better.

A rectangular slide with a black border containing the following text:

Agenda

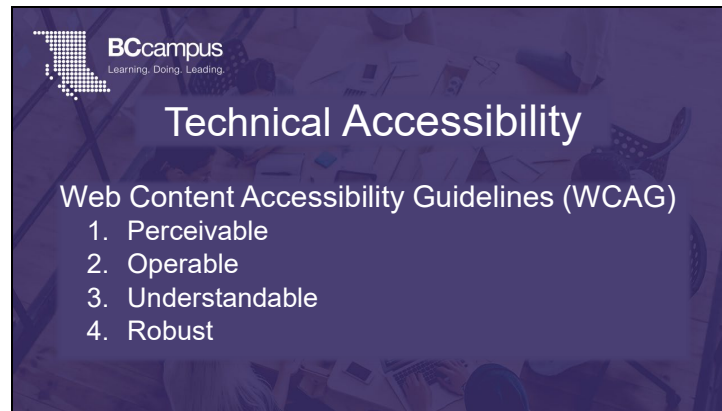
- **Technical Accessibility**
 - Web Content Accessibility Guidelines' 4 principles
 - Accessibility in educational resources
- **Universal Design for Learning**
- **Inclusive Design**
- **Questions**

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Here are the general topics that I want to cover today. We will start by looking at technical accessibility, which are the Web Content Accessibility Guidelines (or WCAG), and go over a number of accessibility requirements that are most relevant to the design of digital educational resources.

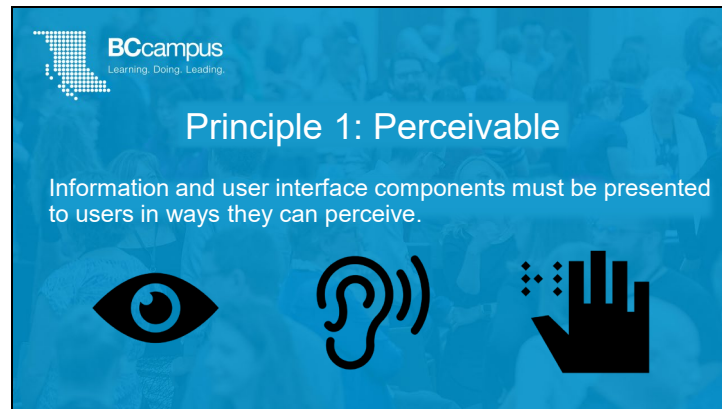
From there, we will talk about Universal Design for Learning and how to create OER that are flexible and consider the idea of inclusive design.

And finally, I will open it up to questions.



So let's start with technical accessibility. When talking about technical accessibility, I am referring to web content accessibility guidelines (WCAG). These are the minimum technical requirements that will allow students with disabilities to access all of the information in a digital resource. WCAG is an international digital accessibility standard that is developed and maintained by the W3C Web Accessibility Initiative.

WCAG has four main principles: That content and digital interfaces be perceivable, operable, understandable, and robust. I want to highlight the first three.



The first principle is perceivable, which is the idea that information and user interface components must be presented to users in ways they can perceive.

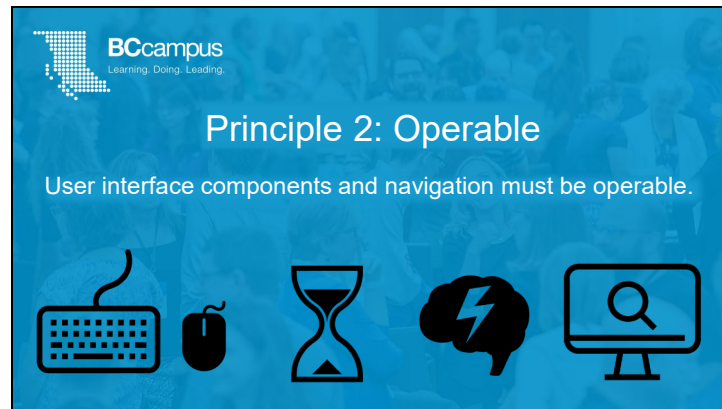
This principle focuses on the format and display of content. Basically, all content included in a resource should be perceivable through a user's senses. That means all information needs to be available through sight, sound, and touch, or available in such a way that assistive technology could be used to translate that content for another sense.

So for example, a blind student may use a screen reader to access digital resources. This student will require text or audio alternatives of all visual content like images and video. In contrast, a deaf student will need captions or transcripts for video and audio-only content.

“Sight” by Alice Design (<https://thenounproject.com/rose-alice-design>). CC BY.

“Hear” by Dmitry Vasiliev (<https://thenounproject.com/dimanebo>). CC BY.

“Braille” by Hadi Davodpour (<https://thenounproject.com/hadivoice>). CC BY.



The second principle is operable, which requires that user interface components and navigation must be usable by everyone.

The operable principle covers how people can navigate and interact with the resource. For example, someone should be able to navigate through a resource using only their keyboard, people should have enough time to complete tasks, none of the content should cause seizures or physical reactions, and navigation should be easy and make sense.


“Keyboard” by Vishal Patel from the Noun Project. CC BY.

“Mouse” by andriwidodo from the Noun Project. CC BY.

“Time” by Pham Duy Phuong Hung from the Noun Project. CC BY.



“Seizure” by Greg Pabst from the Noun Project. CC BY.

“Search” by Andreas Vögele from the Noun Project. CC BY



Principle 3: Understandable

Information and the operation of user interface must be understandable.



The third principle is understandable, which holds that information and the operation of the user interface must be understandable. That means the text is readable and understandable, the layout of a page is predictable and consistent, and there are features that help users avoid and correct mistakes.

Now, I want to look at how these principles can be applied in the design of educational resources and look at more concrete examples.

“Book” by Sebastian Langer from the Noun Project. CC BY.

“Web Page” by Vectorstall from the Noun Project. CC BY

Organizing Content

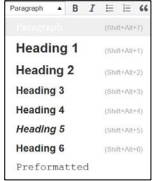
- Content is organized under headings and subheadings
- Headings and subheadings are used sequentially

```
<h1>Chapter 1: Introduction to Sociology</h1>

<h2>Introduction</h2>
Concerts, sporting matches and games, and political rallies
can have...

<h2>1.1 What is Sociology</h2>
A dictionary defines sociology as the systematic study of...

<h3>What are Society and Culture?</h3>
Sociologists study all aspects and levels of society...
```



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Let's start with the organization of content, which is basically talking about the use of headings.

Using headings to identify sections and subsections of a document **helps readers identify the structure and content of a document**. Headings provide a **visual cue** that helps sighted readers quickly skim through content until they find a section they are looking for. Similarly, if there are headings, it makes it possible for someone using a screen reader to **navigate a page or document**.

A screen reader won't identify bolded or larger text as a heading. By marking up the sections and subsection of a chapter as headings, **a screen-reader user can skip from heading to heading** to get an idea about what the chapter is about, understand how the different sections relate to each other based on the heading levels, and skip to parts that they want to read. Without headings, a screen-reader user would be forced to read the entire chapter through from beginning to end every time they wanted to find specific information on a page.

As such, make sure content is organized under headings and subheadings and that headings and subheadings are used sequentially. So if your previous heading was a heading 2, your next heading shouldn't be a heading 4 or 5.

Links

- The link text makes sense out of context
- Links do not open in new windows or tabs (unless a text reference is provided)
- The web address is available for those using a print copy

Not accessible
For more information on web accessibility, [click here.](#)

Not accessible
For more information on web accessibility, go to [https://opentextbc.ca/accessibilitytoolkit/.](https://opentextbc.ca/accessibilitytoolkit/)

Accessible
For more information on web accessibility, refer to the [Accessibility Toolkit.](#)

Accessible
For more information on web accessibility, refer to the [Accessibility Toolkit \[New Tab\].](#)

Accessible
The [BC Open Textbook Review Template \[Word File\]](#) provides guidelines for completing an open textbook review.

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Someone using a screen reader can also have all of the links on a page read out to them. For this reason, **the text of a link should describe the content of the link**, even when read out of context of the rest of the sentence.

I'll go through a few examples of accessible and inaccessible links. > The first example has "click here" as the link text. Someone who can see the whole sentence can understand what the "click here" link is referring to. However, if someone using a screen reader had their device read out the links on this slide, all they would hear is the phrase "click here" and have no idea where that link would take them.

The second example shows the web address as the linked text. While it is better than the first example, it can still be confusing when a screen reader reads out a web address, especially if it is long and complicated.

The third example is the most accessible as the link text is "Accessibility Toolkit," which still makes sense when out of the context of the rest of the sentence. My recommendation would be to use the title of the webpage as the link text wherever possible.

Finally, **links should not open into new windows or tabs** as it can be disorienting and confusing if the user – sighted or non-sighted – is not expecting it. However, if it is important that a link open in a new tab or window, include that information in the link text. This also applies with linking to different document types, such as PDFs, Word files, or Excel files. Because these formats may have different accessibility barriers, require time and bandwidth to download, and require appropriate software to open, it is best practice to include the file type in the link text as shown in the last example, which shows: "BC Open Textbook Review Template [Word File]"

Now if the resources you are creating will also be available in print format, you will want to provide a way for print users to access the web addresses. You might do this by putting the web address in a footnote or by creating a page containing a list of links at the end of the resource.

Data Tables

- ❑ Tables include a caption.
- ❑ Tables include row and/or column headers.
- ❑ Row and column headers have the correct scope assigned.
- ❑ Tables do not have merged or split cells.
- ❑ Tables have adequate cell padding.

Table 15.1 One way scholars have categorized religions is by classifying what or who they hold to be divine

Religious Classification	What/Who Is Divine	Example
Polytheism	Multiple gods	Hinduism, Ancient Greeks and Romans
Monotheism	Single god	Judaism, Islam, Christianity
Atheism	No deities	Atheism, Buddhism, Taoism
Animism	Nonhuman beings (animals, plants, natural world)	Indigenous nature worship, Shinto

"Religious Classification table" © William Little. CC BY. BCCampus.ca • @BCCampus • #BCCampus

For tables to be accessible, they have to be marked up correctly. This means they need a

- Caption that describes the purpose of the table
- Heading cells must be marked as headings with the correct scope assigned (meaning they are marked whether they are a column header or a row header)
- No merged or split cells
- There is adequate cell padding

In this example, the table has a caption. The table also has a header row with three cells. These header cells are marked as headers and have their scope set to “column,” because they are column headers.

Using header cells ensures that the table will be read out correctly by screen reader technologies. The screen reader will read out the cells from left to right, row by row, and when you use column headers, the screen reader will announce what column each data cell falls under as it goes.

If a table is a really long table, it is also recommended to provide a way for people to “Skip” the table, which will save people from having to navigate through the entire table if they aren’t interested in the content.

I won’t go into any more detail here. But if you are inserting tables into the resources you create, you can find specific instructions on how to ensure that the tables are accessible in the *Accessibility Toolkit’s* chapter on Tables, which I will be providing a link to at the end of this presentation.

Audio

- Include a transcript

Examples: Podcasts, interviews, recorded lectures

A transcript provides a text equivalent of audio content. It includes

- Speaker name(s)
- Headings and subheadings
- All relevant audio content, including
 - All speech content
 - Relevant descriptions of speech
 - Descriptions of relevant non-speech audio

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If your resource includes audio, such as a podcast, an interview, recorded lecture, or a song, there should also be a transcript of that audio. The transcript should include the speakers names, headings and subheadings for navigation if it is long, and all relevant audio content, including all speech content, relevant descriptions of speech, and descriptions of relevant non-speech audio.

Video

- ❑ All relevant visual information is conveyed via an audio description or transcript
- ❑ All relevant audio information is conveyed via captions or a transcript

Captions: Text that is synchronized with audio in a video.

Audio descriptions: Audio descriptions of visual content shown in the video that isn't conveyed through audio

Transcript: Includes the same information as with audio transcripts, but may also include relevant description of visual content

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If your resource includes video, all relevant visual information needs to be conveyed in an audio description or transcript and all relevant audio information needs to be conveyed via captions or a transcript.

Captions are text that is synchronized with the audio in a video.

Audio descriptions are for someone who can't see the video and need descriptions of visual content shown in the video that isn't conveyed through the audio.

A transcript includes the same information as with audio transcripts but may also include relevant descriptions of visual content.

If you are creating video, try to plan and design the video so that people who can't see the video still know what is going on without needing an alternative format. You can do this by having the people in your video or a narrator describe any important visual information while recording so an alternative format is not required.



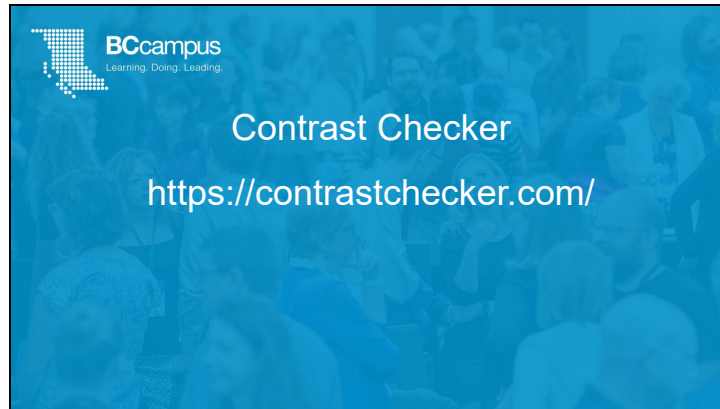
Paying attention to the use of colour and colour contrast in web content is important for people who have low or poor-contrast vision, are colour blind, or for those who use a device with a monochrome display or who may be printing in black and white. In addition, information should never be conveyed by colour alone.

Here is a bar graph that is charting student device preferences. It uses the colours red, blue, and green to differentiate between students who prefer desktops, smartphones, or laptops.

When the same graph is seen in greyscale, it becomes really difficult to tell which bar corresponds with which category. The red and the green look almost identical. This may be a serious barrier for someone who has a hard time differentiating between colours or someone who has printed their resource in back and white.

This problem can be solved by using colours with higher contrast ratios, and by adding labels to each bar, as shown in the bottom example. Adding labels to each bar ensures that the meaning of this graph is not only being conveyed by colour.

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If you're looking for a tool to help measure colour contrast, I would recommend contrastchecker.com, which allows you to test the contrast between colours and will give you pass or fail ratings based on WCAG standards.

Images

- ❑ Images that convey information include alternative text (alt text) descriptions of the image's content or function.
- ❑ Images that are purely decorative do not have alt text
- ❑ Graphs, charts, and maps include contextual or supporting details in the text surrounding the image.
- ❑ Images do not rely on colour to convey information.

A decorative image does not need a text description.

- Is primarily for design
- Does not convey content (or are already described in surrounding text)

A functional image contains content that requires a text description.

- Alt text
- Surrounding text or caption
- Long description

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The next number of slides will be focusing on images and different strategies for describing images.

When talking about images, we need to make distinction between decorative images and functional images. Decorative images are images that are used primarily for design and do not convey content. Or they convey content that is already described in the surrounding text. As such, they do not need text descriptions.

Functional images are images that convey important non-text content. For functional images, you have to consider what information would be lost if those images weren't available. This information needs to be provided in a text format.

There are three ways to provide text descriptions for images:

- Describe the image in the alt text field. This is sometimes referred to as the alt tag or the alt attribute.
- Describe the image in the surrounding text or a caption.
- Create and link to a long description of the image.

Text Descriptions

What to describe

- Content/purpose of the image
- Main focus of the image
- May depend on audience/context

How to describe

- Clear, concise, and accurate
- Go from general to specific
- Use words rather than symbols when writing math or scientific expressions
- Who? What? Where? When? Why?

Adapted from © Supada Amornchat. [Complex Images for All Learners \[PDF\]](#). CC BY-NC-SA.

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When thinking how to describe images, here are something to keep in mind.


In terms of what to describe, focus on the content and purpose of the image? What is the image trying to convey? Note that this will likely depend on the audience and context.

In terms of how to describe, make sure you are clear, concise, and accurate. Go from general to specific. Use words rather than symbols when writing math or scientific expressions. Think about who? What? Where? When? Why?

Alt Text

A short text description of an image that appears in the alt attribute of the image tag.

- Will not appear visually
- Can be accessed by text-to-speech technology (including screen readers)
- Should be less than 125 characters
- Does not need to include "Image of.."
- If left blank, a screen reader will skip the image.



"WFE003: Jacob" © Rosenfeld Media. CC BY

Now let's talk about the different place you can describe an image. The most common is the alt text.

Alt text is a short text alternative for an image that those using screen readers can access. The alt text will also be displayed if images aren't loading due to a weak internet connection. Depending on the tool you are using to create your OER, you will be able to add the alt text when you upload the image or when you edit the image.

When creating alt text there are some things to keep in mind:

- The text will not appear visually in your resource, but it can be accessed by text-to-speech technology
- Second, there is no need to include "image of" in the alt text, a screen reader will announce the presence of an image before reading the content of the alt text
- And finally, alt text is meant to be short. Keep alt text under 125 characters, including spaces and punctuation. If an image requires a longer description, describe it in the surrounding text or add a long description.

If an image is decorative or described in the surrounding text, you can leave the alt text blank. This will ensure that a screen reader will skip the image.

Surrounding Text
or Caption




Figure 2.3 In 1871, the newcomer population in B.C. was still outnumbered by Aboriginal people who were, nevertheless, being hustled onto reserves and mostly without treaties. A Stó:lō woman, weaving baskets, n.d.

Stó:lō woman with a cedar basket by Royal British Columbia Museum (PN996). Public Domain. Image caption © John Belshaw. CC BY.

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You can also use the surrounding text to provide the same information as provided in the image. This is often the best option for complex images because it makes the information available for everyone, not just those using the alt text. If an image has been adequately described in the caption or surrounding text, you can either provide a few-word description of the image as the alt text or not provide alt text.

In the image shown here, the caption reads, “A Stó:lō woman weaving baskets,” which adequately describes the image. Therefore, alt text is not required.

Long Descriptions for Complex Images

Examples
pie charts, bar carts, line graphs, flow charts, diagrams, illustrations, math graphs, and maps

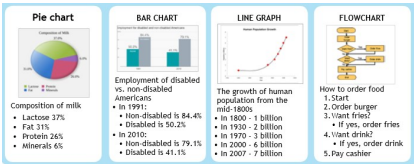
The composite image consists of three parts. On the left is a diagram of a volcano with numbered labels: (1) 'Lots of cones of ash and lava erupting from the upper atmosphere', (2) 'The inner lining of ash and lava makes the upper atmosphere', (3) 'The inner lining of ash and lava makes the upper atmosphere', and (4) 'The inner lining of ash and lava makes the upper atmosphere'. On the right is a line graph showing wave amplitude over time. The y-axis is labeled 'Wave amplitude (mm)' and ranges from -4 to 2. The x-axis is labeled 'Time (min)' and ranges from 0 to 12. The graph shows a complex wave pattern with several peaks and troughs. Key features are labeled: '2 wave arrival (20.7 s)', '3 wave maximum amplitude (2.7 mm)', '4 wave arrival (8.7 s)', and '5 wave minimum amplitude (2.8 mm)'. Below the graph is a cross-section of three volcanoes: Mt. St. Helens (2550 m), Cinder cone, Mauna Loa (4169 m), and Kilauea (1247 m). A scale bar indicates 200 km. The ocean level is marked as 'Sea level'.

Magma Chambers, P and S Waves, and Volcano Size © Steven Earle. CC BY
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Complex images such as charts, graphs, diagrams, maps, and more will likely require longer descriptions than can fit in the alt text. In these cases, you will need to create a long description for the image that students who can't see the image can access.

For some images, you may be able to describe them in a few sentences or a paragraph. But over the next few slides I want to highlight different strategies for describing different types of complex images that might be more effective and manageable.

Lists



Pie chart
Composition of milk

- Lactose 37%
- Fat 31%
- Protein 26%
- Minerals 6%

BAR CHART
Employment of disabled vs. non-disabled Americans

- In 1991:
 - Non-disabled is 64.4%
 - Disabled is 50.2%
- In 2010:
 - Non-disabled is 79.1%
 - Disabled is 41.1%

LINE GRAPH
The growth of human population from the mid-1900s.

- In 1800 - 1 billion
- In 1920 - 2 billion
- In 1970 - 3 billion
- In 2000 - 6 billion
- In 2007 - 7 billion

FLOWCHART
How to order food

1. Start
2. Order burger
 - If yes, order fries
3. Want fries?
4. Want drink?
 - If yes, order drink
5. Pay cashier

Bulleted and numbered lists can be used to present information found in

- Pie charts
- Bar charts
- Line graphs
- Flow charts

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The first is lists. You can use bulleted and numbered lists to represent information that is presented in pie charts, bar charts, line graphs, and flow charts.

Data Tables

Data tables can be used to present information found in

- Complex tables
- Bar charts
- Line graphs
- Pie charts

PIE CHART
List the numbers from smallest to largest.

Composition	%
Minerals	8
Protein	25
Fat	31
Lactose	37

BAR CHART
Briefly describe the chart & a summary, and provide title and axis labels.

Year	New Dealer
1991	84.4%
2010	79.1%

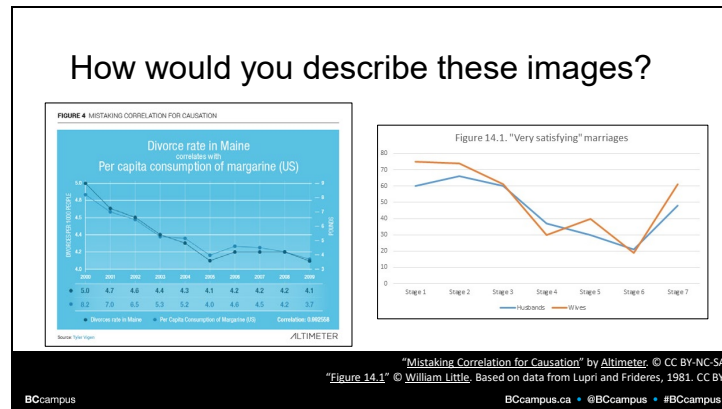
LINE GRAPH
List the numbers from earliest to latest year.

Year	Population
1900	1 billion
1950	2.4 billion
1975	3 billion
2007	7 billion

COMPLEX TABLE
Data separated into 3 tables aids cognitive overload in navigation.

Year	Population
1900	1 billion
1950	2.4 billion
1975	3 billion
2007	7 billion

You can also use data tables to represent information found in complex tables, pie charts, bar charts, and line graphs.



Here are two images that look quite similar. They are both line graphs that appear in an Introduction to Sociology textbook.

I put them here to illustrate how the context and significance of an image needs to be considered when deciding how to describe an image.

The image on the left shows a line graph that shows close correlation between the divorce rate in Maine and the United States' per capita consumption of margarine. This image was included in the textbook to illustrate that correlation does not equal causation. In this example, the visual trend shown in the graph is more important than the individual data points. The rate at which they fell from 2000 to 2005 does not matter as much as the fact that the graph shows them falling and rising again at almost exactly the same rate. Instead of replacing this image with a data table, a short description describing the point of the image is more useful.

The image on the right shows the number of husbands and wives in different stages of family life who described their marriage as "highly satisfying." In this case, while the visual graph is useful for sighted users, it would be quite difficult to describe in a sentence or paragraph, and the student might be expected to compare and contrast the data points. The best solution here is to provide an accessible table based on this graph.

You may also notice that the graph on the right relies on colour alone to convey information. This could be fixed by labelling each line directly.

Symbols

X or × or ·

- or − or —

÷ or /

1/2 or 1/2

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Now I want to talk a little bit about math accessibility.

The most common mistake I see with regards to math accessibility is authors using incorrect symbols for simple math equations. This is generally the case in books that aren't math books but use these symbols for basic equations or to convey things like negative degree temperatures.

I have put a number of symbols up on the slide. The first row uses different symbols that might be used to denote multiplication. However, a screen reader would only read the middle symbol as "times." The first symbol is would read as an x and the last it would read as a dot.

In the next line, the first and last symbols are a hyphen and an em-dash, and as such, screen readers don't announce their presence unless settings are changed. Only the middle symbol is something a computer would read as a "minus" sign.

The next line shows a division sign and a forward slash.

And the last example shows a fraction. A computer would read the first fraction as "one-half" or "one over 2." It would read the second fraction as "1, 2."

Another thing to keep in mind is the different ways we use math symbols. For example, in chemistry, you might want to say that an element has a charge of negative one or positive 2. But when talking about addition and subtraction, you would want those same signs to be read as minus and plus.

<h2>Formulas: MathJax</h2> <ul style="list-style-type: none">□ Formulas have been created using MathML or LaTeX□ Formulas are rendered with MathJax.	<h3>MathJax</h3> <p>This a display engine that translates mathematical markup (like MathML or LaTeX) into accessible, high-resolution equations.</p> <p>This allows the equations to be rendered aurally or visually.</p>
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When dealing with more complex math equations and formulas, using symbols is not longer enough. There are two ways to make math accessible. The first and best option is to create equations using MathML or LaTeX, which are both mathematical markup languages, and then use MathJax to render those equations. MathJax will translate the markup into accessible, high-resolution equations. As long as the markup prioritizes the meaning of equations over the display, then screen readers will be able to accurately interpret the equations.

Formulas: Images with Alt Text

□ Formulas are images with alternative text descriptions if MathML is not an option.

$$m = \frac{m_0}{\sqrt{1 - \frac{v^2}{c^2}}}$$

Alternative Text:
m equals begin fraction m sub 0 over begin square root 1 minus begin fraction v sup 2 over c sup 2 end fraction end square root end fraction

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If MathML or LaTeX isn't an option, the next best option is to provide an image of the equation and provide an alternative text description. I've provided an example on this slide. It reads, m equals begin fraction m sub 0 over begin square root 1 minus begin fraction v sup 2 over c sup 2 end fraction end square root end fraction.

In 2014, BCcampus conducted a user-testing session with visually impaired and blind students who indicated that it would be helpful to place an audio file of the formula or equation alongside the equation, allowing the student to hear exactly how the formula or equation should be interpreted.

Accessibility Checkers

WAVE (wave.webaim.org)

- Can be used to evaluate web content
- Can paste a link to a website or install it as browser plugin

Office 365 Products
(Word, PowerPoint, Excel, Email)


- Built-in accessibility checkers

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If you are publishing web-based resources, I would highly recommend WAVE, an accessibility checker. It is super easy to use and will highlight most accessibility problems. You can either paste a link to the page you want evaluated or install it as a browser plug in.

I should also note that a lot of software includes built-in accessibility checkers, including all Office 365 products like Microsoft Word, PowerPoint, and Excel. Many learning management systems have this as well.

When using Accessibility checkers, it's important to keep in mind that they do not prove a resource is accessible, but they can be helpful in identifying accessibility issues that you might have missed.



Beyond Technical Accessibility

- Limitations of accessibility checklists
- Universal Design for Learning (UDL)
- Inclusive design
- Adopting accessible practices

Now I want to transition beyond technical accessibility. Up to this point, I have mostly provided a checklist approach to accessibility by giving you a collection of success criteria, so I want to complicate that a little but by talking about

- Limitations of Accessibility Checklists
- Universal Design for Learning
- Inclusive Design
- And how we can go about adopting accessible practices

Accessibility Checklists

Strengths

- Easy to understand and follow
- Highlight the most important technical considerations to make sure students with disabilities can access the material

Weaknesses


- Accessibility as something that we can go back and fix later
- Do not ensure good design
- Do not account for the multiple formats of OER
- Students face challenges not addressed in standard accessibility checklists
- Does not ensure equal access to learning outcomes

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A lot of the accessibility considerations I have talked about so far are things that can be checked off. Do your images have alt text? Check. Does your table have a caption? Check. Do your videos have captions?

I've started by focusing on these checklist items because there are concrete and easily actionable. In addition, these items make up the very important minimum technical considerations to make sure students with disabilities can access their educational materials.

However, a checklist approach to accessibility has a number of weaknesses. It makes accessibility seem like something that can be fixed later, it does not ensure good design, it does not account for the multiple formats of OER, students face access challenges that are not addressed in standard accessibility checklists, and it does not ensure equal access to learning outcomes.



What is an average student?

The classroom, “far from neutral, is constructed for a mythical, “able-bodied,” neurotypical norm that neither reflects nor accommodates the wide range of diverse learners within it, regardless of whether these learners have been diagnosed with a disability” (Wilson, 2017).

Students may face all sort of barriers even if they don't have a diagnosed disability, and there is not really such thing as an “average student.”

In an article by Jan Wilson, she argues that the classroom,

“far from neutral, is constructed for a mythical, “able-bodied,” neurotypical norm that neither reflects nor accommodates the wide range of diverse learners within it, regardless of whether these learners have been diagnosed with a disability.”

What she is getting at here is this problem that comes up when we design for what we think is normal, or what we think is average. The reality is, there is no such thing as a normal or average student. Students vary greatly in their interests, family situation, culture, background, experience, strengths, and weaknesses. And all students benefit when educational materials are designed to be accessible and inclusive.

How do we understand disability?

Medical Model: Disability is an individual problem, affliction, or deficit that needs a cure or accommodation.

Social Model: Disability emerges when there is a mismatch between a person, their environment and tools they have available to them, and their goals.

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When talking about accessibility and inclusive design, it is helpful to talk a bit about how we think about disability.

The medical model of disability “understands disability as an individual problem, affliction, or deficit that needs a cure or accommodation.” It sees disability as grounded in the individual. This is the model that is used in medical settings, and it is also used at universities and colleges where students need to have a diagnosed disability to be eligible for accommodation.

In contrast, the social model of disability sees disability emerging when there is a mismatch between a person and their environment.

The social model of disability illustrates the false dichotomy between bodies and minds we perceive as “disabled” and those we perceive as “abled.” Instead, disability becomes more of a spectrum that can affect different people in different ways depending on their context, environment, and the tools they have access to, and is a product of history and culture.

The social model of disability is useful for challenging how we perceive and understand disability. It gives us a way to do something about disability and a motivation to help break down barriers for those with disabilities through inclusive design.



What else affects accessibility?

- **Day-to-day life**
- **Digital literacy**
- **Access to technology**
- **Structure of information**
- **Presentation of information**

All sorts of things affect the accessibility of a resource, and these things are very much context dependent and can vary from student to student.

For example, a student's day-to-day life can affect access. Consider a student who spends an hour on a crowded bus everyday commuting to school and spends long days on campus studying. For this student, a heavy print textbook would be really annoying, and they might decide to leave it at home rather than lug it to school. That is a barrier to access.

Another example is differences in digital literacy among students. Many OER are primarily online resources, and for those of us who work on a computer all day take for granted our comfort and experience with working with digital content. Even young college students who grew up with smart phones and easy access to Internet may not know how to search a PDF or understand how to take advantage of the different features in Pressbooks or know that an EPUB file can be accessed on their phone. A student can't learn well from a resource they don't know how to use or don't like using.

Another example is access to technology. Not every student has access to a computer. And if a course uses a textbook that is only available online, someone without a computer would likely struggle with accessing their textbook.

Day-to-day life, digital literacy, access to technology – all of these things are very individualized and context dependent. And these are things where OER in particular has the potential to really make a difference. Everyone has a preference in how they would like to access their learning materials, and open educational resources that are available in multiple formats make it possible for students to pick the format that they are most comfortable with and will work best for them.

For example, someone without a computer may appreciate a copy that they can read on their phone or a print version. Someone who spends long hours on transit would likely prefer a digital copy that they could download on their computer for easy offline access. Someone who likes to annotate their textbooks would probably love PDFs. By providing students choice, there is the potential to really improve the learning experience.

But with multiple formats come new challenges. Accessibility looks different in a print textbook than it does in a webbook, eBook, or PDF, and if you are providing all of these formats, you have to ensure that students using each format can access the same information. For example, people using a print version will need web addresses if they are going to be able to access any external resources linked to in your book. And a lot of students still really want a print copy. So that's something to keep in mind when you're considering how much interactive content you want to include in your resource that cannot be printed.

The final thing I wanted to highlight is the structure of information. How can you organize and structure your textbook or resource to make it easy to use and easy to find information and navigate. That means paying attention to the number of chapters, the titles, the use of sections and subsections, numbering systems, headings, and more. These considerations will vary from book to book, but the more intentional you are about thinking about structure, organization, and navigation, the more useful and powerful your resource will be, which on its own will increase access.

Universal Design for Learning (UDL)

Provide multiple means of

- Engagement (WHY)
- Representation (WHAT)
- Action and Expression (HOW)

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Part of what I am talking about here is Universal Design for Learning, or UDL. UDL encourages designing teaching and learning environments and materials so that they provide multiple means of engagement, representation, and action and expression for students.

Engagement is the why of learning. It looks at designing learning experiences that provide options to motivate students to learn.

Representation is the what of learning. It looks at how the content is being presented to students and aims to create content that gives students options in how they engage with that content. It also aims for clarity in language and symbols, and to supports comprehension through the structure and layout of the resource.

Action and expression is the how of learning. It looks at the options students have for demonstrating and managing their knowledge and learning.

Multiple Means of Representation: Multiple Modalities

Video, audio, text, images, interactive activities

Click play on the following audio player to listen along as you read this section.

1.1 Ohm's law and watts law

This section provides a brief description of two of the most fundamental electrical relationships: **Ohm's law**, which describes current flow in electrical circuits, and **Watt's law**, which describes how power is dissipated.

MATH FOR TRADES

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The principle I'd like to dive into a little bit deeper is the principle of multiple means of representation and what that could look like in open educational resources.

First, it can look like giving students choice and flexibility in how they engage with content by providing equivalent information in multiple modalities, like audio, video, text, and interactive activities. That way a student can choose if they want to watch a video or read a chapter. Or they could listen to the content while they read or while they do the dishes.

On the slide, I have a screenshot from a textbook that has an audio recording of the chapter's text embedded at the beginning of each chapter. This way a student can read, they can listen, or they can do both at the same time.

The second screenshot shows a math word question. Underneath is a video walkthrough of the answer to the question.

The image shows a slide with a dark purple background on the left and a white background on the right. The purple background contains the text "Multiple Means of Representation: Multiple Formats" and "Web, HTML, PDF, EPUB". The white background shows a screenshot of a book's web page for "Math for Trades: Volume 2" by Chad Flinn and Mark Overgard. The page includes a description of the book, a "Creative Commons Attribution" license, a "READ BOOK" button, and a "Download this book" dropdown menu with options for EPUB2, Digital PDF, Print_.pdf, XHTML, Pressbooks XML, and Web Links. The footer of the slide contains "BCcampus" and social media handles for BCcampus.ca, @BCcampus, and #BCcampus.

Second, it could look like making resources available in multiple formats. If you are creating your own readings or assignment descriptions, you might share the PDF and the Word file. The PDF is easier to download and open, but Microsoft Word has built in accessibility tools like text to speech and the ability to customize the display of text.

If you are creating OER in Pressbooks, which is a self-publishing tool often used for creating open textbooks, you can easily produce OER in multiple formats, including a webbook, PDF, and eBook. Each of these formats have different strengths and weaknesses, and are useful in different situations. PDFs are good for printing and annotating, the eBook is great for offline reading on a mobile device, and the webbook can be accessed in any browser at any time and can include multimedia content. One the slide I have a screenshot of a book that has been published in Pressbooks. This is the book's web home page where someone can read it in their browser. And there is also a drop down list titled "Download this book" with a list of all of the different files types that are available to download.

Additional Resources

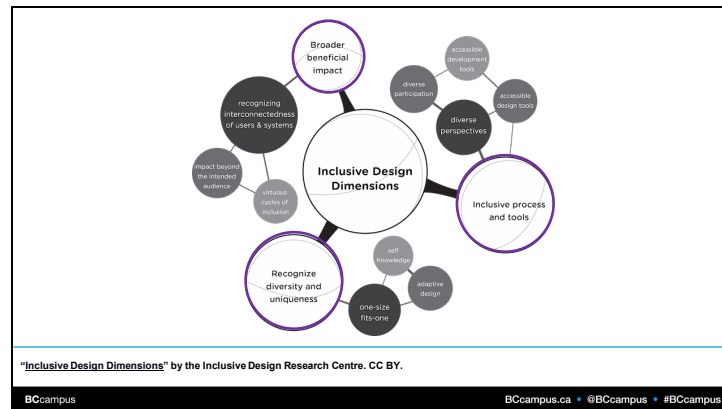
- [UDL Guidelines](#)
- [UDL on Campus](#)
- Webinar: [Using Universal Design for Learning \(UDL\) to Remove Barriers for All Learning](#)



When we bring all of these things together, all of these considerations, all of these practices, we are really starting to talk about inclusive design.


Inclusive Design is defined by the Inclusive Design Research Centre as “design that considers the full range of human diversity with respect to ability, language, culture, gender, age and other forms of human difference.” In inclusive design, one of the most important things is recognizing the people are different. And by designing for differences, we can create things that are more useful, powerful, and accessible to all.

With inclusive design, the work is never done. It’s not a box you can check off. It is an iterative and ongoing practice.



The IDRC has identified three dimensions that make up inclusive design:

- One is, recognize diversity and uniqueness. This includes looking at design as a one-size-fits-one, rather than a one-size-fits-all, a use of adaptive design, and respecting self-knowledge. This dimension encourages design that is flexible and empowers people to use the resource in the way that works best for them.
- The second dimension is inclusive processes and tools. This really looks like the process of design and who is included. When designing for inclusion, we have to consider and include diverse perspectives and participation.
- The third dimension is broader beneficial impact. This dimension encourages us to recognize the interconnectedness of users and systems. When we design for inclusion, our impact often goes much beyond the specific audience we are designing for and can encourage virtuous cycles of inclusion that build on each other.



Adopting Accessible Practices

How can you build accessibility considerations into the creation process?

What are the different formats that you can make available?

How can you empower the students using the resource to take advantage of the features and options available?

How can you collect and encourage student feedback and leverage the diverse needs of students to design better?

I get that it can be a lot of work, and thinking about accessibility adds another layer to the already complex process of developing and adapting open educational resources. However, as a community that values *access,* it's something we need to be always thinking about, and always striving to improve.

For those involved in creating and publishing open textbooks and other OER, think about how you can include accessibility considerations as part of the creation process. Talk to authors about it early. Include accessibility in style sheets; design, format, and organize with accessibility in mind from the very beginning. Think about the different ways that students may want to access information and what formats you can make available. For example, think about how you will make sure that students using a print copy and students using a digital copy can access the same information

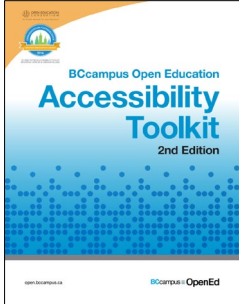
When it comes time to share the resource with students, make sure they know how to use it.

- Are they aware of all formats available and how to use those formats?
- Are there features that allow them to customize their experience?
- Are their tools that allow them to interact with the content in a different way? Think annotation tools or text-to-speech software

And then be open to and encourage feedback from your students. Ask them what they liked and didn't like about the resource.

- Did they find any sections confusing?
- Where they able to find information?
- Did it work on their devices?

Ultimately, accessibility and inclusion isn't a one-and-done kind of a thing. It is not a pass/fail. It is a spectrum, and it may look differently for each person depending on their context. And that plays into one of the best parts of OER: the ability for us to be able to go in and keep making things better.



Accessibility Toolkit

<https://opentextbc.ca/accessibilitytoolkit>

- Information about how to create accessible educational resources
- Accessibility checklists
- Activities
- Webinars on Inclusive Design


Accessibility Toolkit cover © BCcampus. CC BY
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Before we finish, I wanted to point you all to the Accessibility Toolkit, published by BCcampus. This toolkit covers a lot of the same information that I covered today and often in more detail. It also provides an accessibility checklist, activities, and links to a series of webinars on inclusive design.

The toolkit can be accessed at opentextbc.ca/accessibilitytoolkit

Slide 40



Questions?

Download the slides and list of resources
from the following link: bit.ly/oerudl2021

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Here again is the link to where you can download my slides from today. I've also posted a PDF with a big list of tools and resources I mentioned in my presentation plus additional ones I've found really helpful.

Questions?

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