Universal Design for Learning: One Small Step

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About This Book

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Authors & Copyright Info

This book is a collaborative project brought to you by the following USask Teaching, Learning, and Student Experience (TLSE) staff members:

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Why Did We Create This Book?

We know that learners bring a wide range of knowledge, skills, backgrounds, and experiences into the classroom. As educators, we can expect to find variability in our classroom. The USask Learning Charter lists, as one of the Educator Commitments and Responsibilities, to ***Strive for Excellence in Teaching***. This commitment means that educators work to develop respectful and inclusive learning environments that support student learning.

Honouring this commitment requires that educators co-create with students a shared space for learning in which all participants feel respected, valued, and empowered to contribute as they achieve their goals and share the gifts of their identities in relationship with one another. This approach is also part of the work that comes to embody the word **manacihtowin** (Cree) / **manachihitoohk** (Michif) (i.e., respect of all individuals). When we don't respond to the variability in our classrooms, we make our educational experiences exclusive.

UDL is a powerful approach that allows you to make sure the greatest range of students can access and engage in learning – not just certain students. Thus, the intention of *Universal Design for Learning: One Small Step* is to provide educators with strategies and resources to support greater accessibility and inclusion in higher education at the University of Saskatchewan.

Why "One Small Step"?

As seen in the title, *Universal Design for Learning: One Small Step* is built upon the teaching philosophy that even taking **one small step** (that is, making a single pointed change in your course) to provide an additional method of access, option for assessment, or strategy for engagement, is going to make a positive impact upon

the learning experience, and move your course towards greater inclusivity and accessibility. This is similar to the **"plus one"** approach commonly used by UDL practitioners and advocates (for example, see this video by Thomas J. Tobin: UDL plus-one). The broad idea is to not get overwhelmed at the work of applying UDL principles – the UDL approach, and this book, are *not* meant to serve as a checklist of all the "must-do" tasks for your course. Rather, they are meant to provide a framework and a helpful set of guidelines for the ongoing, reflective, personal, and iterative work of course design and of teaching.

Layout of This Book

You will encounter the following content throughout the book:

Challenge

Placed at the outset of a page, these blocks will provide a prompt to start your thinking, a meaty question to consider, or an activity for you to find a starting point in your UDL journey.

Web Resource

Where these are inserted, they offer links to additional resources from around the web where you might dig deeper into a topic or learn more.

Reflection: One Small Step

Placed at the end of a page, these blocks ask you to reflect upon what you are learning and consider just one specific, discrete, and manageable way in which you might apply the principles of UDL in your courses.

Where included, you will also find ***USask Lens*** text boxes that provide a university-specific connection to the content, showing how UDL aligns with the unique context and broad strategic goals of teaching and learning at the University of Saskatchewan, or for links to resources already available to support USask educators and learners.

Note that this book is designed to be used in a modular fashion – that is, you may find only certain chapters or sections of it applicable to the UDL work you are engaged in at any particular time. In a broad overview:

- Chapter 1: Introduction to Universal Design for Learning will provide the research foundations of UDL, an explanation for each of the three principles of UDL, and some guidelines for approaching course design (or redesign) from a UDL perspective.

- Chapter 2: Assessment and UDL will dig more deeply into using the UDL principles to design assessments that are flexible as well as rigorous.
- Chapter 3: UDL & Best Practices for Technology-Enabled Learning will examine web accessibility as a means of reducing barriers to learning, and will provide additional technical guidance and information specific to the USask technology ecosystem.

A handful of downloadable resources are placed throughout this book (handy checklists, case studies, and reference documents). Refer to the Appendix of Downloadable Resources to find these all in one place.

You will also find a collected Glossary of Key Terms in the back matter of the book.

Acknowledgements

The authors wish to extend our thanks to the following people:

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Clyne, C. & Goel, T. (2022). Facilitating Learning Online (FLO) course: Universal Design for Learning (UDL). BCcampus. CC BY-NC-SA. Retrieved from https://bccampus.ca/event/flo-udl/

Coolidge, A., Doner, S., Robertson, T., & Gray, J. (2018). Accessibility Toolkit – 2nd Edition. BCcampus. CC BY-NC-SA. Retrieved from https://opentextbc.ca/accessibilitytoolkit/

eCampusAlberta (2016). Online course shell: Universal Design for Learning in Online Education. CC BY. Retrieved January 4, 2022.

Kearney, D. B. (2022). Universal Design for Learning (UDL) for Inclusion, Diversity, Equity, and Accessibility (IDEA). eCampus Ontario. CC BY 4.0. Retrieved from https://ecampusontario.pressbooks.pub/universaldesign/

La, H., Dyjur, P., & Bair, H. (2018). Universal design for learning in higher education. Taylor Institute for Teaching and Learning. Calgary: University of Calgary. CC BY-NC-SA. Retrieved from https://taylorinstitute.ucalgary.ca/resources/universal-design-learning-higher-education

CHAPTER 1: INTRODUCTION TO UNIVERSAL DESIGN FOR LEARNING

1.1 Introduction to UDL

Universal Design for Learning (UDL) can be defined as *a framework that guides the design of courses and learning environments to appeal to the largest number of learners*. UDL originates from Universal Design (UD), which is a set of principles that guides the design of architecture and products that can be used by the widest range of individuals possible: all ages, access needs, characteristics, and life stages (Institute for Human Centered Design, 2016). Both UD and UDL share a common objective of universal access, but in different contexts; UD focuses on the "built" environment whereas UDL is expressed in learning environments (Pisha & Coyne, 2001).

Proponents of UDL recognize that overly rigid educational approaches can create fundamental obstacles to learning. UDL involves incorporation of a variety of approaches to engage learners in an **inclusive** curriculum that values diversity.

At its foundation, UDL prompts us to consider the complex factors of learning, including the educator's decisions in course design, students' motivations for learning, and the learning environment. The UDL framework emphasizes flexibility in how instructional material is presented, how students demonstrate their knowledge and skills, and how they are engaged in learning. It is informed by environmental design, but also by cognitive neuroscience, learning theory, and teaching practice. This framework is often presented via the **three principles of UDL**:

1. **Multiple means of engagement** – connect with learners' interests, supporting self-reflection of learning, fostering collaboration and varying levels of challenge (e.g., open class discussion, question and answer period, applied problem-solving, goal-setting).
2. **Multiple means of representation** – provide learners with multiple ways to engage and comprehend information and experiences (e.g., video, audio, graphics, symbols, tactile

objects).

3. **Multiple means of action and expression** – provide learners with alternative methods of demonstrating what they comprehend and different ways of managing information (e.g., assignments, multimedia presentations, concept maps).

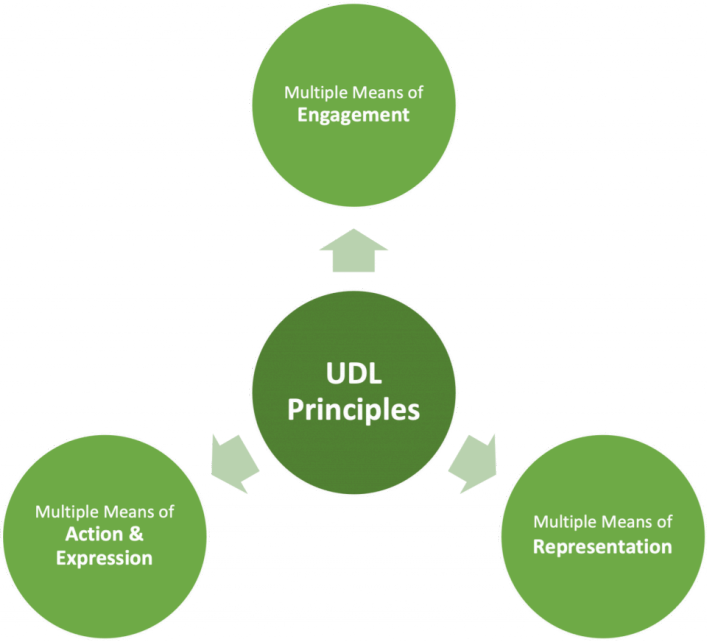

Figure 1-1: The Three Principles of UDL.

We will examine these three principles in greater depth in the following parts of this chapter.

Although much work needs to be done in higher education in understanding UDL, the framework holds a great deal of promise and potential. Educators who incorporate the three principles of UDL into their courses tend to hold certain beliefs about teaching and learning, such as the following:

- They acknowledge there is a diversity of students in their courses.
- They believe that all students have the same right to higher education.
- They aspire to creating equitable access to learning for all students in their courses.

The following video from the Center for Applied Special Technology (CAST) offers a quick overview of UDL.

One or more interactive elements has been excluded from this version of the text. You can view them online here: https://openpress.usask.ca/universaldesignforlearning/?p=30#oembed-1

Web Resources

The Center for Applied Special Technology (CAST) developed nine guidelines, accompanied by 31 checkpoints, that illustrate the three UDL principles: The UDL Guidelines

Learning Outcomes

By the end of this chapter, you should be able to:

1. Recognize the three principles of the universal design for learning (UDL) framework.
2. Discuss the potential teaching and learning benefits of UDL approaches.
3. Identify different ways to engage students in learning, and foster motivation and self-direction (multiple means of engagement).
4. Identify options for presenting information, content, and learning materials in different ways (multiple means of representation).
5. Identify multiple routes for students to demonstrate their learning (multiple means of action and expression).
6. a.) Analyze course design, development, and delivery elements for potential barriers to learning, and
   b.) Apply UDL principles to reduce/eliminate those barriers.

1.2 Why is UDL Important? What Does the Research Say?

Challenge

Think of the past learning experiences you have been a part of, either as a student or as an educator.

Were there times that seemed to cater only to the strengths, experiences, or perspectives of a particular subset of the learners? What was the effect on the other learners?

Arguments for UDL

Neurobiological research shows the importance of emotional engagement in shaping life-long learning, application, and memories (Immordino-Yang, 2016). Also, students' educational outcomes can improve when the **three principles of UDL** are implemented in course design, learning experiences, teaching practices, learning environments, and student assessments (Al-Azawei et al., 2016). Further, using a variety of appropriate entry points and levels of challenge can improve learning for all students while maintaining a high level of academic integrity.

The post-secondary student population is increasingly diverse and our institutions embrace students who have different points of

view, experiences, access needs, backgrounds, interests, histories, stories, and socioeconomic status to name a few (Buzzard et al., 2011; National Center on Universal Design for Learning at CAST, 2017). When traditional instructional approaches such as lectures and readings are used exclusively in a course, they do not address the diversity of learners that are likely to be in that course. To reduce barriers to education and increase student engagement, educators can consider the needs of all learners through course design, learning experiences, and the learning environment. UDL offers a framework for considering diverse student populations in higher education (Institute for Human Centered Design, 2016).

***USask Lens*:**

Consider the following demographic statistics from the University of Saskatchewan (Academic Year Snapshot 2021-2022):

- 14% of undergraduate students, and 7% of graduate students, have self-identified as Indigenous. Of these students, 57% self-identify as First Nations, 43% as Metis, and <1% as Inuit.
- 8% of undergraduate students are international students. Of these students, the top countries of origin are: China (21%), India (20%), Nigeria (16%), Bangladesh (7%), and Vietnam (4%).
- 35% of graduate students are international students. Of these students, the top countries of origin are: Iran (16%), China (15%), India (10%), Nigeria (8%), and Bangladesh (6%).
- In total, 66% of students at the University of Saskatchewan come from within the province,

while 18% come from out of province, and 16% of students come from out of Canada.

- Of the students who come from within the province, 68% come from urban centres in Saskatchewan, while 32% come from rural communities.

These statistics offer just a few examples to illustrate that students bring different experiences and perspectives to their learning.

Several strategies can help meet diverse learner needs, including student learning communities (Tinto, 2003), peer tutoring (Topping, 1996), and supplemental instruction (McGuire, 2006). These approaches aim to increase retention, improve student performance, and, more importantly, shift the educational paradigm from one that is teacher-centred to one that is student-centred. Many of these strategies rely on students seeking assistance from the institution's student academic centre. UDL is a complementary approach that educators can use to provide learning support within the courses themselves.

Implementing UDL requires consideration of both **accessibility** to information and pedagogical approaches. Put simply, UDL is intended to provide flexible curriculum (Pace & Schwartz, 2008) and learning experiences for students. Incorporating UDL does not eliminate educational barriers to learning (Zeff, 2007); however, it provides a new standard and mindset for educators to *reduce* barriers for all students.

Impact of UDL in Higher Education

Davies et al. (2013) conducted a study in which students reported that UDL intervention strategies increased their understanding of concepts in postsecondary courses (Davies et al., 2013). Further, UDL strategies can increase student interest and engagement, with **multiple means of representation** having the greatest perceived value (Black, Weinberg, & Brodwin, 2015; Smith, 2012). In a study on post-secondary students with at least one diagnosed disability (e.g., cognitive, psychiatric, or visual impairment), students emphasized the importance of being offered options for receiving learning materials – including educator prepared notes, notes prepared by student volunteers, recorded class lectures, alternative media, and hard-copy textbooks (Black et al., 2015). Lecture notes in particular, permitted students to focus on retaining information, lowering the pressure of making adequate notes in class, and helped increase students' perceived engagement level during the lessons. Recently, Dean et al. (2017) demonstrated that engaging students both in-class and outside of class using accessible instructional methods – interactive multimedia such as interactive electronic textbooks, flashcards, practice quizzes, activity lists, video lectures, and personalized educator content, have a positive impact on learning, especially for large class settings that are typical of introductory university courses.

In addition to benefitting students, the process of incorporating the **three principles of UDL** can have a positive impact on educators. At the University of Southern Maine, STEM (Science, Technology, Engineering, and Mathematics) faculty members who participated in a UDL development program reported a positive impact on their teaching experience, as evidenced by an increased engagement and commitment to improving student learning. Participation also had a positive impact on their professional relationships with peers, in that it encouraged faculty members to observe each other's course instruction and discuss the ways they

applied UDL principles to making their courses more accessible (Langley-Turnbaugh et al., 2013). UDL principles motivated educators to think about active learning and plan their lessons strategically to engage students by using demonstrations, simulations, models, and examples. Less emphasis was placed on theoretical foundations, offering students more ways to demonstrate competence. At the Metropolitan State University of Denver, a team of educators sent out weekly UDL-inspired tips for other educators to try in their classrooms (Herring et al., 2017). After a largely positive response, a website was developed to archive all instructional tips and offer a library of UDL resources, providing faculty the opportunity to comment and offer new tips.

Progression of Novice Learners to Expert Learners

Novices and experts approach learning differently. An expert educator may skip steps unconsciously, potentially causing learners to have difficulties interpreting concepts and making connections between steps. Additionally, the educator who can perform complex tasks in an efficient manner may underestimate the amount of time it takes for learners to perform an assignment or learn the material. Novice learners may not witness the impacts of their learning at the beginning and therefore may not feel they are making any learning gains (Middendorf & Pace, 2004).

One example of a process that can enhance our teaching practice and help educators recognize how their expertise might potentially complicate student learning is called *Decoding the Disciplines* (Middendorf & Pace, 2004). The decoding portion happens in an interview process: educators and educational developers collaborate to make an expert's thinking processes visible, with the expert being asked provocative questions to help bring any blind spots to the surface. The questions are based on addressing a

student "bottleneck" that the educator identified as an obstacle to learning. The expert's shared stream of consciousness provides clues about why a novice might find it difficult to engage or express their learning at a level the educator expects.

To demystify the discipline's complexity and narrow the gap between expert and novice thinking, Middendorf and Pace (2004) suggest that experts engage in a decoding process to uncover, observe, and interpret the tacit knowledge of the expert through a series of seven steps:

1. Identify a bottleneck to learning
2. Uncover the mental tasks needed to overcome the bottleneck
3. Model these tasks
4. Give students practice and feedback
5. Motivate and lessen resistance
6. Assess student mastery
7. Share what has been learned through the decoding process

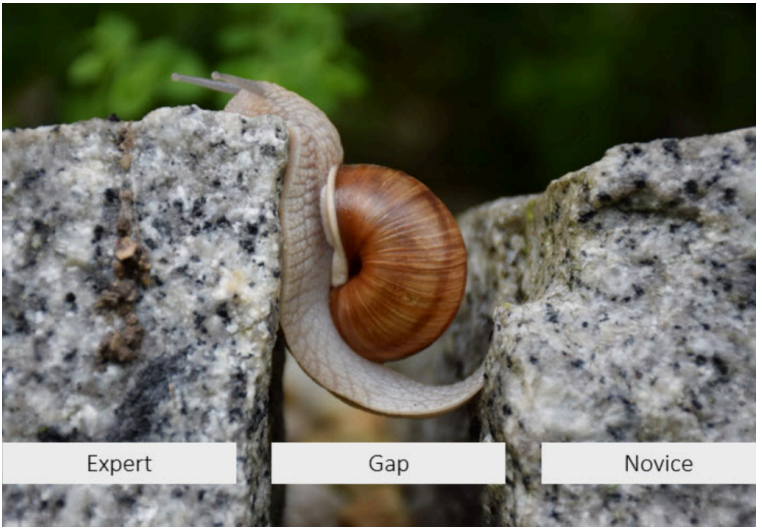

Figure 1-2: Crossing the gap between expert and novice thinking

Miller-Young and Boman (2017) interviewed seven faculty members across disciplines. Their research revealed that an expert has access to multiple ways of knowing, practicing and being, making it easier for educators to deconstruct and reconstruct their learning, recognize patterns, value provisionality, expand their thinking, be attentive to what is happening in the world, take agency, and apply an ethical and authentic understanding to their profession and practice (Miller-Young & Boman, 2017). In connection to UDL principles and guidelines, the expert learner's implicit knowledge must be made explicit in order to be accessible to the novice learner. The novice learner can then share the expert lens and begin to develop multiple ways of knowing, practicing and being in collaboration.

Neural Networks and Principles of UDL

Taking a UDL approach, the educator embraces learner diversity. Informed by cognitive neuroscience, UDL was formed by the Center for Applied Special Technology (CAST) to encompass three broad networks of cognition associated with learning (Kolb & Whishaw, 2015; Rose, 2005; Rose, Harbour, Johnston, Daley, & Abarbanell, 2006):

1. **Affective neural network** – responsible for emotion and affect, located at the medial regions of the brain (e.g., extended limbic system). This network represents the "why" of learning and is responsible for evaluating the significance or importance of the information being perceived.
2. **Recognition neural network** – situated at the posterior half of the brain's cortex. This network represents the "what" of learning and is responsible for recognition and perception of information.
3. **Strategic neural network** – situated in the anterior regions of

the brain's cortex (e.g., frontal lobes). This network represents the "how" of learning and is responsible for planning, organizing, and execution.

These neural networks roughly correspond to the **three principles of UDL**, which inform accessible pedagogy and establish a framework for course planning and learning experiences (National Center on Universal Design for Learning at CAST, 2017; Rose, 2001):

Neural networks and their corresponding UDL principles

Neural Network	UDL Principle	Also known as
Affective neural network	**Multiple means of engagement**	**The "why" of learning**
Recognition neural network	**Multiple means of representation**	**The "what" of learning**
Strategic neural network	**Multiple means of action & expression**	**The "how" of learning**

Gaps in the Research

Research to support the efficacy of UDL principles is, unfortunately, in the nascent stages (Al-Azawei et al., 2016; Mangiatordi & Serenelli, 2013; Rao et al., 2014; Roberts et al., 2011). As noted by Davies et al. (2013), there has been limited research on the larger scale impact of UDL on student performance, or of the value of UDL professional learning development for educators.

Recently, Dean et al. (2017) were among the first to examine learning gains on undergraduate students as a result of UDL-inspired strategies in a large lecture hall setting. In this study,

instructional tools that were accessible both inside and outside of the classroom, such as interactive textbooks, had more of a positive gain on actual and perceived learning than tools, such as audience response systems, that were accessible in-class only.

Rao et al. (2014) noted that the literature lacks a clear explanation of how the **three principles of UDL** should be applied. They questioned the extent to which UDL principles and guidelines must be implemented in a course to be considered accessible and equitable. A cross-cultural examination on the influence of UDL-inspired curricula is also largely absent and is currently limited to a few countries that are similar in culture and socioeconomic conditions (Al-Azawei et al., 2016).

A major limitation to the application of UDL themes across post-secondary settings is the amount of time required to fulfill the three principles (Kumar & Wideman, 2014). Further limitations, such as class size, may limit the application of UDL strategies in large classes (Dean et al., 2017). However, as noted by Poore-Pariseau (2013), a well-designed rubric will help ensure students are graded fairly in UDL-designed assessment formats.

Reflection: One Small Step

Take a moment to recall a teaching/learning activity you offered or observed where you noted that several students struggled.

1. Explain the activity and the specific point of difficulty that the students were experiencing.
2. Identify the student variables that may have impacted student success.

3. What are some strategies you might have used to increase student success?

1.3 UDL Principle 1: Multiple Means of Engagement

Challenge

Do you sometimes wonder about how your teaching practices currently support your learners? You're not starting this journey with an "empty suitcase," correct?

For a quick evaluation of your own starting point, download the How Do You Teach? Checklist, adapted from Colorado State University and the ACCESS project.

To start, complete the first section of the checklist to consider the ways you currently create a learning environment where students have multiple opportunities for engagement.

What does Multiple Means of Engagement mean?

Multiple means of engagement refers to different opportunities for student involvement (e.g., interactive activities, group discussions, online discussion boards). This principle reflects the idea that students have different motivations to engage in learning. For instance, some students are highly motivated by spontaneity and innovation while others may be uncomfortable in such learning environments. Some students may seek active social learning

forums while others will retreat from such environments. Students who are more engaged in learning will be enthusiastic about applying their knowledge and will have a desire to learn more on their own. This principle also refers to offering varying levels of challenge, fostering community and collaboration, and supporting students in self-regulating their learning. In a learning environment that applies this principle, learners are challenged, excited, and motivated about what they are learning.

***USask Lens*:**

"I love the interactive classes because that's where I learn, like I don't learn from writing. I need someone to teach me through it. I saw this classroom where everyone was just sitting in a circle and the prof sat there too, like all in a circle, all interacting with one another and that's how they were being taught and for me that's the best way for me to learn."

"Discussion groups have really helped me, just going through different scenarios and articles and stuff like that and our prof is really good at directing the conversation when he could tell things are getting maybe off track, he kind of redirects it. And we had a lot of guest speakers, it gets boring to sometimes read those books but those practical stories are more interesting."

-Student testimonials from the Wellness Strategy Report highlight the impact on learning and engagement where multiple means of engagement are used in a course.

The following short video from the Southern Illinois Professional Development Center offers an overview of this UDL principle.

One or more interactive elements has been excluded from this version of the text. You can view them online here: https://openpress.usask.ca/universaldesignforlearning/?p=40#oembed-1

What might "Multiple Means of Engagement" look like in the classroom?

This table provides some examples for implementing multiple means of engagement in a postsecondary classroom. Categories are listed on the left, with ideas for implementation on the right.

Examples for implementing multiple means of engagement in a postsecondary classroom

Multiple Means of Engagement	Putting it into Practice
Variety in teaching and learning activities	• Provide a variety of active learning tasks that allow for participation, exploration, and experimentation • Incorporate discussions and small group activities into lecture classes • Embed engagement materials in lecture notes, such as sample exam questions or puzzles • Give multiple opportunities to learn through practice • Provide prompt and regular feedback, so students have sufficient time and support to reflect and improve • Allow students to hand in a "rough draft" of a paper or assignment
Interaction with others	• Create a class climate in which student diversity is respected • Have students complete a pre-course survey in your LMS to understand your students and show interest in them. • Start the course by co-constructing a community agreement for learning (refer to it when necessary during the term) • Incorporate a variety of social learning opportunities, such as in-class and online discussions, problem-based learning, inquiry-based learning • Make yourself available to students during office hours in flexible formats (e.g., face-to-face, telephone, and web conferencing; allow scheduled appointments or hold regular drop-in hours).

Use of technology	• Use the online learning environment for small group work, discussions, links to news articles, practice exam questions, videos, student and educator profiles • Provide tools to support informal student interaction and study group arrangement (e.g., open discussion board forums) • Use online quizzes and other "knowledge check" interactive tools, not for marks but rather to provide immediate student feedback and formative feedback
Student choice of course content	• Add an optional unit or topic after standard units have been addressed • Have student groups each research and present on a different topic • Provide a video on the topic as an alternative or supplement to reading a textbook chapter • Provide students with a list of questions to guide and focus their reading
Self-regulation and motivation	• Guide students through goal setting activities at the outset of the course or assignment • Rubrics given at the beginning of an assignment to prompt self-assessment • Checklists for students to track their own progress • Challenge students with meaningful, authentic "real world" assignments • Create assessments that are outcomes- or competency-based and allow students to demonstrate the learning outcomes • Integrate experiential learning opportunities in your course

Web Resources

For more resources on how to provide multiple means of engagement, see the guidelines and checkpoints from CAST at: Principle: Provide multiple means of Engagement

Reflection: One Small Step

What UDL strategies would you like to try when designing (or redesigning) your next course? Use the following questions for considering this first principle in more depth as it might apply to your course (and remember – start with just one small step!).

Questions for Considering Multiple Means of Engagement:

- How can you incorporate variety in your teaching approaches and student learning activities?
- How might you incorporate student interaction and collaboration into your course?
- How might technology be used to facilitate a diversity of engagement opportunities for learners?
- What opportunities exist to incorporate student choice in learning content?
- How can you encourage student self-regulation and personal coping skills?

1.4 UDL Principle 2: Multiple Means of Representation

Listen to this page:

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https://openpress.usask.ca/universaldesignforlearning/?p=42#h5p-3

Challenge

Continue your work on the How Do You Teach? Checklist that you started earlier.

Complete the second section of the checklist to consider the ways you currently create a learning environment in which ideas and information are represented in multiple ways.

What does Multiple Means of Representation mean?

Multiple means of representation is about providing learners various ways to access and engage with course materials and information. In its simplest form, this could mean offering textbooks in audio or multimedia formats. This principle also refers to how students comprehend information in different forms, such as decoding syntax, vocabulary, notation, symbols, and disciplinary language. The goal is to support students in using multiple representations and developing fluency in traversing across them. Offering flexibility in presenting information also acknowledges differences in how learners comprehend and perceive information. For example, students with visual impairment may find print materials inaccessible, and students with diverse language, cultural backgrounds, and access needs may encounter barriers to information when educators assume common backgrounds. In a learning environment that applies this principle, material and content are presented in a variety of ways at the outset.

The principle also includes pedagogical approaches to a topic or concept. An educator could decide to give a concept overview (lecture) followed by an example and an application of the concept through an in-class exercise. Other examples of approaches include statistics, case studies, and expert opinion. If one approach is ineffective, a different approach may work better.

***USask Lens*:**

"I understand memorization and retaining concepts specifically is a really large aspect of learning, but to integrate a concept really fully you have to be able to

connect it to other ideas. I would like to see more of an emphasis on making sure that the connections between different units in course material are presented really clearly to students, because that provides a really good line for them to start drawing their own connections and contribute to their own retention and learning over the course."

-Student testimonial from the Wellness Strategy Report

Utilizing multiple means of representation is one way to ensure that "connections between different units ... are presented really clearly to students". Multiple means of representation provide all students with the opportunity to access, engage, and make sense of concepts.

The following short video from the Southern Illinois Professional Development Center offers an overview of this UDL principle.

One or more interactive elements has been excluded from this version of the text. You can view them online here: https://openpress.usask.ca/universaldesignforlearning/?p=42#oembed-1

What might "Multiple Means of Representation" look like in the classroom?

This table provides some examples for implementing multiple means of representation in a postsecondary classroom. Categories are listed on the left, with ideas for implementation on the right.

Examples for implementing multiple means of representation in a postsecondary classroom

Multiple Means of Representation	Putting it into Practice
Accessible course materials	• Use common file formats such as .doc and .pdf so that documents are compatible with text-to-speech software • Put a copy of the course text on reserve in the library • Provide links to Creative Commons resources • Use Open Education Resources (OER) • Post slides, readings, and course materials online in advance if appropriate • Post electronic equivalents of paper handouts • Include captions for graphics • Enable closed captioning and provide transcripts for videos
Multimodal sources of information	• Supplement lecture and reading assignments with visual aids (e.g., photographs, videos, diagrams, interactive simulations) • Augment required readings with alternative formats such as audio and video • Video recordings of lectures if allowed • Add an audio file explaining a major assignment • Provide models and graphics in addition to text • Use animations • Embed interactive questions/quizzes into videos
Pedagogical approaches	• Use different pedagogical approaches to topics or concepts, such as logic, statistics, narrative, case study, multiple perspective, and testimonial
Student-created materials	• Graphic organizer summary created by students • Concept maps, metaphors, illustrations, storyboards • Students post their class notes to the course site (perhaps in small groups) • Students create their own glossary of terms throughout the course

Comprehension and key concepts	• Ensure your course syllabus clearly describes your outcomes, content, assessments and your expectations of the students. • Create an advance organizer or study guide to go over expectations for the following week (e.g., readings, focus questions, videos to watch, etc.) • Provide an agenda and key concepts overview at the beginning of each class • Practice exercises and solutions • Highlight patterns and themes between ideas • Post a list of Frequently Asked Questions (FAQs) and responses online
Check for understanding	• Summarize key points throughout the class, and tie these points to the larger course outcomes • Use active learning strategies such as a hinge questions or predictions to review the key points of your lesson • Online discussion forums • Q & A in class • Student response systems (e.g., Poll Everywhere) to check for comprehension and guide further discussion

Web Resources

For more resources on how to provide multiple means of representation, see the guidelines and checkpoints from CAST at: Principle: Provide multiple means of Representation

Reflection: One Small Step

What UDL strategies would you like to try when designing (or redesigning) your next course?

Use the following questions for considering this principle in more depth as it might apply to your course (and remember – start with just one small step!).

Questions for Considering Multiple Means of Representation:

- How can you ensure your course materials are accessible to as many students as possible?
- How might you present main course concepts in more than one format?
- Does your course offer opportunities to encourage student agency?
- What learning activities could emphasize comprehension of key concepts?
- How might you informally gauge student understanding of course concepts?

1.5 UDL Principle 3: Multiple Means of Action & Expression

Challenge

Continue your work on the How Do You Teach? Checklist that you started earlier.

This time, complete the third (and final) section of the checklist, in order to consider the ways that you already create a learning environment in which students can demonstrate their learning in multiple ways.

What does Multiple Means of Action and Expression mean?

Multiple means of action and expression encourages students to demonstrate their learning through various forms (e.g., exams, multimedia, concept maps, papers, projects). This principle highlights executive functioning, where students apply what they learn strategically. That is, it involves finding, creating, using, and organizing information. This process can include graduated levels of support, and using tools and technology. Students may find that they are able to express themselves more proficiently in one

medium than in another. It may be possible to incorporate graded assignments into a course that allow students to select alternative formats. Other opportunities for multiple means of action and expression include notetaking, in-class assignments, and feedback from different sources. In a learning environment that applies this principle, learners can act upon and express their comprehension in multiple ways.

The following short video from the Southern Illinois Professional Development Center offers an overview of this UDL principle.

One or more interactive elements has been excluded from this version of the text. You can view them online here: https://openpress.usask.ca/universaldesignforlearning/?p=44#oembed-1

What might "Multiple Means of Action and Expression" look like in the classroom?

This table provides some examples for implementing multiple means of action & expression in a postsecondary classroom. Categories are listed on the left, with ideas for implementation on the right.

Examples for implementing multiple means of action & expression in a postsecondary classroom

Multiple Means of Action & Expression	**Putting it into Practice**
Assignments and demonstration of skills	• Use a variety of assessment strategies to allow students to express what they know in multiple ways (e.g., using formative quizzes, case studies, model building, and an oral presentation rather than just a traditional midterm and final exam). • Presentations in class or online • Different methods of demonstrating skills, such as roleplay, debate, discussions • Provide opportunities to develop skills in real settings
Exams	• Variety of question types on exams: multiple choice, matching, short answer, fill in the blank, equations, label a diagram • Exam questions that assess various ways of understanding: remember/ comprehend, analyze/ apply, and evaluate/ create (Bloom's Taxonomy) • Incorporate graphics into some questions
Opportunities for interaction and feedback	• Incorporate technologies that facilitate class communication and participation • Use discussion boards, podcasts, or blogs to allow students who need more time to reflect on a topic. • Use polling software to allow all students to participate without feeling "called out" • Use question sets from the textbook as practice • In-class peer feedback • Use rubrics • Student-led study groups • Cumulative assignments with feedback at various stages • Office hours

Student choice	• Give students options to demonstrate mastery of the course learning outcomes • Choice of assignment format: research paper, presentation, website, poster, video, podcast, etc. • Choice of due date or topic • Incorporating social media as a communication tool • Offer tools and technologies to support learner needs and reduce barriers (assistive technology, spelling/grammar checkers, dictation software, typing vs. writing by hand)
Assessment anxiety	• Help students develop deliberate strategies for learning • Engage in goal setting and support strategic competency development • Facilitate learner capacity for monitoring progress and development • Use assignment guidelines to outline your expectations • Provide templates or outlines if appropriate • Option to write final exam as a take-home exam if appropriate • Give sample assignments showing feedback and how they were graded if appropriate

Web Resources

For more resources on how to provide multiple means of action & expression, see the guidelines and checkpoints from CAST at: Principle: Provide multiple means of Action & Expression

Reflection: One Small Step

What UDL strategies would you like to try when designing (or redesigning) your next course? Use the following questions for considering this principle in more depth as it might apply to your course (and remember – start with just one small step!).

Questions for Considering Multiple Means of Action and Expression:

- What opportunities exist to incorporate multiple means of expression in assignments?
- How might you incorporate multiple means of expression on exams?
- How might you provide more opportunities for feedback?
- What choices might you offer students regarding assignments, communication, and content delivery?
- What course design decisions can you make to mitigate student anxiety regarding assessment?

1.6 Applying UDL Principles to Course Design

Challenge

Now that you have learned all about the three principles of UDL, try the following short quiz to review these concepts.

An interactive H5P element has been excluded from this version of the text. You can view it online here:
https://openpress.usask.ca/universaldesignforlearning/?p=222#h5p-1

At the end of this first chapter, you should now be familiar with the 3 parts of the **Universal Design for Learning (UDL)** framework, and should be ready to start deliberately applying it to course design. This will help you to create equitable, **inclusive**, and **accessible** learning environments that are usable by people with the widest possible range of abilities, operating within the widest possible range of situations. Including UDL elements as the first step in curriculum, program, and/or course design (or redesign)

is ideal because you can consider the needs of your learners, and yourself, and (re)design with inclusion, equity, diversity, and access in mind.

As you get ready to integrate the **three principles of UDL** with your course design, it's important to remember that UDL means putting student needs at the center and recognizing that these needs will differ between students and even within students in predictable ways. Explained by CAST's co-founder David Rose, applying the UDL principles to course design is like packing for a trip and considering the different types of weather and activities you're likely to encounter. If you know you're in for a few rainy days, best to throw in a jacket and some pants, along with the swimsuit and sunscreen. UDL just provides a *system* for approaching these predictable scenarios by "packing" the course with three kinds of options before you embark.

Remember also not to feel overwhelmed, and to choose just those approaches that work best for you. If you have limited time to devote to preparation and implementation of UDL, you could look for strategies that require a lower time investment. Other times, you could invest more time in strategies with the potential for a huge benefit for all learners. Keep in mind the general philosophical approach of this book – that even taking "*one small step*" towards incorporating UDL principles into your course will improve the learning experience, and have a positive impact upon your students.

Web Resources

As you are looking for additional ways to apply UDL principles in your course design, refer to the following

resources for additional strategies and ideas that can be applied in various contexts:

- UDL Guidelines from CAST. The interactive graphic organizer on this page links to additional information for each of the three Principles, with Guidelines underneath each Principle, and then is further broken down into Checkpoints for each of those Guidelines.
- Spin the interactive UDL Wheel for strategies and examples related to each of the three principles, along with links to additional resources.

Case Studies in Applying UDL Principles

The purpose of this Case Study activity is for you to practice application of the concepts presented in this book. Select one of the following case studies for your reflection and recommendations. As you are analyzing the case, look for opportunities to incorporate UDL into the design and delivery of the learning. Offer your suggestions and recommendations on barriers you identify, based on what you have learned about UDL.

- UDL Case Study Worksheet – Humanities
- UDL Case Study Worksheet – STEM

If you prefer to analyze a different course (like one of your own), choose this template instead:

- UDL Case Study Worksheet – Choose Your Own

When reviewing your case study, you may want to keep these questions in mind (taken from Meyer et al., 2014, pg. 112):

1. **Think about how learners will engage with the lesson:**
    - Does the lesson provide options that can help all learners regulate their own learning?
    - Does the lesson provide options that help all learners sustain effort and motivation?
    - Does the lesson provide options that engage and interest all learners?
2. **Think about how information is presented to learners:**
    - Does the information provide options that help all learners reach higher levels of comprehension and understanding?
    - Does the information provide options that help all learners understand the symbols and expressions?
    - Does the information provide options that help all learners perceive what needs to be learned?
3. **Think about how learners are expected to act strategically and express themselves:**
    - Does the activity provide options that help all students act strategically?
    - Does the activity provide options that help all learners

express themselves fluently?
    - Does the activity provide options that help all learners physically respond?

Feedback from peers is a powerful development tool in the application of UDL strategies. You may want to share this activity with a colleague, co-worker, or other person from your professional network. Perhaps there are other members of your institution who would like to join with you in a UDL Learning Community?

Reflection: One Small Step

Look back to your initial How Do You Teach? Checklist and ask yourself the following questions:

- What is one change I can make create a learning environment where learners are challenged, excited and motivated about what they are learning?
- What is one change I can make to create a learning environment in which material and content are presented in a variety of ways?
- What is one change I can make to create a learning environment where students can express their comprehension in multiple ways?

CHAPTER 2: ASSESSMENT AND UDL

2.1 Introduction to Universally Designed Assessments

Universally designed assessments create flexible and valid assessments through the application of **UDL principles**. Applied to assessment, the goal of UDL is for all students to demonstrate relevant skills, knowledge and abilities without barriers and without compromising the validity of the evaluation results (Ketterlin-Geller & Johnstone, 2006). In this chapter, you will learn how to remove assessment barriers while designing assessments that are flexible *and* rigorous. Not only will students benefit from universally designed assessments, but the results will provide more reliable feedback for your ongoing course development.

Benefits of Universally Designed Assessments:

- Assessments become more accurate measures of intended learning outcomes
- Assessment is inclusive and transparent, so students have equitable opportunities to demonstrate their learning.
- Students are provided with equivalent rather than identical opportunities to demonstrate their learning
- Validity and reliability of the measurement remain intact
- Develops student's ability to learn effectively and prepares students to be self-directed, reflective, and engaged learners
- Need for formal exam accommodations by students with access needs is diminished

This chapter leads you through the following steps for applying UDL to assessments:

1. Clearly define learning outcomes

2. Create an assessment plan
3. Develop strategies for engaging variable learners in assessments
4. Create accessible assessments
5. Design rubrics with transparent criteria

The following short video from CAST offers an introduction to UDL and Assessment.

One or more interactive elements has been excluded from this version of the text. You can view them online here: https://openpress.usask.ca/universaldesignforlearning/?p=61#oembed-1

Learning Outcomes

By the end of this chapter, you should be able to:

1. Separate means of achieving from learning outcomes.
2. Apply strategies for engaging diverse students in assessments.
3. Apply strategies for incorporating multiple means of representation in assessments.
4. Apply strategies for incorporating multiple means of action & expression in assessments.

2.2 Clearly Define Learning Outcomes

Challenge

Do you sometimes find that ***how*** you asked students to demonstrate what they know prevents them from showing you ***what*** they have learned?

Carefully constructed **learning outcomes** are essential to the design of flexible and valid assessments. A key understanding in the universal design of assessments is that barriers arise when learning outcomes and the means for achieving these outcomes are misaligned. For example, consider the following learning outcome for a course in Canadian Popular Culture:

> "Analyze the factors influencing Canadian television productions in the 21st Century in a 10-page essay."

Notice how one way of demonstrating learning (writing an essay) has been embedded with the outcome of analyzing influences on Canadian television production. This melding of "means and end" will disadvantage those students for whom essay writing is not a preferred means of demonstrating learning. However, separating means from ends helps to remove barriers and create a more valid

assessment of course learning outcomes, in this case, an understanding of influences on Canadian television and the ability to conduct an analysis. Consider the reworked learning outcome:

> "Analyze the factors influencing Canadian television productions in the 21st Century."

Now there are options for the ways students conduct their analysis and present their results (e.g., writing, demonstrations, multimedia, interviews, presentation, wikis).

Learning Personas – Three Assessment Experiences

To illustrate the impact of the **three principles of UDL** on assessment, the following infographic portrays the experiences of three students and the unintended barriers that can arise at various points in the assessment process. Kevin's experience demonstrates how a carefully constructed learning outcome and options for action and expression removed barriers and allowed him to fully demonstrate his learning.

We will refer to this infographic throughout the chapter.

> **Assessment outcome:** Analyze the impact of cultural policy on Canadian film and television industries

Assessment goal: Students demonstrate skills, knowledge, and abilities without barriers

Three assessment experiences

	 **Melanie**	 **Kasha**	 **Kevi**
Profile	Melanie struggles with motivation, self-regulation, & time management.	Kasha has a print disability that impacts her ability to process printed information.	Kevin has cer impacting his word-pr
Assessment Tools	10-page research paper, using APA format, due in 5 weeks	Timed online (LMS) multiple-choice exam	Assignment me slide presentati interview, v
Learner experience: ***Initial steps***	Melanie feels overwhelmed by the paper's length requirement and puts off starting for 4 weeks.	Kasha uses screen-reading software to review instructor-provided study guides, and lecture notes on the LMS.	Because of Ke keyboarding verbal skills, he the podcast
Learner experience: ***Getting organized***	Melanie finds a lot of information but doesn't know how to organize it.	Kasha submits a request for exam accommodations: 1.5X time extension, exam formatted for screen-reading.	Kevin and h learning partn project plan w tasks and time research, scri and podcast p
Learner experience: ***Doing what's possible***	Too many sources, no experience with APA, and tomorrow's due date — Melanie decides not to complete the assignment.	The exam's formatting is not compatible for screen-reading, resulting in poor navigation and out-of-sequence reading.	They listen to attached to the description and Gzowski-sty

Learner experience: *Conclusion*	Although Melanie was interested in the topic and collected a lot of relevant information, she receives a zero on the assignment.	Kasha just barely completes the exam before it closes and worries that she may not have understood some of the questions.	Kevin's partne scripts with K Kevin produce recording and the online d boar

Profile images by Lluisa Iborra, licensed under CC BY 3.0

Web Resources

For more examples and information on refining learning outcomes so that they support universally designed assessments, consult the following CAST site: Learning goals from a UDL perspective.

This site includes the following:

- separating the means from the ends
- addressing variability in learning
- providing UDL options in the materials, methods, and assessments

Once learning outcomes are in place, it's time to make decisions about the types of assessment you want to include and the acceptable ways for students to demonstrate their learning. The following reading is an excellent resource for guiding these decisions.

Reflection: One Small Step

Is there somewhere I can separate means from ends in my learning outcomes to remove barriers and create a more valid assessment of course priorities?

2.3 Create an Assessment Plan

Challenge

Do you sometimes find that you use the same types of assessment methods and tools that you were assigned as a student? Do you sometimes find your students are not achieving the learning outcomes but can't identify where the learning gaps occur?

Effective assessments of students are aligned with the **learning outcomes** and instructional strategies. It is also important to remember that designing assessments, like other elements of curriculum, is best approached within the context of the course and as a part of the overall **assessment plan**. An assessment plan, viewed through the UDL lens, needs to include a variety of assessment tools and techniques in order to meet the needs of variable learners.

***USask Lens*:**

"I think it's nice when professors have a lot of different ways to get marks and its not all just midterm and final. The classes that I have enjoyed the most and that have been the least stressful are the ones where there are multiple assignments. It's more

> accommodating to various learning styles not necessarily just people who can memorize material."
>
> -Student testimonials from the Wellness Strategy Report

One of the most significant things you can do to create **inclusive** and transparent assessments when creating your assessment plan, is to ensure the various types of assessment are represented: assessment for learning (formative assessment), assessment as learning, and assessment of learning (summative assessment).

- **Assessment for Learning (Formative assessment**) provides ongoing and frequent ways to measure student progress towards learning outcomes. Formative assessments give students multiple opportunities to learn through practice and feedback, so they have sufficient time and support to reflect and improve. Formative assessment acts as an informal check-in to determine student progress in achieving learning outcomes. Data and feedback from formative assessments allows teachers to adapt their instructional decisions in a responsive and immediate fashion.
- **Assessment as Learning** actively involves students in monitoring and assessing their own learning. Assessment as Learning develops student's ability to learn effectively and prepares students to be self-directed, reflective, and engaged learners.
- **Assessment of Learning (Summative assessment)** focuses on learner performance after instruction has occurred, such as midterm exams and final projects. Summative assessments allow students to provide evidence demonstrating their level of achievement of the course learning outcomes. Common forms of summative assessment include: student portfolios, projects

that have written and/or oral products, exams, or performance tasks that demonstrate student achievement of the learning outcomes.

The following table compares the three types:

Types of Assessment

Assessment for Learning (Formative Assessment)	**Assessment as Learning**	**Assessment of Learning (Summative Assessment)**
Assess student's progress and learning needs	Assess student's cognition about their learning	Assess what students have learned
Part of course teaching strategies	Part of course teaching strategies	Part of course assessment strategy
Opportunity for students to practice and grow	Opportunity for students to reflect and set goals	Opportunity for students to demonstrate learning
Goal is to improve and inform student learning	Goal is to engage student's in monitoring and assessing their own learning	Goal is to measure student learning
Grade component not required	Grade component not required	Assigned grade required
Educator provides feedback and guidance for improvement	Educator provides feedback and guidance for improvement	Educator provides feedback and guidance for improvement
Examples: journal entries, portfolios, exit slips, practice quizzes, classroom discussions, peer-assessment, self-assessment	***Examples:*** self-assessment, reflective assignments, co-creation of assessment criteria	***Examples:*** exams, projects, research papers, group presentations, podcast

Reflection: One Small Step

Ask yourself the following questions about the assessments in your course:

Assessment for Learning (Formative Assessment):

- Have I offered timely, outcome-related feedback on the assessment?
- Have I provided regular opportunities for students to check their learning progress through non-graded learning activities?
- How can I use information from formative assessments to adjust my future instructions so my students achieve the learning outcomes?

Assessment as Learning:

- Have I provided students with opportunities to reflect and self-assess their progress in the course and also set goals?
- Have I offered learners the opportunity to assess individual learning progress and process, for example, through regular check-ins?
- Have I shared options, strategies, and background knowledge needed to build the necessary skills and expertise for achieving the targeted learning outcomes?

Assessment of Learning (Summative Assessment):

- What kinds of summative assessments am I using to measure my learners' learning outcomes? Are there barriers to **accessibility**?
- What are the summative assessments measuring and how can that data be used to inform my future instructional design?

2.4 Strategies for Engaging Variable Learners in Assessments

Challenge

Do you sometimes find that your students are not engaged or struggle to demonstrate the extent of their learning in your assessments?

- When it comes to engaging students in assessments, it's about 1. *demonstrating relevance*, 2. *providing flexibility and choice*, and 3. *giving supports*. Consider how these strategies could have helped Melanie (Three Assessment Experiences in previous section) successfully reach her learning goals.

(*Assignment excerpts adapted from Liu, 2009*).

1. Demonstrate relevance

Demonstrating the relevance of assessments can help learners transfer usable knowledge and understand the "what," the "how," and the "why" of their learning. Let's consider some excerpts from an Organic Chemistry "Sequenced Writing" assignment:

Chem 101: Organic Chemistry

Everyday, we are exposed to dozens of chemicals through our own personal care regimen. Personal care products, whether mostly synthetic or "all natural," have all been carefully formulated by chemists. As your understanding of organic chemistry grows, your ability to compare products and understand why they work the way they do will increase.

Notice how the educator has made Organic Chemistry relevant by applying it to students' personal care regimens. Again, at the end of the assignment introduction, the educator clearly states the purpose of the assignment.

Chem 101: Organic Chemistry

The purpose of this assignment is for you to apply your understanding of functional groups in organic molecules to everyday life.

Relevance is also demonstrated when assessments are designed so students apply disciplinary learning under authentic, or close to authentic as possible, circumstances.

2. Provide flexibility and choice in ways students demonstrate the learning outcomes

USask Lens:

"I get that there is a need to have some kind of assessment on the knowledge that you've built up throughout the year but I don't think it's necessarily an exam. I would love if there were more options...like take home exams, they can be a great way to show what you've learned or final projects. Diversifying the kind of evaluations that you give students so that is not just tests that comprise their final marks."

-Student testimonials from the Wellness Strategy Report

Offering flexibility and choices in assessment topics, procedures, and timelines helps to engage students and increases inclusivity. Flexible options available in an assessment can enhance access, support learner performance, and reduce possible perceived threats. Most often we see these kinds of choices provided through an "assignment menu." Included below is an example of an assignment menu adapted from Durham College's UDL and Assessment and Evaluation site. Notice how the example includes a wide range of options for students to demonstrate their learning and both also help students to identify which options might suit their particular learning preferences.

- Assignment Menu Example

Providing **multiple means of action and expression** (the how of

learning) means providing different ways for students to work with information and content and to demonstrate what they are learning. Consider which actions are relevant to the learning being measured and where flexibility and choice can be provided in order to gain an accurate picture of what each student has learned.

3. Provide supports

Students will be more engaged in their assessments when they believe they can be successful and when they are provided with the tools they need to achieve the learning outcomes. Create engagement by making the available tangible supports explicit and including them in assignment descriptions and in your syllabus. Let's return to the Organic Chemistry writing assignment for examples of assessment supports.

Chem 101: Organic Chemistry

Suggested Resources:

A good place to start your search is SciFinder

- Log in and click on "explore substances"; then click on "substance" from the menu on the left and search the name of your compound
- If that fails, you can "Google" your compound. However, keep in mind that the web can contain faulty information. Verify the information by checking multiple sources.
- As you conduct these searches, keep in mind that Part II of this assignment asks you to

summarize information on one of your listed compounds. It may be a good idea to keep track of some of the resources you come across during these initial searches.

***USask Supports for Students*:** Writing Help

Supports can include resources as well as tips for using the resources strategically to accomplish the goals of the assignment.

Another type of support is providing samples of required assignment elements. Embedded in this assignment description are instructions for writing an annotated bibliography and example entries:

Chem 101: Organic Chemistry

What is an annotated bibliography?

http://owl.english.purdue.edu/owl/resource/614/01/

An example of an annotated bibliography (in CSE style):

Liu JM, Livny J, Lawrence MS, Kimball MD, Waldor MK, Camilli A. 2009. Experimental discovery of sRNAs in *Vibrio cholerae* by direct cloning, 5S/tRNA-depletion

and parallel sequencing Nucleic Acids REsearch 37: e46-

In this research paper, the authors from Tufts University present a new method for identifying small RNAs (sRNAs) in bacteria. The method is extremely high throughout and provides some exciting results. For example, the authors suggest that there are 1000s of sRNAs in a typical bacterial transcriptome. Additionally, the authors characterize one new SRNA in *Vibrio cholerae*, and show that this sRNA may be a repressor of the gene *mtl*A, which is involved in mannitol-metabolism. This will be a great paper to include in the "identification" section of my paper on non-coding RNAs in bacteria.

Reflection: One Small Step

Identify an assessment in which students have been well engaged.

- Did you demonstrate relevance, provide flexibility and choice, or offer supports in your assessment?

Now think of an assessment in which students were less engaged.

- What UDL strategies could you employ to support

better engagement?

- Is it possible to include flexibility and choice in how your assessment is represented, how can your learners show what they know, or how can your learners engage in the assessment process?
- How do the flexible options still support the intended learning outcome(s) that need to be measured?

2.5 Create Accessible Assessments

Challange

Do you sometimes wish that you could create an assessment that was inclusive for all learners?

If your **assessment plan** includes print-based exams or assignments, you'll want to ensure these do not pose barriers for any students and that you represent assessment instructions and content in a variety of ways.

Consider how Kasha's assessment experience (Three Assessment Experiences) would have improved had her exam been formatted for access with speech-to-text software.

Accessibility Guidelines for Assessments

1. Assessment context is consistent with learning context

Kasha was able to use her screen-reading software to access online readings, LMS notes and study guides, but she did not have effective access to the exam.

Other factors to consider when making assessment and learning contexts consistent are the allowable supports such as calculators, formula sheets, notes, and online resources. If students learned a concept through tactile means, they should be given the opportunity to demonstrate their learning in the same way. If students worked together in groups on learning activities, consider group assessments.

- What role does time play in the learning activities and assessments?
- If completing exam questions in a certain amount of time is construct relevant, do students have opportunities to practice with the same time pressures?

2. Items are amenable to accommodations

The most common accommodation request for print-based exams is for access with screen-reading or text-to-speech tools. And, while there may be additional software-specific requirements for accessibility, the following sites are excellent resources to consult:

- Optimizing text for learning
- Guidelines for accessible information
- National Centre on Accessible Educational Materials: Audio-supported reading
- Inclusive Learning Design Handbook: Accessible standardized testing

3. Simple, clear, and intuitive directions

When writing assessment directions, consider diverse backgrounds,

language skills and concentration levels. Again, by maintaining consistency between the assessment and learning contexts—learners should already have some familiarity with similar instructions from their learning activities, including formative assessments and practice tests. Within the assessment itself, it's helpful to provide sample items, practice questions and scoring criteria. And make sure to sequence instruction steps in the exact order of occurrence.

4. Comprehensible language

- Use simple, clear, commonly used words, eliminating any unnecessary words
- When technical terms must be used, be sure they are clearly defined
- Break compound complex sentences down into several short sentences, stating the most important idea first
- Introduce one idea, fact, or process at a time; then develop the ideas logically
- Make all pronoun relationships clear
- When time and setting are important to the sentence, place them at the beginning of the sentence
- If processes are being described in the question stem, make sure they are simply illustrated, labelled, and placed close to the text they support

5. Maximum legibility

- Avoid grey scale and shading, particularly where pertinent information is provided
- To increase the readability for a wider range of persons,

increase font size to 14-point
- Make sure type size for captions, footnotes, keys and legends is at least 12 point
- Use standard typeface or boldface as opposed to all caps or italics
- Avoid font styles that are decorative or cursive

Guidelines adapted from Ofiesh, Rojas & Ward; 2006, p. 177.

Reflection: 1 Small Step

What is one thing you can adapt in your assessments that would make them more accessible for all learners?

2.6 Design Rubrics with Transparent Criteria

Challenge

Do you find sometimes your assessments are measuring unintended skills and outcomes?

Rubrics are effective tools in making the **learning outcomes** and expectations of an assignment explicit. They clarify what is expected and can even include room for students to add goals they have for a given assignment. Clarifying expectations through a rubric allows for consistent measurement of the intended learning outcome.

Allowing students flexibility in the ways they demonstrate their learning is key to developing strategic, goal-directed learners. Referring back to Kevin's positive assessment experience (Three Assessment Experiences), critical to his success was his ability to choose a learning product (podcast interview) in keeping with his preferred mode of expression (verbal). This flexibility stemmed from a learning outcome which was intentionally separated from the means of achieving the outcome. One of the challenges in providing this kind of flexibility is the grading of diverse assessment products. You may be asking yourself, "How do I apply consistent grading to a podcast, presentation, essay, and website?"

The answer lies in stripping away all of the frills or *ways* of demonstrating learning. In Kevin's case, the construct included a

knowledge outcome (understanding how government policy interacts with Canadian cultural industries) and a skill outcome (conducting an analysis). The next step is to create a rubric based on these two main outcomes. Here's an example rubric for Kevin's assignment:

- Universally Designed Rubric Example

Creating Rubrics for Universally-Designed Assessments

- **Step 1: Look at samples.** Show students examples of "good" and "developing" work. Identify the characteristics that make the good ones good and the developing ones incomplete.
- **Step 2: List criteria.** Use the discussion of models to begin a list of what counts in quality work.
- **Step 3: Articulate gradations of quality (not frequency).** Describe the best and worst levels of quality; then fill in the middle levels based on your knowledge of common problems and the discussion of developing work.
- **Step 4: Practice on samples.** Have students use the rubrics to evaluate the samples you gave them in Step 1.
- **Step 5: Use self and peer assessment.** Give students their task. As they work, stop them occasionally for self- and peer-assessment.
- **Step 6: Revise.** Always give students time to revise their work based on the feedback they get in Step 5.

Source: *UDL: Supporting diversity in BC schools*

Reflection: One Small Step

Ask yourself:

- What are the skills or understandings this assessment is intended to measure?
- Have components that are not tied to learning outcomes been removed from my rubric?
- Are there opportunities for choice within the rubric to engage learners in the assignment?

CHAPTER 3: UDL & BEST PRACTICES FOR TECHNOLOGY-ENABLED LEARNING

3.1 Introduction to Web Accessibility for Technology-Enabled Learning

Ensuring your course content is **accessible** helps reduce barriers to comprehension, helping all students engage with a course regardless of any differences in ability. A course will reach a wider audience when its content is made accessible. Even when there are no students with identified academic accommodations in a class, accessible course content can be reviewed in a variety of ways, while inaccessible content offers limited forms of engagement. This chapter will help ensure your course is accessible to students with access needs, including those with impairments to vision, hearing, physical coordination, and cognition, as well as those whose native language is not English.

If you're wondering where to start in developing content that meets UDL standards, consider reviewing the following checklist. Completing this checklist will highlight the sections in this chapter that best meet your needs.

- UDL Checklist – Technology-Enabled Teaching

Benefits of accessible course content:

- Offers the widest range of learners the opportunity to succeed
- Makes large amounts of information easier to navigate
- Ensures information is clear and unambiguous

When developing an accessible course, this chapter will help you to:

- Write information with proper headings, fonts, and hyperlinks
- Structure content with tables and lists
- Use accessible colour and contrast
- Offer formulas and mathematical expressions for all learners
- Create documents and files that meet accessibility needs
- Design multimedia content for those with visual impairments
- Follow a basic checklist for accessibility

USask Lens:

The 8 Learning Technology Ecosystem (LTE) Principles are research-supported characteristics of effective digital learning spaces that prepare students for work and life, and they are aligned to the USask Learning Charter. The first of these states that learning must be **Accessible**. This means that *learning must be found easily at any time, and all learners and teachers have equitable access, regardless of culture, language, ability, etc.*

More information on the LTE Principles and supports specific to the various edtech tools available at USask can be found on the Learning Technology Ecosystem Toolkit.

The following short video from CAST offers an explanation of how accessibility relates to UDL.

One or more interactive elements has been excluded from this version of the text. You can view them online here: https://openpress.usask.ca/universaldesignforlearning/?p=75#oembed-1

Learning Outcomes

By the end of this chapter, you should be able to:

1. Use resources and tools to support the design of accessible course content
2. Write course content that meets basic accessibility needs
3. Design multimedia and layouts that meet basic accessibility needs
4. Assess the accessibility of a variety of digital content

3.2 Headings, Fonts, and Hyperlinks

Challenge

Do you use headings, fonts, and hyperlinks mainly to fit your own writing style and preferences, or do you use them in a way that supports student learning?

When writing course content, it's important to make proper use of **headings**, **fonts**, and **hyperlinks** to ensure your writing is clear to students.

Headings

Structure written content with appropriate use of headings. Organizing your writing with proper headings supports students with cognitive and vision impairments, making course content easier to navigate and clarifying how various concepts are related.

Use the h1-h6 heading hierarchy. Documents and web pages are organized with headings that are ranked 1-6, titled "heading 1" (h1) through "heading 6" (h6), with h1 being most important, and h6 being least important. Always follow a consecutive hierarchy when using headings. For example, where h1 is used as a page title, h2 can be considered a section heading, with h3 as a subheading, h4 as a detailed subheading, etc.

Avoid using bold or italicized text in place of a proper heading. A common heading mistake is to simply bold, italicize, or capitalize regular text, with the hope that this will serve as a heading. While someone without a visual impairment may understand your intentions, a student with a screen reader won't see the difference. Screen readers rely on proper headings, with h1-h6 tags, to convey the structure of course content.

Examples of incorrect and correct use of headings

Incorrect	Correct
[h1] Sections of a Grocery Store [h1] Breakfast Aisle **Hot cereals** **Cold cereals** [h1] Bread Aisle **Loaves** **Rolls** [h1] Dairy Aisle **Milk** **Butter** **Cheese**	[h1] Sections of a Grocery Store [h2] Breakfast Aisle [h3] Hot cereals [h3] Cold cereals [h2] Bread Aisle [h3] Loaves [h3] Rolls [h2] Dairy Aisle [h3] Milk [h3] Butter [h3] Cheese

Fonts

Selecting a font can be an easy way to express your style and set a tone for your writing. Although you may be interested in picking the most unique and interesting font available, some fonts are simply more accessible than others.

There are a variety of factors affecting the readability of fonts, but

a few general guidelines will help ensure your content is readable for all students.

Avoid using small fonts. In documents and webpages, use around 12-point font for typical body text and for any footnotes or endnotes, use a 9-point font. If you're delivering a presentation, aim for 18-point font or larger for the body text of your slides.

Use simple, familiar fonts. While there is no consensus on which fonts are most readable, stick to fonts that are familiar and simple, avoiding more stylized or decorative fonts that may be unfamiliar and require more concentration to parse. If you're unsure what font to use, try one of the following (Pennsylvania State University, n.d.):

- Arial
- Calibri
- Cambria
- Garamond
- Georgia
- Helvetica
- Lucida Sans/Lucida Grande
- Palatino/Palatino Linotype/Book Antiqua
- Tahoma
- Times New Roman
- Verdana

Underline only linked text. While handwritten and printed writing might use underlines more freely, digital content typically only uses underline for links. If you underline text that is not a link, it may confuse students and make them think it's a link. When you need to emphasize something, use **bold** or *italics* instead of underlining.

Web Resources

If you're unsure about a font in your writing, review WebAIM: Typefaces and Fonts to evaluate the font's readability based on various key principles.

Hyperlinks

Hyperlinks are generally comprised of two components for their users: the target URL, where users will be directed to after clicking a hyperlink; and the anchor text, which is the visible text of a link. Here's an example:

- USask Homepage
    - Target URL: https://www.usask.ca/
    - Anchor text: USask Homepage

Generally, the anchor text of a hyperlink described the purpose or use the title of the link's destination, as this will clearly inform students of the link's purpose.

Ensure link text makes sense out of context. Avoid anchor text that uses non-informative phrases, like "Click here" or "Read more." While contextual clues may help most students decipher the destination of "Click here," a screen reader won't often convey that same context, and students with visual impairments will be left wondering where the link goes.

Avoid using URLs as anchor text. Once again, make anchor text informative,while also respecting the patience of those using screen readers. If using a link's URL as its anchor text, the URL will simply be read, character by character, for those using a screen reader. For some links, this can take a very long time!

Examples of incorrect and correct use of anchor text

Incorrect	Correct
Want to learn more about how to print on campus? Click here.	Want to learn more about how to print on campus? Visit Printing at the University of Saskatchewan libraries.
The university's privacy policy can be found here: https://policies.usask.ca/policies/operations-and-general-administration/freedom-of-information.php	The university's privacy policy can be found here: Freedom of Information and Protection of Privacy at University of Saskatchewan

Reflection: 1 Small Step

Is there somewhere I can separate means from ends in my **learning outcomes** to remove barriers and create a more valid assessment of course priorities?

3.3 Tables and Lists

Challenge

Do you look for ways to make your course content easier for students to process? Your current practice may improve the experience for some, but can you make it digestible for every student in your class?

While course content can take many forms, tables and lists can make it easier for students to scan and digest content in discrete segments. However, unlike basic paragraphs of text, tables and lists require more careful planning and design to ensure their accessibility.

Tables

Tables are a great way to organize complex information, making content more readable and helping readers to assess trends and relationships in data. There are key steps to making a table accessible to students, but it's important to know how a screen reader reads a table.

The columns and rows of a table can be easily scanned by students without visual impairments. The purpose of a table and its rows and columns is often conveyed via headers at the top and/or side. If one is unsure how a cell relates to the rest of the data,

they can typically return to the table headers to help understand the content.

However, for students using screen readers, it's not as easy to scan a table quickly to understand it, as the screen reader simply moves through the table, cell by cell, to convey the information. For this reason, it's important to build tables with accessible features.

Create table captions. A table caption essentially acts as a label, making tables easier for screen readers to find and conveying the purpose and content of a table for all users.

To add a caption to your table, follow these steps:

- Microsoft Word documents
    1. Click your table
    2. Click the "References" tab on the ribbon
    3. Click "Insert Caption"
    4. Add a descriptive title in the "Caption" field
    5. Click "OK"

- Canvas pages
    1. Click your table
    2. Click the "Table Properties" button
    3. Click the checkbox labelled "Show caption"
    4. Click "Save"
    5. Add a descriptive title in the space that now appears above your table

Tag headers. Use headers for every table, and tag them properly, or they won't be conveyed as actual headers by screen readers. Instead, the headers will be treated like any other cell in the table.

To properly tag your headers, follow these steps:

- Microsoft Word documents
    1. Click your table
    2. Click the "Table Design" tab on the ribbon

3. If your headers are at the top of the table, check the box for “Header Row”
4. If your headers are at the side of the table, check the box for “First Column” or “Last Column”, depending on the location of your headers

- Canvas pages
    1. Highlight cells that include headers
    2. Click the “Table” button
    3. Hover over “Cell”, and then click “Cell properties”
    4. Click the dropdown beneath “Cell type” and select “Header cell”
    5. Click the dropdown under “Scope”
        a. If your headers are at the top of the table, select “Column”
        b. If your headers are at the side of the table, select “Row”
    6. Click “Save”

Keep tables simple. Follow the list below to ensure your table is as simple as possible, making it accessible to screen readers and easier for all students to process:

- Includes a table caption
- Includes a maximum of one row of headers and/or one column of headers
- Does not use merged or split cells

Web Resources

Wondering what it sounds like when screen readers process tables? Check out a demonstration here: How screen readers navigate data tables – YouTube

Lists

When creating accessible content, lists are a great alternative to tables because they are easier for all learners to navigate. However, like tables, lists must be created properly to be accessible. When screen readers encounter a proper list, they will announce the list's presence and indicate how many items are included before reading each item, one-by-one. There are just a few key steps to creating accessible lists.

Use the proper list type. If the ordering of list items doesn't matter, use an unordered/bulleted list. If your list has a defined order, use an ordered/numbered list.

Do not simply type bullets or numbers in place of a proper list. Both Microsoft Word and Canvas have built-in tools to help build your lists:

- Microsoft Word documents
    1. Click the "Home" tab on the ribbon
    2. In the "Paragraph" section, click "Bullets" for an unordered list or "Numbering" for an ordered list
        - NOTE 1: If you start your list by typing bullets or numbers, instead of using the buttons in the "Paragraph" section, Word may automatically format your list for you; however, Word won't always format lists automatically, such as when copying and pasting

lists from another source.

- NOTE 2: To confirm your list is built properly, simply highlight it and check if either the “Bullets” or “Numbering” button are highlighted in the “Paragraph” section of Word.

- Canvas pages
  1. Click the chevron-down icon beside the “Ordered and Unordered Lists” button (see Figure 3-1 below)

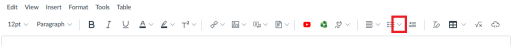


Figure 3-1

  2. Select the appropriate type and symbol
     - NOTE 1: If you start your list by typing bullets or numbers, instead of using the buttons in the “Paragraph” section, Canvas will not automatically format your list for you; use the appropriate buttons to create lists
     - Note 2: To confirm your list is built properly, simply highlight it and check if the “Ordered and Unordered Lists” button is highlighted

Reflection: One Small Step

How can you convert an existing table or list into something more accessible for your students? Can you tweak them to ensure they are built and labeled properly,

or edit a complex table to create simpler to read table or list?

3.4 Colour and Contrast

Challenge

Are your course designs strictly monochrome, or do you like to use colour? How can you use colour in a way that supports all learners?

Using colour is an easy way to add visual interest to course content. By following a few steps, it's easy to ensure colour is used in a way that won't exclude any students from engaging with colourful courses.

Both colour and colour contrast are important to consider because not all students process colour in the same way. Students with colour blindness won't process colour the same way as others, and students with vision impairments require text that is clear and legible if they do not use screen readers.

Here are a few ways to improve your use of colour:

Don't use colour, alone, to convey concepts. Not everyone sees colour the same way, and screen readers won't convey colour at all, so students might miss key information if it's conveyed only via colour.

Don't let this discourage the use of colour on a page. Instead, ensure any concepts are also conveyed in another visual way.

Examples of incorrect and correct use of colour to convey concepts

Incorrect	Correct
Key terms to study for the exam will be conveyed in red, like so: "The agora is worth exploring as a prototype for modern public spaces."	Key terms to study for the exam will be conveyed in red, followed by (!), like so: "The agora (!) is worth exploring as a prototype for modern public spaces."

Ensure link colour is distinct from surrounding text colour. Links should be clearly distinguishable from their surrounding text, not only through underlining, but also via colour. By default, links in Microsoft Word become blue and links in USask's instance of Canvas become green. When writing documents or webpages, avoid using these same blues or greens for regular text.

Use a contrast of 7:1 for text and background colours. A variety of colour combinations are available when writing your course content, however only a limited number are truly accessible. While you may have no issue reading your colourful text, it may lack the necessary contrast against its background to be legible for students who have vision impairments.

Text may be readable for those with a screen reader, however, it's important to note that not all students with vision impairments will use a screen reader.

Web Resources

The WebAIM Contrast Checker will allow you to input the

hex codes for two colours (text and background) to ensure there is sufficient contrast between them.

Wondering how to get the hex codes for your colours? Try these steps:

- Microsoft Word documents
    1. Highlight the word(s) that you want to investigate
    2. Click the "Home" tab on the ribbon
        - Font colour: Under the "Font" section, click the down chevron icon beside "Font Color"
        - Background colour: Under the "Paragraph" section, click the down chevron icon beside "Shading"
    3. Click "More colors..."
    4. Click the "Custom" tab
    5. Copy the # and the numbers/letters in the "Hex" field
- Canvas pages
    1. Click </> to access the html editor
    2. Press CONTROL+F on Windows or COMMAND+F on Mac
    3. Type in the first few words of the text that you want to investigate
    4. On the same line as the words you're investigating, look for "color: #..."
    5. Copy the # and the numbers/letters that follow

Reflection: One Small Step

Skim your course for a single element with colour. Check if the colour is accessible based on the recommendations above.

3.5 Formulas and Mathematical Expressions

Challenge

Does your course use formulas and mathematical expressions? How are they conveyed to students?

Formulas and mathematical expressions are essential in any quantitative course, and every one of them must be constructed in a way that is accessible. Creating images alone, is not sufficient for students with vision impairments. Consider the image below:

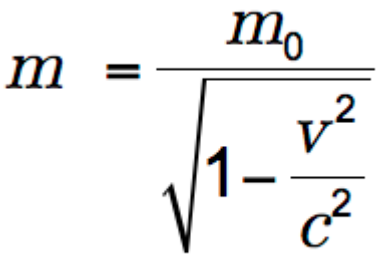


Figure 3-2: Open UBC, 2021.

This image is not accessible because screen readers are unable to read it. Some students require a black background with white text. Contrast tools can convert actual text and backgrounds to meet this

requirement, however they often cannot convert pictures of text in this same way. Similarly, images of text are not easily scaled larger, compared to true text. Thankfully, there are a few ways to make formulas and mathematical expressions accessible.

Build equations using the Canvas Math Equation tool. Canvas has a built-in tool to create complex equations using text entry. The tool will allow you to display equations properly, while also ensuring they can be scaled and read aloud by screen readers.

Web Resources

To learn the essentials of the Canvas Math Equation tool, please review How do I use the Math Editor in the Rich Content Editor as an instructor?

If you prefer to write your mathematical expressions using LaTeX, see the following blog post from the USask Distance Education Unit for more information on how to do this in the Canvas LMS: Writing Mathematical Expressions in Canvas Using LaTeX

Write alt text for images of equations. If you are not using the Math Equation tool, you might write alt text (or alternative text) that describes the equation in the image. See the chapter titled Images and Alt Text to learn about alt text and general best practices around offering it.

If you're unsure what to write for equation alt text, here is an example for the image above:

> "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" (Open UBC, 2021)

Record audio files reading equations. Students may find it helpful to have an audio file of the equation being read aloud.

You can either upload a recording, or you can record audio directly in Canvas. Simply click "Record/Upload Media" when you're editing a page (see Figure 3-3 below). If you have an audio file, just drag it into the window. If you don't have a recording yet, click "Record", followed by "Webcam", and then "No Video" to create an audio-only file.

Figure 3-3

If you're unsure what to record for your audio file, listen to the audio file for the equation above (Open UBC, 2021).

Reflection: One Small Step

If you're moving beyond basic images of equations, consider adding alt text or audio files to describe them. If you're already using alt text or audio files, give the Math Equation tool a try!

3.6 Images and Alt Text

Challenge

Reflect on your use of images in course content. Will they convey meaningful information for all students, or will students with visual impairments miss the benefit of them?

Including relevant images in course content is a great way to improve student engagement. Selecting images that support your content can help convey new meanings about course concepts and make them more relevant to learners. However, despite their benefits, images can be quite ambiguous or even invisible for students with visual impairments.

Most images require **alt text** (short for "alternative text") to be made accessible. Alt text serves as a description of an image for students with visual impairments. If your image didn't load, what would you write in its place?

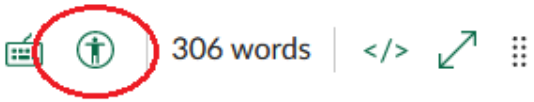
To write alt text in your documents and Canvas pages, follow these steps:

- Microsoft Word documents
    1. Right-click the image
    2. Click "Edit Alt Text"
    3. If the image does not require alt text, click the checkbox beside "Mark as decorative"; otherwise, add your description in the "Alt Text" pane to the right (if this field contains auto-generated text, be sure to delete it)
    4. Close the Alt Text pane

- Canvas pages
    1. While in the page editor, click the image
    2. Click “Image Options”
    3. If the image does not require alt text, click the checkbox beside “Decorative Image”; otherwise, add your description in the “Alt Text” field
    4. Click “Done”

When editing Canvas pages, you can easily find images that may need alt text using the Accessibility Checker (see image below). This tool will highlight every image on a page that should either include descriptive alt text or should be marked as decorative, as well as indicate other helpful revisions to improve accessibility.

Figure 3-4



Web Resources

While most images require alt text, it’s important to note that not all require it. Some images may simply be decorative. To help determine if an image needs alt text, review An alt Decision Tree.

Consider the following when writing your alt text to ensure it is helpful and conveys meaning.

Leave out unnecessary information. For example, alt text doesn’t need to include “Picture of…”. Screen readers will convey that it’s

a picture. Focus on the content of the image and how it supports student learning.

Avoid redundancy. Do not include information that appears elsewhere on the page. Screen readers will pick up all text content, so repetition may simply distract, if not annoy, a student using a screen reader.

Keep alt text concise, when possible. Aim for one or two sentences, at most. Lengthy alt text can disrupt the flow of reading for students with screen readers. If your alt text needs to be longer than two sentences, follow the recommendation below.

When images are too complex for concise alt text, include your description elsewhere. Some images are too complex to describe in two sentences. In these cases, do not use the "Alt Text" field. Instead, write your description either in text that is adjacent to the image (e.g., in nearby body text, in a caption, etc.) or use a separate linked page to write the description.

Reflection: One Small Step

Find an important image in your course. It might be a graph or a historical photo. Imagine that photo disappeared. Try to write a brief, clear description that might replace the image. Add the description as proper alt text.

3.7 Multimedia (Audio & Video)

Challenge

How do you integrate multimedia content in your course? Do you take advantage of current technology to make it as accessible as possible?

For a variety of disciplines, multimedia content can be a great way to help convey ideas to students. Multimedia may also appeal to individual learning preferences. Although multimedia content is a common course component, it is not as accessible as ordinary text-based content, due to restraints for students with visual and hearing impairments, students who are not native English speakers, and students with internet bandwidth constraints.

Two approaches stand out for making audio and video content more accessible.

Create accurate captions for multimedia content. Timed text captions are essential to conveying spoken words and sounds in videos that include audio. Students with hearing impairments and those whose native language is not English will greatly benefit from captioned video.

USask's video platform, Panopto, automates the process of caption creation. Follow these steps to generate captions:

1. Sign into Panopto
2. Open "My Folder" to access your videos

3. Hover your mouse over a video and click "Edit"
4. After your video loads, click "Captions" on the left
5. Click "Import captions"
6. Click "Import automatic captions"
    - NOTE: If this option does not appear, you may need to wait; it can take up to 24 hours after a video is uploaded for captions to generate
7. Review the captions for errors (e.g., punctuation, capitalization, word detection) and click to edit, where necessary
8. Click the green "Apply" button in the top right

Live captions can also be offered during Zoom meetings. While Zoom calls the feature "Live Transcript", the function acts the same as captioning, converting speech into on-screen text. Here's how to enable captions in your Zoom meetings:

1. Click "More" at the bottom of the Zoom window

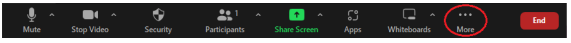


Figure 3-5

2. Click "Live Transcript"
3. Click "Enable Auto-Transcription"

Create detailed transcripts for multimedia content. Similar to captions, transcripts convey the spoken words and sounds found in audio, although a transcript includes all audio content written out in paragraphs, rather than timed to a video. Transcripts can be offered for either video content with audio, or for audio-only content (e.g., podcasts).

Any captions generated by Panopto can be downloaded, edited, and distributed as a transcript. Follow these steps to download your captions file:

1. Sign into Panopto
2. Open “My Folder” to access videos you have already uploaded
3. Hover your mouse over a video
4. Click “Settings”
5. Click “Captions”
6. Click the language of your captions, under “Available Captions”
7. Click “Download file”

When sharing a transcript for multimedia content, include additional detail to make it easier to read, such as headings to break up the content.

Web Resources

To help clean up Panopto caption exports and use them as transcripts, try editing them using Notepad++. Follow these steps to strip all timecodes from your transcripts:

1. Open the file with Notepad++
2. Press CTRL+Home (or COMMAND+Home on Mac) to put your cursor at the start of the file
3. Press CTRL+H (or COMMAND+H on Mac) to open the “Replace” window
4. Copy and paste the following text into the “Find what” field: ^\R?(\d+)\R\d\d:\d\d.+\R
5. Leave the “Replace with” field blank
6. Check “Match case” and “Regular expression,” only
7. Click “Replace All”

For more on creating captions and transcripts using tools built into Panopto, see also the following blog post from the

USask Distance Education Unit: Improve Your Video Content with Captions and Transcripts.

For more information and USask-specific supports for using Panopto, see the Learning Technologies Ecosystem (LTE) website.

Reflection: One Small Step

Find a recorded lecture in Panopto and import the automatic captions. Skim the captions for major errors and apply your changes.

Glossary of Key Terms

Accessibility: Providing equal opportunity for learners to acquire information, engage in activities and interactions, demonstrate understanding, and enjoy the same services through proactive design approaches. This can also encompass practices of web accessibility, which is the inclusive practice of ensuring there are no barriers that prevent interaction with, or access to, websites on the World Wide Web (as examples, by people with physical disabilities, situational disabilities, and socio-economic restrictions on bandwidth and speed).

Alt text: The HTML attribute (alt=" ") used in HTML documents to specify alternative text that is to be rendered when the element to which it is applied cannot be rendered. It is used by "screen reader" software so that a person who is listening to the content of a webpage (for instance, a person who is blind) can interact with this element.

Assessment for Learning (Formative assessment): Assessments that provides ongoing and frequent ways to measure student progress towards learning outcomes. They give students multiple opportunities to learn through practice and feedback, so they have sufficient time and support to reflect and improve, and act as an informal (i.e., ungraded) check-in to determine student progress in achieving learning outcomes. Data and feedback allows teachers to adapt their instructional decisions in a responsive and immediate fashion.

Assessment as Learning: Assessments that actively involve students in monitoring and assessing their own learning. They help to develop student's ability to learn effectively and prepares students to be self-directed, reflective, and engaged learners.

Assessment of Learning (Summative assessment): Assessments that focus on learner performance after instruction has occurred, to allow students to provide evidence demonstrating their level

of achievement of the course learning outcomes. Typically such assessments are formal (i.e., graded). Common forms include: student portfolios, projects that have written and/or oral products, midterm and final exams, or performance tasks that demonstrate student achievement of the learning outcomes.

Assessment Plan: A document that outlines and aligns learning outcomes with course assessments and includes descriptions of the assessment methods and tools.

Learning outcome: A statement of what we want students to learn to do. Effective learning outcomes typically include an observable action-based verb, reference the content, and describe the criteria that will be used to evaluate student performance. The criteria describes the level of proficiency learners will need to demonstrate by providing information on things like quality, quantity, or time measurements.

Inclusive: Ensuring access to quality education for all learners by effectively meeting their diverse needs in a way that is responsive, accepting, respectful, and supportive.

HTML: HyperText Markup Language; the standard markup language for content designed to be displayed in a web browser, ensuring that the content displays various effects (such as font, color, graphics, hyperlinks, etc.) in specific desired ways.

Affective neural network: Network of cognition responsible for emotion and affect, located at the medial regions of the brain (e.g., extended limbic system). These networks represent the 'why' of learning (i.e., responsible for evaluating the significance or importance of the information being perceived).

Font: A set of text characters in a certain style and size that may be printed or displayed digitally.

Heading: Text that is larger and more distinct than regular paragraph text, used to convey the organization of content.

Hyperlink: Also known as a link, a hyperlink directs users to a different portion of a document or page, or an entirely different document or page, once clicked or tapped by users.

Multiple means of engagement: One of the three principles of

UDL, it aims to connect with learners' interests, supporting self-reflection of learning, fostering collaboration and varying levels of challenge (e.g., open class discussion, question and answer period, applied problem-solving, goal-setting). Also referred to as the "why" of learning.

Multiple means of representation: One of the three principles of UDL, it aims to provide learners with multiple ways to engage and comprehend information and experiences (e.g., video, audio, graphics, symbols, tactile objects). Also referred to as the "what" of learning.

Multiple means of action and expression: One of the three principles of UDL, it aims to provide learners with alternative methods of demonstrating what they comprehend and different ways of managing information (e.g., assignments, multimedia presentations, concept maps). Also referred to as the "how" of learning.

Recognition neural network: Network of cognition situated at the posterior half of the brain's cortex and can be described as the 'what' of learning (i.e., responsible for recognition and perception of information).

Strategic neural network: Network of cognition situated in the anterior regions of the brain's cortex (e.g., frontal lobes), these networks represent the 'how' of learning' (i.e., responsible for planning, organizing, and execution).

Three principles of UDL: Principles that inform accessible pedagogy and establish a framework for course planning and learning experiences. They are: 1. Multiple means of engagement, 2. Multiple means of representation, 3. Multiple means of action and expression.

Universal Design for Learning (UDL): A framework that guides the design of courses and learning environments to appeal to the largest number of learners.

Appendix of Downloadable Resources

Downloadable resources from this book:

- UDL Checklist – How Do You Teach
- UDL Case Study Worksheet – Humanities
- UDL Case Study Worksheet – STEM
- UDL Case Study Worksheet – Choose Your Own
- Universally Designed Rubric Example
- UDL Checklist – Technology-Enabled Teaching

References

Al-Azawei, A., Serenelli, F., & Lundqvist, K. (2016). Universal design for learning (UDL): A content analysis of peer-reviewed journal papers from 2012 to 2015. *Journal of the Scholarship of Teaching and Learning*, 16(3), 39-56.

Ambrose, S. A., Bridges, M. W., DiPietro, M., Lovett, M. C., & Norman, M. K. (2010). *How learning works: Seven research-based principles for smart teaching*. John Wiley & Sons.

Black, R. D., Weinberg, L. A., & Brodwin, M. G. (2015). Universal design for learning and instruction: Perspectives of students with disabilities in higher education. *Exceptionality Education International*, 25(2), 1-16.

Burgstahler, S. (2009). *Universal design of instruction (UDI): Definition, principles, guidelines, and examples*. DO-IT.

Buzzard, C., Crittenden, V. L., Crittenden, W. F., & McCarty, P. (2011). The use of digital technologies in the classroom: A teaching and learning perspective. *Journal of Marketing Education*, 33(2), 131-139.

CAST. (2018). *UDL and Assessment*. Retrieved from http://udloncampus.cast.org/page/assessment_udl

CAST. (2018). *Universal Design for Learning Guidelines version 2.2*. Retrieved from http://udlguidelines.cast.org

Chickering, A. W., & Gamson, Z. F. (1987). Seven principles for good practice in undergraduate education. *AAHE Bulletin*, 3-7.

Colorado State University ACCESS Project (n.d.). Various UDL resources, including the "How do you teach?" checklist. Retrieved from http://accessproject.colostate.edu/documents/; see also https://www.theudlproject.com/uploads/8/8/1/9/8819970/udl_quick_tips.pdf, https://durhamcollege.ca/cafe/wp-content/uploads/sites/5/2019/07/accessproject.colostate.edu_udl_documents_how_do_you_teach_checklist.pdf

Davies, P. L., Schelly, C. L., & Spooner, C. L. (2013). Measuring the effectiveness of universal design for learning intervention in postsecondary education. *Journal of Postsecondary Education and Disability*, *26*(3), 195.

Dean, T., Lee-Post, A., & Hapke, H. (2017). Universal design for learning in teaching large lecture classes. *Journal of Marketing Education*, *39*(1), 5-16.

eCampusAlberta (2016). *Universal Design for Learning in Online Education* (course). CC BY. Retrieved January 4, 2022.

Font Face (n.d.). Pennsylvania State University. Retrieved from https://accessibility.psu.edu/legibility/fontface/

Herring, T., Morrison, A., Young, K., Kleinfeld, E., & MacDonald, L. (2017). Take a SIP of this: Peer-to-peer promotion of strong instructional practice. *International Journal of Teaching and Learning in Higher Education*, *29*(3), 571-579.

Higbee, J. L., & Goff, E. (2008). Pedagogy and Student Services for Institutional Transformation: Implementing Universal Design in Higher Education. *Center for Research on Developmental Education and Urban Literacy*.

Immordino-Yang, M. H. (2016). *Emotions, learning, and the brain: Exploring the educational implications of affective neuroscience* (First ed.). New York: W. W. Norton & Company, Inc.

Institute for Human Centered Design. (2016). History of Universal Design. Retrieved from https://humancentereddesign.org/universal-design/history-universal-design

Ketler-Geller, L.R.,& Johnstone, C. (2006). Accommodations and universal design: Supporting access to assessments in higher education. *Journal of Postsecondary Education and Disability*, 19(2),163-172

Kolb, B., & Whishaw, I. Q. (2015). *Fundamentals of human neuropsychology* (Seventh ed.). New York: Worth Publishers.

Kumar, K. L., & Wideman, M. (2014). Accessible by design: Applying UDL principles in a first year undergraduate course. *Canadian Journal of Higher Education*, *44*(1), 125-147.

Langley-Turnbaugh S. J., Blair, M., & Whitney, J. (2013). Increasing

accessibility of college STEM courses through faculty development in UDL. In S. Burgstahler (Ed.), *Universal design in higher education: Promising practices*. Seattle: DO-IT, University of Washington. Retrieved from www.uw.edu/doit/UDHE-promising-practices/college_stem.html.

Liu, J. M. (2009). *Sequenced Writing Assignment*. Retrieved from https://www.drew.edu/wp-content/uploads/sites/95/orgosequencedwritingassignmentpdf.pdf

Mangiatordi, A., & Serenelli, F. (2013). Universal design for learning: A meta-analytic review of 80 abstracts from peer reviewed journals. *REM*, 5(1), 109-118.

McGuire, J. M., & Scott, S. S. (2006). Universal design for instruction: Extending the universal design paradigm to college instruction. *Journal of Postsecondary Education and Disability*, 19(2), 124- 134.

McGuire, S. Y. (2006). The impact of supplemental instruction on teaching students how to learn. *New Directions for Teaching and Learning*, *2006*(106), 3-10.

Meyer, A., Rose, D. H., & Gordon, D. (2014). *Universal design for learning: Theory and practice*. Wakefield, MA: CAST. Retrieved from http://udltheorypractice.cast.org/home?6

Middendorf, J. & Pace, D. (2004). Decoding the disciplines: A model for helping students learn disciplinary ways of thinking. *New Directions for Teaching and Learning*, *2004*(98), 1-12. Retrieved from http://dx.doi/org.10.1002/tl.142

Miller-Young, J., & Boman, J. (2017). Uncovering ways of thinking, practicing, and being through decoding across disciplines. *New Directions for Teaching and Learning*, *2017*(150), 19-35 Retrieved from http://dx.doi.org/10.1002/tl.20235

National Center on Universal Design for Learning at CAST. (2017). *Universal Design for Learning Guidelines*. Retrieved from http://www.udlcenter.org/aboutudl/udlguidelines_theorypractice

Office of Institutional Analysis. (2018). Fact Book 2016-2017. Calgary: University of Calgary. Retrieved from

https://oia.ucalgary.ca/fact-books/fact-book-20162017#quicksetfield_collection_quicktabs_1

Open UBC. (August 24, 2021). *OER Accessibility Toolkit*. Retrieved from https://open.ubc.ca/oer-accessibility-toolkit/

Pace, D., & Schwartz, D. (2008). Accessibility in post secondary education: Application of UDL to college curriculum. *US-China Education Review*, 5(12), 20.

Pisha, B., & Coyne, P. (2001). Smart from the start. *Remedial and Special Education*, 22(4), 197-203.

Poore-Pariseau, C. (2013). Universal Design in Assessments. In S. Burgstahler (Ed.), Universal design in higher education: Promising practices. Seattle: DO-IT, University of Washington. Retrieved from www.uw.edu/doit/UDHE-promising-practices/ud_assessments.html

Rao, K. (2013). Universal instructional design of online courses: Strategies to support non-traditional learners in postsecondary environments. In S. Burgstahler (Ed.), *Universal design in higher education: promising practices*. Seattle: DO-IT, University of Washington. Retrieved from www.uw.edu/doit/UDHE-promising-practices/uid_online.html

Rao, K., Ok, M. W., & Bryant, B. R. (2014). A review of research on universal design educational models. *Remedial and Special Education*, 35(3), 153-166.

Roberts, K. D., Hye Jin, P., Brown, S., & Cook, B. (2011). Universal design for instruction in postsecondary education: A systematic review of empirically based articles. *Journal of Postsecondary Education & Disability*, 24(1), 5-15.

Rose, D. H. (2001). Universal design for learning: Deriving guiding principles for networks that learn. *Journal of Special Education Technology*, 16(2), 66.

Rose, D. H. (2005). Cognition and learning: Meeting the challenge of individual differences. *SIGACCESS Access. Comput.* (83), 30-36.

Rose, D. H., Harbour, W. S., Johnston, C. S., Daley, S. G., & Abarbanell, L. (2006). Universal design for learning in postsecondary

education: Reflections on principles and their application. *Journal of Postsecondary Education and Disability*, 19(2), 135-151.

Shaw, R. A. (2011). Employing universal design for instruction. *New Directions for Student Services*, 2011(134), 21-33.

Shaw, S. F., Scott, S. S., & McGuire, J. M. (2001). Teaching College Students with Learning Disabilities. *ERIC Digest*.

Silver, P., Bourke, A., & Strehorn, K. (1998). Universal instructional design in higher education: An approach for inclusion. *Equity & Excellence*, 31(2), 47-51.

Smith, F. G. (2012). Analyzing a college course that adheres to the universal design for learning (UDL) framework. *Journal of the Scholarship of Teaching and Learning*, 12(3), 31-61.

Sprague, J., Stuart, D., & Bodary, D. (2015). The Speaker's Handbook. Toronto: Wadsworth Publishing. Tinto, V. (2003). Learning better together: The impact of learning communities on student success. *Higher Education Monograph Series*, 1(8), 1-8.

Topping, K. J. (1996). The effectiveness of peer tutoring in further and higher education: A typology and review of the literature. *Higher Education*, 32(3), 321-345.

University of Guelph. (2016). *The universal instructional design implementation guide*. Retrieved from http://opened.uoguelph.ca/instructor-resources/resources/uid-implimentation-guide-v13.pdf

Zeff, R. (2007). Universal design across the curriculum. *New Directions for Higher Education*, 2007(137), 27-44.