# Designing for Diverse Learners

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Diversity     Universal Design For Learning

Designing educational programs and curricula involves developing understandings of the learner and instructional environment characteristics that could impact learning success. While there may be some commonalities among learners, it is important for designers to recognize that there will likely be a great diversity of learning preferences, abilities, and experiences that learners will bring to a course or other learning experience. Rose (2015) remarked that the notion of an "average" learner is a misnomer, and learner diversity (rather than uniformity) is actually the norm. When learner variability is not addressed in a design, it is inevitable that many learners will experience obstacles to their learning, limiting the effectiveness of the learning experience for them and inducing additional costs in time and resources to make adjustments and accommodations (Brinck, 2005). Planning for learner variability from the outset is therefore a valuable step in the design process that can lead to more robust, accessible, and impactful designs. Being able to plan for diverse learners begins with developing empathetic understandings of the characteristics in which learners will vary. This chapter first describes ways that instructional designers can become familiar with the diverse needs of target learners and then offers recommendations for next steps in implementing inclusive design practices as part of curricular planning.

## Recognizing Learner Needs

Learners vary along many different dimensions, with a learner's profile as "individual as DNA or fingerprints" (Rose & Strangman, 2007, p. 388). In general, people have different preferences and habits for how they approach learning that are worth noting in the design. Some learners may have specific disabilities that can impact how they absorb, process, and express information. Disabilities can affect sensory areas such as vision, hearing, speech, and motor control. They can also be characterized by neurodiversity in that there are distinct differences in an individual's neural networks involved with cognitive processes that impact how learners attend to, organize, and remember information. Learners may have varied needs in their social-emotional tendencies, which can drive how they work in groups, initiate and sustain engagement through the learning process, and create meaningful connections with content. It is also important for designers to recognize learner diversity in linguistic proficiency and cultural backgrounds that can play into how learners bridge their prior knowledge with new learning and the kinds of scaffolds and tools that could enable learning success.

Further, the use of technology as part of instruction and learning can pose challenges to ensuring equal access among learners. Digital educational materials and tools can introduce accessibility and usability issues. For example, some learners may use screen readers or closed captioning to review content; some learners may use voice-command, keyboard navigation, or gestural movements to interact with digital applications. When instructional designs do not

support these varied means of access and interactivity, learners will experience barriers to being able to fully engage and benefit from the instruction.

Educational programs that require the use of specific technology equipment for access of computer-based instruction can be met with barriers to obtaining the equipment in parts of the world that have limited financial resources or under-developed infrastructures. For instance, the International Telecommunications Union (ITU, 2018) reports that just under half of households worldwide have a computer in the home. Similarly, web-based instruction is often dependent on learners having sufficient bandwidth through which to access the materials and activities, and this is not yet available in some areas. In the Americas, for example, about 70% of broadband subscriptions in 2017 reported access 10 Mbit/s or faster (ITU, 2018), which is generally sufficient speed for streaming video and making fast downloads. However, in least developed countries (LDCs, as designated by the United Nations according to their low socioeconomic development and Human Development Index ratings), access to high-speed Internet is not as prevalent. In 2017, 30% of broadband connections were at very slow speeds of less than 2 Mbit/s, which would make content streaming and course material downloads quite difficult. Designers can [simulate slow internet](#) in a variety of ways to understand how this impacts their learners.

Therefore, it is important in instructional design practice to recognize such elements and characteristics of the target learners and learning environments that relate to how learners will access, participate in, and show what they have learned through the instruction. Planning strategically to enable learners to navigate learning pathways that best meet their needs may involve greater investment of designer attention, time, and resources at the front-end. However, accessibility is necessary, and workaround solutions and accommodations are often costly and can have social implications that make them less than equal access for all learners.

Intentional effort in developing empathetic understandings of target learners during initial design phases can support more sustainable implementation of the educational program. This approach is characterized as universal design (UD), or designing for all people. UD "defines ways of thinking about and designing environments and products that work for the greatest number of people possible" (Null, 2014, p. 12). Robert Mace coined the UD term, noting that UD is "a process, rather than an achievement" (Story et al., 1998, p. 2). Applied to education, UD involves designing instruction that will be usable to the greatest extent possible by the target learners. The design should facilitate equitable use, offering equivalent means of access and engagement for learners with diverse abilities, and flexible use, providing options that accommodate varied learning preferences and abilities (Story et al., 1998). Thus, designing for diverse learners yields great benefits. Harris (2018) provides an example from nursing education, "Implementing UD concepts in nursing classrooms which support equity and inclusion of students with diverse learning needs is a practical and sustainable alternative to granting reasonable adjustments to students on a case-by-case basis" (p. 180).

## Developing Empathy in Design

Designers of all types, and especially novice designers, can be somewhat self-centered. This is not to say that they are selfish, but they can be self-referential, reflecting their own needs, experiences, and preferences in their designs rather than those of the learners. For example, Molenbroaek and de Bruin (2006) related the story of a hearing aid designer who fit the shape of his designed hearing aid to the comfort of his own ears instead of those of older people who would actually wear them. This created great frustration for those who purchased the hearing aids when they found that they could not find a comfortable fit in their ears. (For more examples, search for "bad design style" or read *The Design of Everyday Things* by Don Norman.)

So, too, in designing for education, attempts at universally designed instruction can fail to meet the actual needs of the learners. While self-referential design can certainly be used as a starting point, designers should not stop there but continue to develop empathic understanding for the target learners who will be using their designed materials. Empathic understanding is not binary, that is, it is not simply present or absent; rather, it is a skill that can be developed and deepened over time through experience and effort. As Brinck (2005) related in the book *Cost-Justifying Usability*, the investment of time and attention will be well worth it.

There are many ways that instructional designers can build empathic understanding for target learners. Fila and Hess (2015) described five techniques often used by instructional designers. First, designers can directly observe learners, both within the target learning context and in related places beyond. By watching how learners interact with environments, tools, and problems, designers can see barriers and points of confusion, as well as learner-initiated workarounds and strategies. Another technique is for designers to directly interact with sample target learners. Face-to-face, phone, and email conversations can lead designers to ask pointed questions that can help them learn more about the learner's experiences. Having a conversation with someone close to a target learner can also yield insights, such as discussing learning needs with parents of young target learners.

Designers may also project themselves into the viewpoint of a target learner in order to envision what his/her experience within the planned instruction might be like. To do so, designers can imagine how learners with various characteristics and abilities would experience the exercise, activity, or lesson and where they may encounter barriers, misalignments, or other frustrations. Finally, designers can simulate participation by piloting drafted designs and materials to gain understanding for how learners may experience interacting in the learning context.

## Tools for Understanding Target Learners' Experiences

- [Dyslexia](#)
- [Vision Disabilities](#)
- [Hearing Loss](#)
- [Slow Internet](#)

For example, Dr. Temple Grandin uses a simulation technique when designing livestock facilities to build understandings for how to improve the designs for the users (Raver, 1997). Her ability to empathize with the reactions of livestock have made her an international expert on designing humane animal processing plants.

## Animal Behavior



[Watch on YouTube](#)

[Link to transcript](#)

## Visual Thinking and Animal Behavior



[Watch on YouTube](#)

[Link to transcript](#)

# Applying Empathy in Design

Empathic understandings of target learners can then be applied to design parameters, such as how content will be communicated to learners through the designed instructional experience, how learners will practice concepts and skills during a lesson, or how learning will be assessed formatively and summatively. As designers generate ideas for these parameters, they can integrate their empathic understandings of the target learners with expectations and requirements from stakeholders and the realistic constraints of available resources and the target learning environment. See Table 1 for a sample of learner characteristics, potential instructional barriers, and supports that can be built into a learning experience.

**Table 1**

*Non-Exhaustive List of Potential Considerations, Barriers, and Supports*

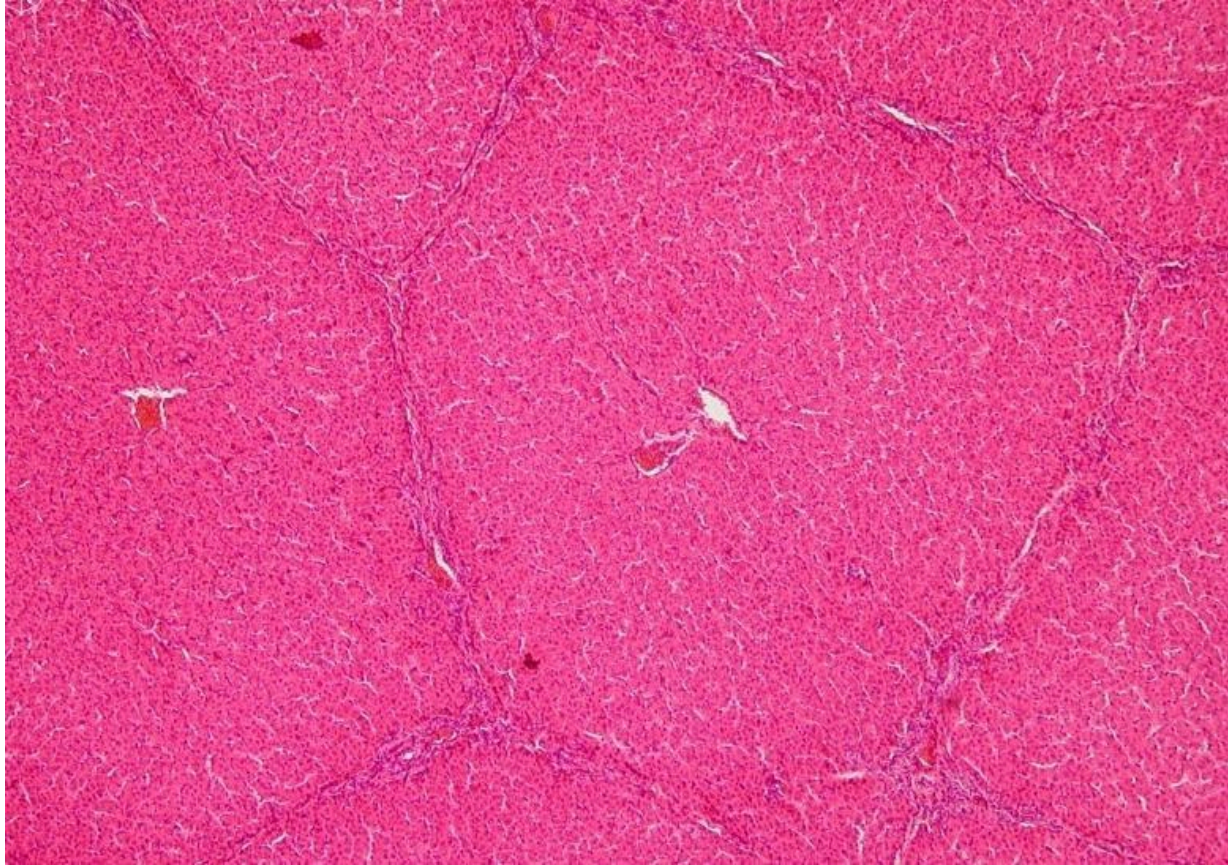| Considerations | Potential Instructional Barriers | Supports |
|---|---|---|
| Hearing difficulties | <ul><li>Video</li><li>Podcasts</li><li>Screencasts</li><li>Lecture</li></ul> | <ul><li>Captions (complete and synchronized)</li><li>Interpreters</li><li>Audio transcripts</li></ul> |
| Vision difficulties (such as low vision and color blindness) | <ul><li>Presentation materials and demonstrations</li><li>Printed texts</li><li>Color use in presentations</li><li>Tasks requiring color differentiation</li></ul> | <ul><li>Audio descriptions of visible motion on a video</li><li>Zoom functionality</li><li>Screen reader accessibility</li><li>Braille alternatives</li><li>Image alt-text</li><li>Designations other than color for conveying key information</li></ul> |
| Physical mobility difficulties | <ul><li>Using a mouse</li><li>Physical requirements</li><li>Inaccessible spaces</li><li>Stairs and platforms</li></ul> | <ul><li>Keyboard accessibility</li><li>Furniture rearrangement for increased mobility</li><li>Varied seating options</li></ul> |
| Information processing difficulties | <ul><li>Assessment time limits</li><li>Extensive, complex tasks</li><li>Language comprehension</li><li>Technical jargon</li></ul> | <ul><li>Remove time limits</li><li>Chunk information</li><li>Support strategy development (small goals, organize tasks, more deadlines for smaller sections)</li><li>Flexible schedules</li><li>Use simple language and/or provide vocabulary support</li></ul> |

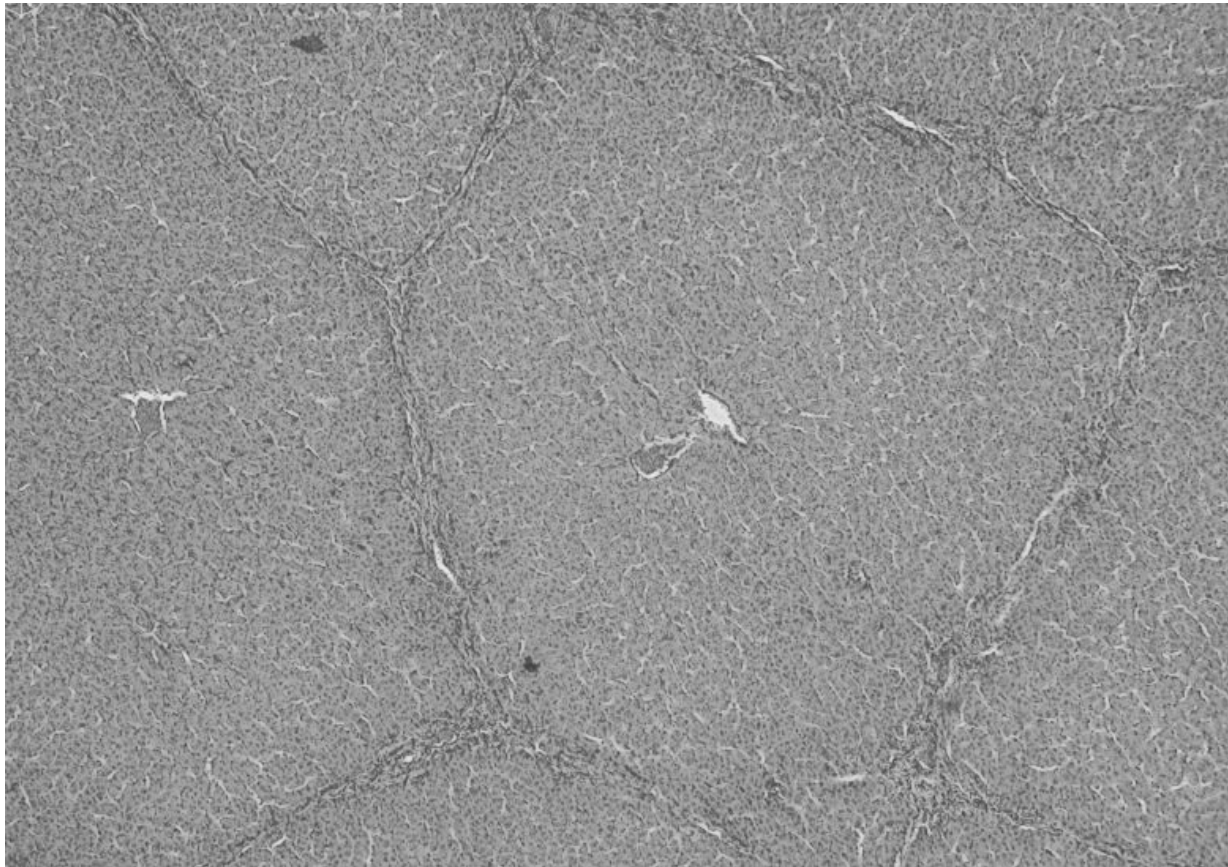| Considerations | Potential Instructional Barriers | Supports |
|---|---|---|
| Language differences | <ul><li>Spoken language</li><li>Written language</li><li>Collaborative activities</li><li>Writing tasks</li><li>Idiomatic language</li></ul> | <ul><li>Translation tools</li><li>Vocabulary instruction</li><li>Captioning</li><li>Transcripts</li><li>Starter text for writing</li></ul> |
| Low Internet bandwidth | <ul><li>Slow loading of large files (video, audio, images)</li><li>Poor connections for real-time interactions</li><li>Multimedia streaming limitations</li></ul> | <ul><li>Provide alternatives to video</li><li>Reduce image file size</li><li>Have options for asynchronous participation</li><li>Mobile-friendly interface</li><li>Chunk content in smaller sections</li></ul> |
| Cultural differences | <ul><li>Gender roles or relationships between genders</li><li>Power differences between students and instructors</li><li>Concepts of authority and respect</li><li>Behavior expectations</li></ul> | <ul><li>Collaboration with knowledgeable stakeholders</li><li>Guided group collaboration structure and specified roles</li><li>Communicated expectations</li><li>Examples of expected contributions and activities</li><li>Connections between learner culture and new content</li></ul> |
| Digital literacy | <ul><li>Tasks requiring technical skills</li><li>Navigation of online environments</li><li>Learning curve for digital tools</li><li>Frustration or discouragement</li></ul> | <ul><li>Specific instruction or tool tutorials</li><li>Emotional support and encouragement</li><li>Time and scheduling guidance</li><li>Just-in-time help desk support</li></ul> |

Learner voice can be a valuable contributor to applying empathy in design. Checking in with learners and giving them a chance to respond to the design throughout the development process will likely result in meeting pertinent needs and avoiding miscommunications and misinterpretations. This can be done through formal and informal presentations of a drafted design to learners for feedback and further suggestions. Thus, instructional design is an iterative process of continual refinement through such feedback loops and checks for congruency and alignment across components of a module or educational program.

To illustrate how empathy can be applied in the instructional design process, two cases will be described. First, a case mentioned in Meeks, Jain, and Herzer (2016) related how medical students with color blindness experienced difficulty in histology courses when they were asked to identify microscopic structures, as the slides used to depict these structures were often stained using red or green colors that tended to obscure some key distinguishing features. The instructors addressed this barrier by converting the slides into grayscale, which enabled all students to view the structures. Thus, a recommended practice in designing instructional materials is to use shapes, labels, or other means to differentiate elements in illustrations, graphs, and other visuals, rather than color only. Doing so will facilitate a more universally designed experience for target learners.

**Figure 1**

*Using Stain to Help Students with Color Blindness Identify Microscopic Structures*

A second illustrative case is from the Industrial Design program at the University of Illinois at Urbana-Champaign. Students in this program are coached to build empathy for users of their designed products and then use these empathetic understandings to refine their designs. One strategy that they use is to explore what it feels like to intentionally impair each of their senses and attempt to use their designs in representative home, school, and public spaces. This pushes them to develop insights regarding users who may have specific sensory impairments and how they may experience use of the design in varied environments. The design students also team up with non-design students who have both visible and invisible disabilities to review and pilot their drafted designs. Doing so allows them to build empathy through the interactions and dialogues with their team members, then they incorporate their user experience insights into future revisions (McDonogh, 2015).

## Design Approaches to Address Learner Variability

### Differentiated Instruction (DI)

Since learner variability is the norm rather than the exception, it is important that designers incorporate instructional approaches that will meet the needs of individual students and optimize their capacity to learn. One such approach is differentiated instruction (DI). Stradling and Saunders (1993) defined *differentiation* as "the process of matching learning targets, tasks, activities, resources and learning support to individual learners' needs, styles and rates of learning" (p. 129). This means incorporating flexibility in the modes of learning, types of provided resources, and assessments in order to respond to specific learner differences. Instructional designs can be differentiated in content, process, and product (Tomlinson, 2017). Each of these dimensions will be discussed in further detail.

Differentiation of content involves varying the concepts and skills students will learn. While engaging in instructional planning, designers may work alongside subject matter experts or instructors to identify learning goals and outcomes

for a course. Within the goals and outcomes, there can be variance in the levels of knowledge, skills, and dispositions that learners could be expected to gain from the course. For example, the content can be differentiated into concrete and abstract concepts, and students could be provided with a range of options (additional links, supplementary material, multimedia) to access learning materials and to work at their own pace. A pre-assessment could be used to gauge prior content mastery among learners and identify areas of additional needed support. Pre-assessments may also be used to determine learner readiness levels, interests, and learning preferences (Tomlinson & Allan, 2000). Gaining insights into learner interests and learning preferences (including preferences regarding individual/group work, personality traits, and internal/external motivators) will enable appropriate matching of course design to these learner characteristics. A pre-assessment can be in written form (such as a survey or test), or it can take the form of one-to-one interviews, focus groups, or demonstrations.

Differentiation of process refers to the varied ways that students make sense of learning materials and take ownership of their own learning. For a designer, it means factoring in activities that are engaging and intellectually challenging and that lead students to practice and apply targeted concepts and skills. Some examples are problem solving, mind mapping, and reflective journaling. What learners create through such activities, that is, the products of their learning, can also be varied. Products should demonstrate knowledge and skills that learners have gained from a course, but they can be in various forms, such as written, physical demonstration, spoken performance, or a video compilation. Designers can develop performance expectations to guide learners to incorporate critical thinking and connections to real-world applications through their products.

## Universal Design for Learning (UDL)

Universal Design for Learning (UDL) calls for a flexible approach to learning that supports all students. Similar to the tenets of Universal Design mentioned earlier, UDL aims to minimize barriers for learners as part of the design of curricula and learning environments so that they are accessible to as many people as possible. UDL involves building in flexibility into the curricula from the outset instead of retrofitting and adapting inaccessible curricula after the fact (Meyer et al., 2014).

It is worth noting that UDL differs from DI because it provides learners with multiple options to pursue self-directed learning whereas DI is often more instructor-directed.

**Differences Between UDL and DI With Katie Novak**

[Watch on YouTube](#)
[Link to transcript](#)

The UDL framework contains three key principles:

- Provide multiple means of engagement that stimulate interest and persistence in learning, thereby producing learners that are purposeful and motivated;
- Provide multiple means of representation so that content is delivered in varied formats, enabling learners to become resourceful and knowledgeable; and
- Provide multiple means of action and expression in which learners can show their developing knowledge in varied ways, supporting them to become strategic and goal-directed (CAST, 2018).

Each principle has guidelines and checkpoints that detail implementation strategies.

To access the UDL framework, visit http://udlguidelines.cast.org/.

Hall, Strangman and Meyer (2003) offer four steps for implementing UDL in the planning and delivery of curriculum: set goals, analyze status, apply UDL, and teach the UDL lesson. When setting goals, it is important to establish the context for the instruction. Designers may need to consider, for example, if target goals would need to align with state or organizational standards. Designers can also consider if the methods that students use to accomplish the learning goals can be separated from the goals themselves. For instance, a goal that requires students to "write a paragraph about how the circulatory system works" may be reframed to prompt learners to "describe a complete cycle in the circulatory system," which would facilitate flexibility in the means that learners could achieve that goal.

Analyzing the status of instructional materials involves evaluating the methods, materials, and assessments that will be used, considering their accessibility and flexibility in the ways that students engage and demonstrate their learning and identifying potential barriers. UDL can then be applied to elements of the instruction wherein potential barriers and opportunities for flexibility have been identified. Ultimately, the intentional flexibility in the UDL approach to design is aimed to position learners to be more self-directed and self-regulated, as learners are provided options for their learning pathways that align with their individual needs.

So, how might that look in practice? To provide multiple means of engagement, students are provided with tools that enable them to take ownership of their learning. Challenge levels should match their readiness, and there should be built-in opportunities for mastery-oriented feedback. This could begin with a well-designed syllabus that clearly states learning goals and objectives, course expectations and structure, information on how to navigate the learning environment, methods of assessment, and options for participation. Learning environments should support varied navigation and control methods that are accessible to all learners. Designers may also consider incorporating checkpoints that can help learners chart their progress in a course and provide opportunities for feedback and self-reflection after completing a unit of study.

Providing multiple means of representation offers learners options to customize the display of information, make sense of language and symbols, and enhance their levels of comprehension. Course materials can be presented in a variety of formats to provide varied means for students to connect with the content. Materials may be customizable, enabling learners to adjust text size, color, contrast, etc. and access content in varied forms, such as video, interactive simulations, audio, and text-to-speech.

In providing multiple means of action and expression, designers can incorporate planned flexibility in learner response options, navigation, access to tools and assistive technologies, forms of communications, and demonstration of learning. One strategy to achieve this is to maintain uniformity in the design of the content, both across functionalities and through consistency of visual appearance. Another strategy is to offer multiple options for learners to demonstrate their mastery of the content, such as through text, mind maps, audio, and video.

## Culturally Relevant Education

Culturally relevant education is built on the premise that culture is an essential component of students' learning, as instructional practices, curriculum, and modes of assessment that are couched in "mainstream ideology, language, norms, and examples often place culturally diverse students at a distinct educational disadvantage" (Howard, 2012, p. 550). Culturally relevant education is characterized by several frameworks, including culturally responsive pedagogy, culturally relevant teaching, and culturally congruent teaching. It is empowering to students intellectually, socially, politically and emotionally by using culturally relevant frameworks to convey knowledge, abilities, and attitudes (Ladson-Billings, 2009). Consequently, a culturally relevant education recognizes the culture, attributes, and knowledge that ethnically diverse students bring to their learning experiences and uses those resources to maximize their learning (Howard, 2012).

**Culturally Relevant Pedagogy With Irvine, Gay, & Gutierrez**

[Watch on YouTube](#)

[Link to transcript](#)

The question then becomes, how can instructional methods and materials be designed for cultural relevancy to learners, especially those on the fringes of dominant culture? An initial step for designers is to develop cultural sensitivity through becoming familiar with target learner interests, core values, traditions, modes of communication, and backgrounds. Knowledge about the learners can then be strategically integrated into plans for instructional methods and materials (Gay, 2002). To help learners see the relevance of instructional materials to themselves, instructional resources can be situated within the cultural and ethnic contexts of the target learners. Designers can incorporate materials and activities that reflect multiple voices and perspectives rooted in the personal experiences and cultures of the learners. Learner autonomy can be enhanced through the provision of varied options for expression. For example, learners can be provided an array of materials and activities to choose those that are relevant to their backgrounds of experience. Designers can also plan for ways that learners can share personal experiences as they are related to course topics, creating meaning-making opportunities.

## Conclusion

Universally designing instruction involves recognition and intentional planning for components and features that often do create accessibility challenges for learners so that all learners can access and engage in learning experiences equitably. As learners vary in their characteristics, preferences, and experiences, so do the approaches through which designers can develop empathetic understandings and incorporate flexibility to meet diverse learner needs. This chapter offers an initial look into these strategies, and designers are encouraged to revisit these strategies in the instructional design process so that they can anticipate variability in their target learners and address this variability strategically.

# Activity/Exercise Ideas

1. Explore built-in accessibility features. There are built-in accessibility features in many of today's tools that support varied vision, hearing, mobility, and learning needs. Explore the built-in accessibility features of one of the following:
    1. Mac OS: https://www.apple.com/accessibility/mac/
    2. Windows: https://www.microsoft.com/en-us/accessibility/
    3. iOS: https://www.apple.com/accessibility/iphone/
    4. Android: https://www.android.com/accessibility/
    5. Chrome OS: https://edu.google.com/why-google/accessibility/chromebooks-accessibility/
    6. Other Google tools: https://www.google.com/accessibility/products-features/
2. Share in a discussion board post, blog, video post, Tweet, etc. about what you learned in your exploration of the built-in accessibility features. Did you find any that you would like to use in the future?
3. Experience accessibility of digital resources. Choose a website, app, or program, and access it in a different way than you usually do. For example, you can use some of the built-in accessibility tools from Activity #1, such as trying to do research through an online library website using a screen reader and voice-input (such as VoiceOver and Dictation on MacOS). You could also try navigating around a course site using keyboard-only (no mouse, touchscreen, or touchpad). Or, you could try using a web application on a mobile device that you usually access via laptop/desktop computer. Spend about a half hour accessing the digital resource in one or more different ways and then reflect on your experience. How accessible was the resource for the means that you accessed it? What did this experience prompt you to think about in regards to your own design of digital educational resources? Create and share a summary of your experience and related thoughts as an audio clip, discussion board posting, graphic (could include screenshots or sound clips), etc.
4. Observe universal design. Spend 30-60 minutes observing people using universally designed features in different contexts, such as the automatic door openers, ramps, buses, playgrounds, water fountains, food service centers, libraries, etc. What do you notice about who is using them and how? Collect pictures of examples and non-examples of universally designed features around campus. How might these impact people with different needs?
5. Using technology to implement UDL. Choose a guideline (see http://udlguidelines.cast.org/) associated with one of the UDL principles and find a technology tool that supports the implementation of the guideline. For example, you may find a tool that supports the guideline "recruiting interest" under the principle of engagement. How would the tool optimize individual choice and autonomy, optimize relevance, value and authenticity, and minimize threats and distractions?
6. Create accessible materials. Use the Accessibility Evaluation and Implementation Toolkit (AIET) to evaluate and improve accessibility in one of your own Word documents, PowerPoint presentations, Excel spreadsheets, a WordPress website, or a Canvas module. Use the links in the checklist to identify accessibility barriers and then resolve all errors.

# Resources

- [Accessibility Resource List](#) from Designers for Learning based on "POUR" - Perceivable, Operable, Understandable, Robust recommendations related to website accessibility.
- [Culturally Responsive Teaching & the Brain](#) by Zaretta Hammond offers tools and recommendations for applying CRT into instruction.
- [Dive Into UDL](#) by Kendra Grant and Luis Pérez provides a UDL self-assessment and a variety of resources to explore UDL more deeply.
- [Global Accessibility Awareness Day (GAAD)](#) is an annual event in May that focuses on the design, development, and usability of technology for users around the world.
- [Inclusive Learning Network](#) of ISTE (International Society for Technology in Education) provides professional learning opportunities and resources on inclusive design and technology.
- [National Center on Accessibility Education Materials (AEM)](#) provides resources and technical assistance on producing learning materials that meet accessibility standards.
- [Techniques for Empathy Interviews in Design Thinking](#) is a resource with ideas for how to set up and conduct exploratory interviews with potential learners.
- [The UDL Toolkit](#) is a collection of UDL resources for teachers, coaches, and instructional leaders.
- [UDL-IRN](#) (The Universal Design for Learning Implementation and Research Network) provides resources and professional learning opportunities to connect with other educators and designers regarding implementation of UDL.
- [UDL Progression Rubric](#) by Katie Novak and Kristan Rodriguez provides specific examples of UDL practices across the three principles of providing multiple means of engagement, representation, and action and expression.

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Lydia Oluchi Ugwu is a PhD student of curriculum and instruction at the University of Houston. Her doctoral research focuses on teaching strategies for diverse learners, teaching skills and competencies for online learning, and blended learning. She has a Masters in human resource education from Louisiana State University and a bachelors in culture, media and communication from the University of Surrey.