Designing Online Learning to be Accessible to Students with Disabilities

Sheryl Burgstahler
Accessible Technology Services
University of Washington
Seattle, USA
sherylb@uw.edu

***Abstract*—This paper shares the design and results of an exploratory study that focused on improving the accessibility of online tools and pedagogy. It tells how a universal design framework can be used by instructors and researchers interested in ensuring that online learning is accessible to and inclusive of all students, including those with disabilities. The paper concludes with readily achievable recommendations for researchers working in this space.**

Keywords—disability, universal design, accessible design, accessibility, online learning

I. Introduction

The COVID-19 pandemic led to an exponential increase in the number of academic courses offered online. To ensure equity, it is important that these offerings are accessible to and inclusive of everyone, including instructors and students with disabilities. However, many online courses erect barriers to people with disabilities. Examples include the use of documents, often PDFs, that do not provide content in a text-based format that can be read aloud by screen reader technology to students who are blind or have reading-related learning disabilities, videos that do not have accurate captions for students who are deaf, and technology tools that cannot be operated with the keyboard alone, which makes them inaccessible to students using assistive technology that can emulate the keyboard but not the mouse.

II. An Exploratory Study

An exploratory study focused on equal access to online learning was led by the DO-IT (Disabilities, Opportunities, Internetworking, and Technology) Center [1] at the University of Washington (UW). DO-IT staff recruited a group of collaborators with a wide range of expertise relevant to online learning research to conduct a review of literature, participate in a multi-day capacity building institute, and engage in an online community of practice. Together, they conducted a literature review, explored online learning access barriers and solutions, and wrote a white paper to inform practitioners about how instructors and researchers can help ensure the design of learning technologies and pedagogy is accessible to and inclusive of everyone, including instructors and students with disabilities.

III. Findings

Research collaborators found that many components of courses are not accessible to people with disabilities, few instructors routinely use accessible and inclusive online content and practices in their courses, and few online learning technology and pedagogy researchers address accessibility issues in their work. They also identified three sets of principles inspired by the practice of universal design (UD) that have well established guidelines and evidence-based practices that can be used to design accessible and inclusive online teaching and research.

UD is defined by the Center for Universal Design [2] as "the design of products and environments to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design." Principles for the UD of any product or environment include the following:

- Equitable use: The design is useful and marketable to people with diverse abilities.
- Flexibility in use: The design accommodates a wide range of individual preferences and abilities.
- Simple and intuitive use: Use of the design is easy to understand, regardless of the user's experience, knowledge, language skills, or current concentration level.
- Perceptible information: The design communicates necessary information effectively to the user, regardless of ambient conditions or the user's sensory abilities.
- Tolerance for error: The design minimizes hazards and the adverse consequences of accidental or unintended actions.
- Low physical effort: The design can be used efficiently, comfortably, and with a minimum of fatigue.

- Size and space for approach and use: Appropriate size and space is provided for approach, reach, manipulation, and use regardless of the user's body size, posture, or mobility. [3]

These basic principles, originally applied to the design of architecture and commercial products, have also been used to design hardware and software, instruction, student services, and other applications [4]. UD results in products and environments, including those used in learning activities, that are accessible to and inclusive of everyone, including people with disabilities.

UD-inspired frameworks have emerged to specifically address instructional applications. Each is based upon a common finding in educational research: that learners are highly variable with respect to their abilities and responses to instruction. The most common framework applied to curriculum and pedagogy is called Universal Design for Learning (UDL). Developed by the Center for Applied Special Technology, UDL practices offer students multiple means of engagement, representation, and action and expression, as represented below.

- Engagement: For purposeful, motivated learners, stimulate interest and motivation for learning.
- Representation: For resourceful, knowledgeable learners, present information and content in different ways.
- Action and expression: For strategic, goal-directed learners, differentiate the ways that students can express what they know [5].

For the design of IT that avoids erecting barriers to individuals with disabilities, online learning practitioners and researchers can apply the widely used and well-documented international Web Content Accessibility Guidelines (WCAG) published by the World Wide Web Consortium. The Guidelines require that accessibly designed IT apply four principles.

- Perceivable: Users must be able to perceive the content, regardless of the device or configuration they're using.
- Operable: Users must be able to operate the controls, buttons, sliders, menus, etc., regardless of the device they're using.
- Understandable: Users must be able to understand the content and interface; and
- Robust: Content must be coded in compliance with relevant coding standards in order to ensure its accurately and meaningfully interpreted by devices, browsers, and assistive technologies [6].

The combination of UD, UDL, and WCAG principles addresses all aspects of online learning—physical spaces, technology, curriculum, and pedagogy—and ensures that students are offered multiple and accessible ways to gain knowledge, demonstrate understanding, and interact [2], [7]. Although the need for additional accommodations for individuals with disabilities is minimized with this approach, reasonable accommodations are sometimes necessary to ensure full access and engagement when the universally designed offering does not already do so. For example, a student with a learning disability engaging in a universally designed course may require extra time on an examination as a reasonable accommodation.

IV. Recommendations for Researchers

The exploratory research reported in this paper led to recommendations for online learning practitioners and researchers [8]. These recommendations include that researchers become familiar with the UD, UDL, and WCAG principles and the established guidelines and practices they support; include individuals with disabilities and accessibility professionals on their research teams; ensure that IT designers are trained on basic accessibility principles and standards-compliant coding practices; establish internal policies and guidelines for accessibility within their projects; consider a wide range of disability types in all phases of their research; compare the experiences of participants with disabilities to those of other demographic groups; and include accessibility limitations whenever they report other limitations of their studies.

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