

Four Types of Disabilities: Their Impact on Online Learning

By Kevin L. Crow

The U.S. Department of Commerce, Economics, and Statistics Administration notes that up to 8.5% of the approximately 301 million people living in the United States have at least one disability that can have a negative effect on their ability to use a computer or to access the Internet (DOC, 2002). If these figures are correct, then approximately 26 million people living in the U.S. have at least one disability that can negatively affect their ability to access online learning materials.

This article has been written to help designers and developers of online learning materials better understand some of the issues and challenges that are faced by online learners who have disabilities by providing an overview of four major disability categories: Visual Impairments, Hearing Impairments, Motor Impairments, and Cognitive Impairments. It will also provide the reader with common-sense suggestions to help make online learning materials more accessible to learners who have disabilities.

Visual Impairments

The American Foundation for the Blind (AFB) (2006) claims that there are about 1.5 computer users in the U.S. who are blind or visually impaired (§ 23). Additionally, the U.S. has about 93,600 students who are visually impaired; 10,800 of whom are deaf-blind and are served in special education programs (§ 11).

Paciello (2000) notes that visual impairment is the most often cited disability regarding web accessibility. Paciello also notes that visual impairments are cited most often in the literature because the majority of web sites rely heavily on graphical content and written text in order to present information.

There are three types of visual impairments that designers of online learning materials generally consider when developing instructional web sites: total blindness, low vision and color blindness (Bohman, 2003).

Total Blindness. People who are totally blind cannot see at all; therefore, when accessing the Internet or using computerized equipment, these individuals typically rely on devices referred to as screen readers. A screen reader scans a computer screen for text then audibly reads the text content to the user. Screen readers offer accessibility and independence to computer users who are blind; however, they also have limitations. First, screen readers can only read text; they cannot read images such as pictures, graphics, banners, Flash animations, movies, navigational buttons, and some types of portable document formats (PDF). Second, screen readers often encounter difficulties when attempting to read tables and charts.

Designers of online learning materials can help make those materials more accessible to individuals who are blind by providing meaningful alternate or long descriptions (alt tags) for each nontext element on the web page. Alt tags are the descriptive text balloons that pop up when a mouse-arrow hovers over a nontext item such as a picture. Screen-reading devices are able to read these descriptions to learners. Designers of online learning materials can also help make online materials more accessible to learners who are blind by not using tables for design, layout, and formatting purposes. Screen-reading devices typically read from top-left to bottom-right. Minimizing the use of "layout tables" helps to ensure that the screen-reading device can read the entire text without interruption. Additionally, designers can make online materials more convenient for individuals who use screen readers

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by utilizing proper heading levels (heading 1, heading 2, heading 3, body text, and so on) and by providing some option to skip past the navigation section of each web page. Screen readers are capable of navigating from heading to heading. They can also skip past web-page navigation sections and go directly to the page content provided the web page contains a skip navigation function. Finally, designers of online

materials should avoid using background images to convey meaningful information. Screen readers are currently unable to read background images.

Low Vision. People with low vision can see images; however, they cannot see most images clearly. Low vision varies in severity with the extreme condition being termed as legally blind. People who are legally blind may be able to see light and images; however, they usually have vision that cannot be corrected past 20/200 (American Foundation for the Blind, 2007, ¶ 29). The AFB estimates that there are approximately 1.3 million legally blind Americans (American Foundation for the Blind, 2006, ¶ 4).

Individuals with low vision often rely on devices known as screen magnifiers. Screen magnifiers enlarge areas of the screen in order to make text and images more readable to individuals with low vision. Individuals with low vision also frequently use screen readers.

Designers of online learning materials can help individuals with low vision by keeping the web page layout free from unnecessary clutter and using a san-serif font. Additionally, designers of online learning materials should avoid the use of italics. Italic and serif fonts tend to become jagged and difficult to read on many computer monitors due to limited screen resolution.

Color Blindness. People who have color blindness have difficulty in perceiving certain colors and/or combinations of colors. These individuals may, however, have no difficulty seeing black and white images or varying shades of gray (Paciello, 2000). Therefore, designers of online learning materials should be careful not to include any information that relies exclusively on the use of color or color recognition.

Hearing Impairments

The National Institute on Deafness and Other Communication Disorders (NIDCD) claims that approximately 28 million Americans have some type of hearing disorder or impairment (NIDCD, 2006, ¶ 4). Hearing impairment disabilities vary in type and severity. People who have a hearing impairment may have a diminished ability to hear certain frequencies (pitches), or they may have difficulty hearing at all frequency levels. Hearing impairments may also result from tinnitus (ringing) (NIDCD, 2006, ¶ 1; Paciello, 2000).

An on-line learner who has a hearing impairment or is completely deaf needs (and is entitled under U.S. law) to be able to access the same audio information that is available to non-disabled learners. Consequently, designers of online learning materials should provide real-time text captioning for all audio, video, and multi-media presentations that are placed on learning web sites. Moreover, Section 508 law requires covered entities to provide real-time text captioning for all audio, video, and multi-media presentations that are delivered electronically. Designers of online learning materials may also offer printed text transcripts of audio content on the website providing that the text version does not violate copyright protections. It is important to remember, however, that under Section 508 law a printed version of the text does not substitute for real-time captioning.

Motor Impairments

Online learners who have physical or motor impairment disabilities face a wide range of challenges as they attempt to access online courses and learning materials because the range of conditions associated with motor impairment disabilities is quite broad (Foley & Regan, 2002). Some learners with motor impairment disabilities may have limited use of their hands; others may not be able to use their hands at all. Conditions that may lead to a motor impairment disability include arthritis, amputation, birth defects, cerebral palsy, essential tremor, loss or damage of limbs, muscular dystrophy, multiple sclerosis, spina bifida, spinal cord injury, neurological conditions, paralysis, and Parkinson's Disease (WebAIM, 2006, ¶ 1). Hudson (2002) maintains that individuals who have motor impairment disabilities commonly experience difficulties accessing computer keyboards and mice; therefore, they often rely on special assistive technologies in order to interact with a computer. These technologies range in sophistication from mouth-sticks to eye-tracking devices that work in combination with straws to

create mouse input when the user puffs into the straw device.

Designers of online learning materials need to remember that learners with motor impairment disabilities may have a difficult time interfacing with their computer. Therefore, designers of online learning materials should consider limiting the use of synchronous (real-time) chat-based assignments and limiting the use of games and simulation activities that require high degrees of motor dexterity. Moreover, individuals with motor impairment disabilities should be allowed as much time as needed to complete assignments that require human-computer interaction (Crow, 2006).

Cognitive Impairments

Cognitive impairments involve a wide variation of memory, perception, problem-solving, and conceptualizing challenges. Often cognitive impairments are attributed to conditions such as autism, brain injury, cerebral palsy, epilepsy, mental retardation, or neurological impairment (Rowland, 2004). Cognitive impairments can also include developmental disabilities, pervasive developmental disorders, Rett syndrome, and Williams syndrome (Seeman, 2002).

Bohman and Anderson (2005) claim that there are many cognitive disabilities; therefore, it may be better for designers of online learning materials to categorize cognitive disabilities by using functional characteristics rather than clinical diagnoses. Consequently, Bohman and Anderson propose the use of a taxonomy of cognitive impairments based on functional descriptors including memory; problem solving; attention; reading, linguistic, and verbal comprehension; math comprehension; and visual comprehension.

Rowland (2004) notes that patterns emerge when one attempts to describe or define difficulties that result from cognitive disabilities. Rowland claims that the most common problems (patterns) encountered by individuals with cognitive disabilities who attempt to use the Internet include attention, memory, perception and processing, and problem solving. Rowland also suggests that in the case of web accessibility for individuals with cognitive impairment, it may be most effective for web designers to focus on these functional disability characteristics rather than on any one specific cognitive disability.

Learners who have learning disabilities comprise the largest group of learners with disabilities. Nonetheless, many web designers do not attempt to incorporate accessibility for individuals with cognitive impairments because they believe

that these individuals are not the target student for their services and that providing accessibility to individuals with cognitive impairments might present an undue burden (Rowland, 2004; Seeman, 2002; Wimberly, Reed & Morris, 2004). There are, however, some practical, cost-effective universal design practices that designers of online learning materials can incorporate in order to make those materials more accessible to learners who have cognitive impairments.

- Avoid making cluttered or disorganized web pages.
- Avoid using unnecessary graphics or pop-up windows.
- Make web pages easy to navigate.
- Lay out web pages so that they present a logical flow of content material.
- Always use page titles and headings.
- Make all text portions in sizes large enough to be easily seen and distinguished.
- Avoid the use of flashing on-screen objects. Flashing objects can trigger seizure episodes.
- Whenever possible, allow individuals with cognitive impairment disabilities as much time as needed to complete assignments that require human-computer interaction (Crow, 2006).

More Information on Accessibility

Throughout this article, several examples and suggestions have been offered to help make online learning materials more accessible. In general, each of these suggestions falls into one of two commonly utilized approaches. The first approach involves the utilization of an *assistive technology*. The second approach involves the utilization of a design principle referred to as Universal Design.

Assistive Technologies. Section 508 Standards (1998) defines assistive technologies as “any item, piece of equipment, or system, whether acquired commercially, modified, or customized, that is commonly used to increase, maintain, or improve functional capabilities of individuals with disabilities” (§ 11994.4, ¶ 4). Within the context of online learning, an assistive technology generally refers to some type of device that helps make online materials and interaction accessible to learners with disabilities. Examples of assistive technologies include screen magnifiers, voice recognition software, and computer mice that track the user’s eye movement.

Assistive Technologies

ABLEDATA – <http://www.abledata.com>

Provides information on over 32,000 products available for individuals with disabilities. ABLEDATA is sponsored by the U.S. Department of Education and does not produce or sell any products.

Ability Hub – <http://www.abilityhub.com/index.htm> Provides assistive technology solutions for individuals with disabilities.

ATIA: Assistive Technologies Industry Association – <http://www.atia.org/>

A nonprofit membership organization of manufacturers, sellers, or providers of technology-based assistive devices and/or services.

Trace Center – <http://trace.wisc.edu/>

The Trace Research & Development Center is a part of the College of Engineering at the University of Wisconsin-Madison. Trace has been a pioneer in the field of technology and disability since 1971.

Universal Design

Accessify.com – <http://www.accessify.com/default.php> Offers free tools and other useful resources that are related to web accessibility.

CAST: Center for Applied Special Technology – <http://www.cast.org/>

Collaborates with stakeholders in educational policy, publishing, administration, research, and practice to realize practical applications of Universal Design for Learning.

DO-IT: The University of Washington: Disabilities, Opportunities, Internetworking, and Technology – <http://www.washington.edu/doit/>

W3C's Web Content Accessibility Guidelines (WCAG) – <http://www.w3.org/WAI/>

The World Wide Web Consortium guidelines for web accessibility.

WebAIM.org – <http://www.webaim.org>

Web Accessibility in Mind. An initiative of Utah State University; WebAIM is a vast resource for anyone who wishes to learn about web accessibility.

Universal Design. The term “universal design” was coined in the 1970s as an architectural concept for making facilities accessible to all persons without the help of special assistance or devices. Since that time the universal design concept has been adopted by many additional fields including the computer industry, telecommunications, and information systems (Tobias, 2003). Universal design can be defined for this discussion as “the theory and practice pertaining to design, development, and implementation of communication, information and technology products and services that are equally accessible to individuals who are both disabled and non-disabled” (Crow, 2006, p.20).

Universal design has two major facets. First, universal design refers to the process of designing commercially available products that can be used by the greatest number of people without the need for assistive technologies. Second, universal design refers to the process of designing products so that they are compatible with available assistive technologies (Vanderheiden & Tobias, 2006). Three examples of the utilization of universal design principals in online learning materials include providing a text equivalent for all non-text elements, providing real-time text captioning for all audio/video components elements, and avoiding the use of tables for design-layout purposes.

Much information is available regarding the topic of universal design. Unfortunately, this forum only affords room for a cursory discussion of this topic. Readers who would like to find out more about universal design may wish to examine Figure 1 which lists several excellent sources pertaining to universal design.

Summary

This article introduced some of the issues and challenges faced by online learners who have disabilities by providing an overview of four major disability categories: Visual Impairments, Hearing Impairments, Motor Impairments, and Cognitive Impairments. It also discussed how assistive technologies and universal design are being incorporated in order to make online learning materials more accessible. Finally it offered several common-sense suggestions to help make online learning materials more accessible to learners who have disabilities.

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Figure 1: Accessibility Resources

To learn more about assistive technologies, readers may wish to visit the website of ABLEDATA at <http://www.abledata.com>. ABLEDATA, a non-profit group sponsored by the U.S. Department of Education, provides information on over 32,000 products for individuals who have disabilities; however, it does not produce or sell any products. Figure 1 lists several excellent sources pertaining to assistive technologies.

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