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With the majority of public postsecondary institutions offering online or hybrid credit courses and 11 percent of postsecondary students having a documented disability, the accessibility of online courses cannot be ignored.

Accessible Online Learning

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The number of online courses offered at the postsecondary level is increasing at a rate greater than the increase in overall higher education enrollment, with approximately one of every four higher education students taking at least one course online (Allen and Seaman, 2009). In the 2006-07 academic year, 97 percent of public two-year and 88 percent of public four-year postsecondary institutions offered college-level online or hybrid credit courses (Parsad and Lewis, 2008). In 2008, students with disabilities represented nearly 11 percent of all postsecondary students (U.S. Government Accountability Office, 2009), yet whether students with disabilities can access these courses is rarely considered (Kinash, Crichton, and Kim-Rupnow, 2004). Rowland (2000) found that only 25 percent of college and university Web pages were accessible to individuals with disabilities (Rowland, 2000), and the accessibility of postsecondary Web sites continues to be a concern (Fichten, Ferraro, Asuncion, Chwojka, Barile, Nguyen, Klomp, and Wolforth, 2009; Parton, Hancock, and Oescher, 2009). Making technology such as online learning accessible is ethically appropriate, economically sensible, and self-serving, as everyone may need accessible technology as the population grows older. And it is also the law (Coombs, 2000).

A number of laws, standards, and guidelines exist to help make online courses accessible to students with disabilities. The 1990 Americans with Disabilities Act prohibits discrimination based on disability that would prevent participation in "the services, programs, or activities of a public entity." Section 504 of the Rehabilitation Act of 1973 similarly prohibits discrimination based on disability by any program or activity that receives federal funding, and section 508 provides specific guidelines on how to

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make Web sites accessible. The World Wide Web Consortium also provides detailed recommendations for accessible Web sites, although these guidelines do not carry the force of law. Accessibility of online courses is included as well in the Higher Education Opportunity Act (2008), which established an advisory commission on accessible instructional materials and allocated money for professional development and technical support on accessibility. (See Chapter Eight, this volume.)

Students with Disabilities in Online Courses

Students with disabilities cannot be denied the opportunity to take online courses, assuming they meet the academic prerequisites required of all students for the course. However, like all other students, those with disabilities should consider their own preferred learning style to determine if an online course provides a good fit. For example, online courses are best for students who are strong self-learners. Students who prefer to have information explained to them or who benefit from lively class discussions will probably not thrive in online courses. In addition, most of the steps required to create accessible materials are simple and do not require much additional time and effort.

Advantages. Online courses can be particularly beneficial to students with disabilities. The flexibility of working from home at any hour of the day helps students who have numerous doctor appointments or medications that affect their ability to focus at certain times of the day. Students with mobility or transportation difficulties, weakened immune systems, or other challenges that make attending a traditional face-to-face course difficult appreciate the ability to work from home.

Some students benefit from working on course work more frequently for shorter periods of time at each sitting. For example, instead of attending a class for seventy-five minutes twice a week, a student can log into the class several times during the week for just a twenty-minute session. In addition, students can review online course materials as often as needed instead of relying on a single lecture presentation.

Many online courses use bulletin boards for student interaction. Some students with disabilities are hesitant to participate in live class discussions because they need more time than most other students to collect and organize their thoughts or because they have impaired speech. Online discussions allow students the time needed to consider and edit their comments, and speech problems are not apparent in typed communication. Deaf students can communicate directly with their peers without the intervention of an interpreter.

Disadvantages. Online courses require self-discipline, good time management, and the ability to work independently. Some disabilities make this more difficult. In addition, a larger amount of reading is usually required in online courses than in face-to-face courses. Students with

disabilities related to reading may have more difficulty in online courses as a result.

Note that we do not address accessibility as a disadvantage. Students should not avoid online courses, and teachers and advisors should not dissuade students from taking online courses because of the extra work to make them accessible. If course designers are proactive and make online courses accessible as they are created, then students need only consider personality and learning styles when deciding whether take an online course, not whether the course will be accessible to them.

Importance of Proactive Design

Most adjustments needed in order to make online courses accessible are fairly easy and inexpensive if accessibility is taken into consideration at the time the course is created. It is much more difficult, time-consuming, and expensive to retrofit a course to make it accessible after a student with a disability has enrolled in the course.

Making courses accessible at the time of creation also helps avoid a last-minute scramble to meet student needs. Properly adapting an inaccessible course may take more time than is available, resulting in a poorly designed site and stress for the faculty, Web designers, disability counselors, and the students involved.

Because making courses accessible as they are designed costs little in time, effort, and resources, there is no disadvantage in doing this work from the start. Accessible course design benefits all students, not just those with disabilities. However, most departments already have a number of courses that have been created without attention to accessibility, and a plan should be created for addressing their accessibility. For example, some programs review and revise course materials and syllabi on a regular basis. The online component can be assessed and edited for accessibility at the same time content is reviewed. Another option is to develop a schedule for reviewing and revising existing online courses a few at a time, beginning with the most frequently offered courses or the courses with the highest enrollment, since these courses are most likely to have a student with a disability enrolled in them. Some established courses take more time and effort to revise than others, but planning ahead allows the time necessary to create effective and accessible materials.

Content Management Systems

Many colleges and universities use a learning management system (LMS) to manage their online courses or as a supplement to face-to-face courses. This software provides structure and tools such as bulletin boards, mail, chat rooms, online quizzes and tests, a way to submit homework

assignments, and file storage. Typically the LMS provides a general template, and faculty members add their specific course content to it.

All of the major LMSs make an effort toward accessibility, though some are more successful than others, and none of them are perfect. However, even if completely accessible LMSs were available, the instructors' materials must also be created with accessibility in mind. An accessible LMS will be rendered inaccessible if the instructor adds inaccessible materials to the course, such as poorly formatted documents or uncaptioned videos.

It is important for instructors to make their materials and course components as accessible as possible. However, no matter how much effort they put into considering all of the obstacles students may face and trying to make everything accessible, it is impossible to guarantee complete accessibility. Sometimes an additional accommodation must be made on a case-by-case basis. Nevertheless, careful planning and good design will decrease the number of individual accommodations that must be made.

Accessibility Versus Usability

Instructors should keep the difference between accessibility and usability in mind. While accessibility is the baseline, usability is the real goal. Whenever possible, students with disabilities should be able to use materials with the same amount of effort as students without disabilities.

With the rationale for providing accessible materials established, we address the details of how to accomplish this goal.

Word Processing Documents. For the most part, documents that are created using a word processing program are accessible. Nevertheless, several techniques can be implemented to increase usability.

Whenever available, the formatting tools that the word processing software provides should be used. For example, if there is a tool to mark text as a title or a heading, it should be used instead of changing the font or type size manually to visually denote a title. These software tools produce a hidden code that can be read by assistive technology to let students know they are reading a title or section heading, but assistive technology does not inform the reader that a title has been introduced when large, bold type is simply used.

Table and columns creation tools are available in most word processors and should be used instead of the tab key or space bar to line up columns. Again, hidden code makes tables and columns easier to read by text-to-speech software.

Pictures or images in the text need to have alternative text. Alternative text, sometimes referred to as ALT-text, is a brief description of the picture that text-to-speech software programs read. The text should explain the important aspects of the image to someone who cannot see it. Alternative text can usually be added in the image properties section. If the word processor does not have the option to add alternative text to the image, a text caption can be added underneath the picture instead.

Text boxes should be avoided whenever possible because text-to-speech software generally cannot read it.

Scanned Documents. Documents that have been scanned are a frequent problem for accessibility and usability. Unless the scanned file has been run through optical character recognition (OCR) software, it is likely only a picture of words, not readable text. Text-to-speech software cannot recognize the pictures as words and therefore cannot read the words aloud to students who cannot see them or need auditory access to the content because of reading difficulties.

With advanced planning, OCR software can be used with the document to make it accessible. The OCR software scans the pictures of words and tries to recognize patterns of lines that form letters. Using OCR requires some training with specialized software, and the results should be manually proofread for accuracy. A campus that uses many scanned documents may decide to invest in high-quality OCR software that has better character recognition than lower-cost or free versions. For cost-effectiveness and efficiency, a campus may have a centralized point for document conversion with high-quality software and trained staff who can convert documents for the entire campus or university. Foresight allows for a less hectic and productive start to a semester for faculty, staff, and students.

Slide Presentations. Slide presentations are popular for live lectures. Many instructors who start teaching a course online after having taught it face-to-face put slide presentations from their face-to-face courses online without adaptation or consideration of whether the slide presentation is the optimal way to present the information. Often slide presentations are intended to be accompanied by a live speaker and are less effective when presented alone unless they have been adapted for online use.

Although it is possible to create slide presentations that are effective for online courses, making an accessible slide presentation is much more difficult. Initially instructors should decide whether the slide presentation is used because it serves a purpose or if it is just a carryover from the face-to-face version of the course. If it is the latter, another format may serve the same purpose more effectively and more accessibly. Whenever possible, documents should be created in a format that is accessible for all students.

Some steps can be taken to improve the accessibility of a slide presentation. For example, using plain text and avoiding images, graphs, and charts will make a presentation more accessible. Necessary images can be described in the notes section of the slide. However, these techniques will not guarantee access because students use a variety of assistive technologies. The best and simplest way to provide access is to have an additional text-only equivalent of the information in the presentation.

The text-only equivalent is easy to produce by copying the text from the slide presentation into a word processing document and providing text equivalents of any pictures, charts, or graphs from the slides. Slide numbers added at appropriate places in the text can help students follow along and

find specific places in the text easily. Both the slide presentation and the text equivalent should be made available to all students so they can choose their preferred file format.

Audio and Video. Audio and video can add depth and interest to an online course and can benefit many students with disabilities. Video should be used only if the video adds more to the course content than audio alone. Demonstrating a technique or showing archival footage are examples of using video well. A video of the professor talking in front of the camera, also known as a talking head, is not a good use of video. Video files are larger than audio files, meaning they take up more disk space and require more time for students to download. They are also more difficult and expensive to make accessible. Video should therefore be used judiciously.

A transcript (that is, a verbatim script of the audio content) of audio files is required to make them accessible. Transcripts benefit students with hearing loss. They are also appreciated by second-language learners and by all students when the speaker has a strong accent. Transcripts also serve as useful study tools for all students.

Many agencies are available to transcribe audio, but transcripts also can be created by student workers because little special training and few skills are necessary beyond attention to detail and good typing skills. The transcript should be provided at the same time the audio is made available.

For video, providing a simple transcript of the audio track is not sufficient. The text must be synchronized with the video using captions. There are two types of captions: open and closed. Open captions are part of the video itself and will always be visible. Closed captions can be turned on and off through the software used to play the video. Either option provides accessibility as long as students know how to turn the captions on and off for closed captions. Because transcripts provide additional benefits for all students, the instructor may choose to make transcripts available in addition to captions, but it is not generally required.

Audio descriptions of videos are necessary for students who are blind or have low vision and cannot see the action on the screen. In some videos, a speaker or narrator may describe enough of the action that no further description is needed. If all important information cannot be gleaned by just listening to the sound, audio descriptions will need to be added.

Although transcripts can be easily done in-house, synchronizing captions and creating audio descriptions require more training and more specialized software, and should probably be outsourced. The chapter appendix provides URLs for information on finding an agency to caption or create audio descriptions for video.

Chat Rooms. Chat rooms can help replicate the energy of face-to-face classroom discussions. Students receive immediate feedback from the instructor and other students without waiting for a discussion board post or e-mail. They may also feel that they get to know each other better

because the feedback seems like a natural discussion. However, chat rooms can pose problems for some students with disabilities.

Text-to-speech software that many students who are blind use may not work with some chat rooms, depending on the software used. Even if the software is able to read the text in the chat window, listening to text read aloud is slower than reading silently. It may be difficult for blind students to keep up with a live chat room conversation.

Students who cannot use their arms or hands or have poor fine motor skills will also have difficulty with chat rooms. Online conversations tend to move quickly. Students may be able to type with time and effort, but the topics will likely shift before students can type their question or comment.

Some students with learning disabilities, hearing loss, or cognitive disabilities read slowly or need additional time to gather and compose their thoughts before responding. The fast pace of chat rooms may give them little time to read and respond before the conversation scrolls off the screen or moves to another topic. Students with disabilities who have poor spelling and grammar skills may be inhibited or embarrassed about typing mistakes and may avoid participating in the chat conversation.

Students with attention deficit disorder (with or without hyperactivity) may have problems maintaining focus. If they are distracted by something else in their environment, they will miss conversations that took place while they looked away from the screen. They may also have difficulty refocusing after a distraction.

But in spite of the difficulties for some students, chat rooms are a useful tool for online learning. One way to make chat rooms easier for students with disabilities is to have a moderator who controls the pace of the conversation. In some chat room programs, participants can press a button to indicate they want to make a comment or ask a question. The moderator can see which students have virtually raised their hands and call on them individually, making sure that each student has a chance to participate and time to type comments. This technique slows the pace of the conversation and provides access to students who need more time to read and respond.

If the chat system within the LMS does not meet the accessibility needs of students with disabilities in the course, other options for real-time interaction may be explored. Chat systems written in HTML and some instant messaging programs are more accessible to text-to-speech software.

Audio chats are another option, making it easier for students who have difficulty reading or typing. However, audio chat tools have problems of their own. Students with hearing loss will not be able to easily participate in audio chats. They are also difficult for students with speech impediments, auditory processing disorders, or cognitive disabilities who need more time than usual to process information.

Unfortunately there is no one-size-fits-all chat room option to date. The approach selected should be determined by the specific types of dis-

abilities the students in the class have. As a result, techniques may differ from semester to semester, depending on the needs of the students enrolled. In the case of chat rooms, finding a universal design approach may not be possible.

As a last resort, chat logs or transcripts can be provided for those who cannot participate. Most chat room software can keep a transcript of the conversation, and those logs are generally easy for the instructor to obtain and make available to students. Although participation in the live chat is preferred, transcripts of the conversation can provide students with the information discussed. In addition, students who read more slowly or are distractible will appreciate the ability to review information they may have missed, and the transcript can serve as a reference for all students.

Quizzes and Tests. Extra time on quizzes and tests is a common accommodation for students with disabilities. Most LMSs provide a way to create a duplicate test with a different time limit. The permissions for the test can be set so that students who need extra time see one test while the rest of the class sees the other.

General Web Accessibility

The recommendations addressed so far are specific to online courses, especially those managed by an LMS. But some instructors create a Web site for their course instead of, or in addition to, the LMS. This section provides general guidelines for Web accessibility. A Web designer or someone from the information technology support office may need to implement some of these features, but instructors who are aware of issues can bring them to the attention of appropriate staff.

Alternative Text. Alternative text is a brief description of a picture that can be seen by text-to-speech software and read aloud to students who cannot see the picture. When a mouse is rolled over a picture on a site, a text box should appear displaying the alternative text of that picture. If the text box does not appear, images can be turned off in the browser options, causing the text to display where the pictures normally appear. If the text says something uninformative such as "pic000123.jpg" or "Picture 1," consider the purpose of the picture. Determine the critical information that the picture conveys and how that information can be expressed in one or two short sentences. The alternative text should be changed to reflect the picture's purpose.

Also look for words that are actually images. For example, the button that returns students to the home page may be a picture of the word "Home" instead of text. The alternative text should match the displayed word exactly (that is, "Home," not "Picture of the word Home").

Use of Color. While color can be used to help convey information, students who are blind or color blind cannot see the colors, so the information must be delivered in another way. For example, a form that has

required information indicated in red could also have an asterisk by those items. A green button that starts an exercise could also be labeled "Start."

High color contrast between the text and the background is important for easy readability. Achieving this is more difficult than it sounds because some color combinations that appear to have high contrast to someone with typical vision may not be clear to someone with low vision or color blindness. The appendix at the end of this chapter has links to sites that can mimic different types of color blindness and suggest color combinations for high contrast. Also, avoid all patterned backgrounds because the clutter greatly reduces contrast. A simple test for contrast is to print out the page on a black and white printer and then make several generations of photocopies. If the text becomes difficult to read after a few copies, the contrast may not be high enough.

Data Tables. Similar to tables in word processing documents, the tools available for creating tables and charts on Web pages should be used instead of the tab key or space bar. Tables should be used to convey information, not to format the layout of the page. A good general rule of thumb is to use software tools for their intended purpose whenever they are available.

The first row or column of a chart or table can be used to provide headings to indicate the content of each row or column. For example, a person with typical vision can easily glance at a chart and see that it is a mailing list with names, addresses, and phone numbers. It is much more difficult for someone with impaired vision. Adding a heading to each column that says "Name," "Address," and "Phone" makes the chart easier for a person who is blind to understand and navigate. A Web designer can add code to make charts and tables even more accessible, but adding headings can usually be done easily when the chart or table is created.

Forms. A Web designer will need to add specific code to make forms accessible, but some simple techniques can be done by anyone using Web page creation software. For example, required fields on a form should be identified by an asterisk or the word *required* in parentheses after the label, not by visual cues such as color, italics, or bold type. Another technique is to provide the description of information to be entered before the entry box, not after. For example, the form should say "Name" followed by the space to type the name, not the reverse.

To determine the order in which the form will be read by text-to-speech software, start at the top and press the tab key repeatedly to move through the form. If the cursor does not progress in a logical manner, a Web designer can adjust the form. Some forms, such as log-in screens, have a time limit in which the information must be entered. A Web designer can add an option to request extra time to allow a person who types slowly the opportunity to enter the required information.

Drop-Down Menus. Drop-down menus need to have a Go or Submit button for students to press after highlighting their choice. Drop-down menus that automatically send users to the highlighted location when the

mouse button is released cause problems for students using text-to-speech software. Their software automatically takes them to the first option before having an opportunity to hear the other choices.

Link Names. In the early days of the Internet, almost every link said "click here." Today assistive technology allows students with disabilities to pull up a list of all the links on the page, allowing them to find a link quickly and easily. Unfortunately, a list of links that all say "click here" is not informative. A better practice is to make the link descriptive of the destination, such as "Home," "Apply for Admission," or "Contact Us."

Navigation. Starting at the top of the page and pressing the tab key moves the cursor through the page in the order that text-to-speech software will read the page. If the cursor does not move in a logical order, a Web designer may need to adjust the layout so the text-to-speech software will present the page in a more useful manner. If the navigation links are the same on every page, there should be a link at the top of the page that jumps directly to the main content. By clicking on this link, a student using text-to-speech software can avoid listening to the same menu again and again on each new page.

Mouse Dependency. Some students with disabilities are unable to use a mouse to navigate the computer screen. This may be because they cannot see the screen or do not have the physical ability to control the mouse. Students must be able to navigate and use the Web site with just the keyboard. Some pages use mouse-over links that show additional choices when the cursor is placed over a menu item. These types of menus should be avoided, or duplicate links should be placed elsewhere on the page.

Conclusion

Implementing these accessibility features when designing online courses saves time, money, and stress and benefits all students. Most of the techniques for adapting materials are simple to use, and even many people without much computer experience can do them. Although nothing will guarantee complete accessibility to all potential students, advance planning will reduce the number of individual accommodations needed when a student with a disability takes an online course.

Appendix: Additional Resources

Because Web addresses may change, a current and more extensive list of resources can be found at http://www.bethcase.com.

Captions and Audio Description for Video

Described and Captioned Media Program, http://www.dcmp.org/About/Vendors/Default.aspx

Color Use

AccessColor, http://www.accesskeys.org/tools/color-contrast.html
Lighthouse International, http://www.lighthouse.org/accessibility/effective-color-contrast/

General Web Accessibility

Web Accessibility Initiative, http://www.w3.org/WAI
WebAIM (Web Accessibility in Mind), http://www.webaim.org

Legal

Section 508.gov, http://www.section508.gov
United States Access Board, http://www.access-board.gov

Software Accessibility

Accessibility in Microsoft Products, http://www.microsoft.com/enable/products
Adobe Accessibility Resource Center, http://www.adobe.com/accessibility

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