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See table of contents

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Technical Evaluation Report

32: Using Internet Audio to Enhance Online Accessibility

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Distance Education and Online Accessibility

What constitutes online accessibility? Vanderheiden, Harkins and Barnicle (2002) indicate that accessibility involves the ability to use online content *without vision, without hearing, without pointing or manipulation, and without speech by persons with cognitive limitations, with language disabilities, with low vision and limited or no hearing, and with alternative languages*.

The impetus to provide accessibility in online learning comes from many sources. First and foremost, it is the moral thing to do. Houtenville (2003) indicates that 1 in 13 people aged 18-64 in the United States reports a disability; and this population may be expected to increase as the population ages. Blair, Goldmann and Relton (2004) report that 10 – 20 percent of post-secondary students in 2002 identified themselves as having a disability. Schmetzke (2001) found, however, that only 15 percent of 219 DE homepages examined with *Bobby* (an accessibility validation tool from the Center for Applied Special Technology) were free of major accessibility errors. Similarly, a study by the National Center for Education Statistics (2003) indicated that 95 percent of 2- and 4-year institutions offering distance education (DE) courses use websites for course delivery, but that only 18 percent of these sites ensured accessibility to a major extent. A recent British Disability Rights Commission study indicates that these trends still prevail, with more than 80 percent of websites unusable by persons with disabilities (Adams-Spink, 2004). Rowland, Burgsthaler, Smith and Coombs (2004), report the specific under-utilization of DE programs by disabled students, possibly due to the failure of those programs to adapt to their needs. DE institutions, no less than face-to-face (f2f) ones, should give accessibility issues a high priority.

It is also the right thing to do pedagogically. Anyone who has viewed a *PowerPoint* presentation on the Web can attest that slides without captioning and/or narration are usually not very informative to anyone. Accessible features can result in enhanced learning for all students (Nielsen, 2000). Accessible design benefits students with other disadvantages to learning besides physical limitations or learning disabilities. Burgsthaler (2002) indicates that students for whom English is a second language may have reading difficulties similar to individuals with certain learning disabilities; and Edmonds (2003) indicates that accessibility features can particularly benefit students who speak a different language from that used in the course, or who receive instruction from a non-native speaking instructor. Elderly learners can also benefit. In addition, educational institutions frequently require students (campus-based and virtual) to use online technology to access library catalogs, for example, and to obtain information from institutional websites. It is important that people desiring education not be caught, as Burgstahler (2001) states, on the wrong side of a "second digital divide" – i.e., without full use of technology, services and information. Economically, the individual, the learning institution, and wider society all benefit from greater accessibility to learning (Sonstein, 2003).

Other factors encouraging accessible online course design include legislation (Harrison, 1999), market forces (Broadbent, 2002), and the incidental effects of burgeoning technology (Blair, Goldman and Relton, 2004). Accessibility is being mandated by legislation in many countries. As workforce accommodations for physically and learning disabled persons have developed, there is a need for these workers to have access to skills training. Students and their advocates are demanding equitable access, particularly with the adoption of technology in the classroom, whether it is on campus or online. Burgstahler (2002) and Slatin (2002) make the point that developing DE technologies with accessibility in mind yields better access than, for example, attempting to retrofit existing webpages or courses. Software developers are actively working to meet these needs, with products that make commercial sense as well as benefiting disabled users. Audio streaming, for example, found an initial, large audience via, for example, Internet radio application, and is now becoming a valuable tool for accessibility purposes (*see the previous report in this series*).

What does the future hold for accessible learning? Olenick (2004) indicates that the next major step in Internet development will be the improved integration of sound into websites. Sound is already used to enhance websites, but Olenick sees it becoming "a normal, expected part" of the Internet experience (*see next section*). Cutting-edge technologies will certainly improve accessibility. Strandvall (2003) gives the example of a developing technology, the *Nomad Augmented Vision System*, by which screen images are projected onto a "virtual computer screen" that floats before the user's eyes. *VKey* (2002), similarly, is a virtual keyboard that can be incorporated into mobile devices, projecting a laser hologram of a regular QWERTY keyboard onto any flat surface. A tiny portable camera turns finger movements into navigation and text. Strandvall (2003) indicates that the use of mobile devices for "m-learning" will increase rapidly, for they are less expensive than desktop computers and permit flexible access from many locations. Vanderheiden and colleagues (2002) points out, however, that accessibility is not always be a high priority in the development of new information technologies. Indeed, new mobile technologies may actually hinder the accessibility challenge. The personal digital assistants (PDAs), for example, contain miniaturized keyboard features that are difficult for use generally, and have obvious accessibility issues.

Rowland and colleagues (2004) have summarized the situation for DE institutions in terms of three challenges:

- All standards must consider accessibility features
- Interoperability must be considered
- Standards must become widely known and enforced

And the message is being heard. Technology is improving access in regard to tactile graphic materials. Virtual reality tools and avatars are under development to supplant human interpreters by providing online sign language translation. Universal design principles are evolving to ensure that websites and online learning courses are accessible to all without the need for *post hoc* modification; and a range of accessibility standards and validation applications has been developed in this regard (*Appendix I*). Inherent in universal design is the need for accessibility not only of the general instructor-student interface, but also of the instructional components, including text, graphics, audio, and video. Universal design principles also assist the learning of persons without disabilities and those experiencing situational limitations such as noisy environments or the need for hands-free access (Burgstahler, 2001).

Voice-Over-IP and Accessibility

Particularly valuable in the enhancement of online accessibility is the Voice-over Internet Protocol (VOIP) medium. VOIP compresses analog voice data and converts it into digital packets for transmission over the Internet, enabling speech, language translation, transmission of voice cues and emotion, as well as hands-free and eyes-free navigation. Other types of digital data, including graphics and video, may be transmitted along with the audio, enabling a wider range of communication media. The combination of audio and text, for example, permits the use of text chat, speech-to-text (STT), and text-to-speech (TTS) methods of value to users with disabilities. While often expensive to implement, TTS, STT, and captioning technologies provide an enormous amount of added accessibility. They can meet a variety of learning styles and benefit persons with visual, hearing, and speech impairments, and dyslexia. VOIP with video enables not only the incorporation of cues such as lip reading and sign language (using relay services for the deaf), but also para-linguistics and non-verbal communication. Vanderheiden, Harkins and Barnicle (2002) state that "providing only the 'words'... may not communicate the full or intended message. Capturing... paralinguistic and non-verbal aspects when using text communication or translating from speech to text" provides more effective and accessible communication. Chong, Tosukhowong and Sakauchi (2002) indicate the value of STT and TTS techniques for enhancing student understanding of non-native instructors in, for example, online synchronous chats.

Particular features of VOIP with value in DE settings are: the reduction of long distance telephone costs to individuals and groups for online meetings, and the capability of using Web-cams. Various applications can be integrated including telephone, voice-mail, email, and text chat. Users can keep one telephone number that can be accessed from any computer with the VOIP software. Use of Extensible Markup Language (XML) allows open source software (OSS) applications to be created. A problem with VOIP is the fact that currently it is replacing a familiar technology, the telephone, with an unfamiliar one. It is reliant on Internet technology, and often on the need for costly broadband access. It requires all parties to use the same VOIP software; and VOIP often involves time delays due to variable routing of packets over the Internet, and it is not sufficiently reliable at this time for emergency calls. A particular delay problem occurs when students use a variety of bandwidth speeds for downloading (Foreman, 2003).

In improving online accessibility, course designers also need to consider that students will require additional assistive hardware. In the incorporation of video with VOIP to allow real time sign language transmission, for example, users need to possess a Web-cam; and in text translation a Braille device may be needed. Other assistive devices include alternative keyboards, pointing devices, and extra large monitors. Eilers-Crandall and Aidala (2000) indicate, however, that many Web-cams are not suitable for sign language owing to the speed of sign conversations, computer processing speed, and quality of Internet connection. This is important to recognize, because many sign language programs incorporate the use of relay services to connect to human interpreters, rather than using purely digital signing routines. In these relatively early days of VOIP software development, the question of interoperability also remains a consideration. It is important that the applications to work with *Macintosh* as well as *Windows* assistive technologies. A current problem with voice-recognition software is the fact that it needs to be laboriously "pre-trained" for efficient voice recognition. General VOIP accessibility barriers are outlined by Inclusive Technologies (Voice over Internet Protocol [VOIP] Accessibility). These barriers should be considered when choosing VOIP hardware and software.

- No carrier (telephone company) operation means less documentation and customer support

- Limited product support training can result in less customer support
- Poor signal compatibility with the standard telephone system
- Many VOIP phones cannot connect to the standard system
- Captioning and video description may not be available
- Some networks and routers do not allow VOIP
- Some VOIP phones are not compatible with screen readers
- Some VOIP phones rely on hardware displays or soft-keys with contextual meanings making them inaccessible for those with vision problems
- Some VOIP phones use touch-screens or other hard-to-use controls for operation, making them inaccessible for those with vision or mobility
- Problems for those using prosthetics
- Small or hard to read displays for those with limited vision or hearing difficulties
- Hardware installation may be hard to understand for those with cognitive difficulties
- Arranging peer-to-peer services is complex
- Graphics-rich screens may be hard to understand
- Some VOIP systems do not provide alternative audio for visual information
- Some VOIP phones incompatible with screen readers, magnifiers, and/ or high-contrast settings
- Some VOIP phones use moving text, which is not compatible with screen readers
- Some VOIP phones do not provide alternative visual display for audio
- Poor audio quality may result in unintelligible information
- Loss of synchronization between audio and video makes speech reading difficult
- VOIP headsets without a separate headset jack means audio cannot be turned off, and does not allow for external audio processing
- PC use may increase interference

It is important to provide the VOIP industry with motivation to address social responsibilities such as accessibility, quality of service, and universal service. This may require regulation. The United States Federal Communication Commission recently held a Solutions Summit (May, 2004) to examine accessibility issues. VOIP has also been the topic of two Solutions Summits arranged by the US Federal Communications Commission (FCC, 2004) to address concerns about accessibility for persons with disabilities. These Summits have questioned whether VOIP should be regulated, whether it is needed to ensure accessibility to persons with disabilities, and whether it is feasible.

Conclusions

Accessibility to online education programs is an important factor that requires continued research, improvement, and regulation. VOIP applications provide significant opportunities to increase the accessibility of online distance education, by virtue of the additional features they incorporate.

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The next report in the series reviews authoring tools used in the creation of online learning environments.

N.B. Owing to the speed with which Web addresses become outdated, online references are not cited in these summary reports. They are available, together with updates to the current report, at the Athabasca University software evaluation site: *cde.athabascau.ca/softeval/*. Italicised product names in this report can be assumed to be registered trademarks.

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