Making Online Learning Accessible for Students With Disabilities

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In a matter of minutes, and with her fingers moving rapidly over the keyboard, Mrs. Pierce sends initial feedback to a student on his multimedia project, posts questions on an online discussion board, and records a video tutorial for an upcoming assignment. A student's father also has requested additional practice modules for his daughter, who is struggling with a new unit. After spending most of her career teaching fifth-grade science, Mrs. Pierce has been enjoying her first year as an online teacher in her district's new full-time online school. Proud of the impact she is having on her students' growth and achievement, she is confident in her ability to reach a variety of students using a powerful set of web-based tools and resources. Students appear engaged and much of their work indicates they are progressing. Although this seems to be true for most of her students, Mrs. Pierce has noticed certain students are not progressing, despite the increasing levels of support she has provided.

While reflecting on all of the enhancements she has made to her lessons, Mrs. Pierce is caught off guard when she opens an e-mail from her principal. The message informs Mrs. Pierce that some of the resources used in her online classes do not meet the district's accessibility standards. Mrs. Pierce is baffled: How can her curriculum and lessons—so rich, interactive, and technology-infused—be restricting student access? After talking with her principal, she is surprised to learn that digital resources are not guaranteed to be accessible resources, despite appearing to be far more flexible and adaptable than traditional print resources. Mrs. Pierce wonders if it's possible that the very tools and learning systems she uses to teach might be jeopardizing some students' access and success in her class. She decides that she will first need to understand the barriers present in certain environments and then identify tools that will be helpful in assessing and selecting accessible online resources in the future.

Growth of Online Learning

Online learning opportunities gained prominence in the early 1990s and online educational opportunities for K–12 students continue to grow at a rapid pace. Even in traditional schools, using the Internet for teaching and learning is now a common instructional approach. As these resources become increasingly available and further refined, online learning opportunities potentially could become even more of a staple in the educational landscape. Currently, 31 states offer statewide full-time virtual schools, enrolling an estimated 275,000 students (Watson, Murin, Vashaw, Gemin, & Rapp, 2012). In fully online schools, teachers lead instruction over the Internet from separate locations using soft ware and web-based educational delivery systems to facilitate

the learning environment (Watson et al., 2012). Online interaction between teachers and students is either *synchronous*, with teacher–student interactions occurring in real time (e.g., video chat), or *asynchronous*, with interactions occurring at different times (e.g., e-mail). Another approach to online education, blended learning, combines online learning opportunities with more traditional, face-to-face settings. Blended learning programs include (a) online delivery; (b) some degree of student control over the time, place, path, or pace of content and instruction; and (c) supervised brick-and-mortar locations where at least some of the learning occurs (Stalker & Horn, 2012).

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Just as teachers in brick-and-mortar schools need to make choices about the content and instructional approaches, online educators must also decide how best to teach content and skills to help students achieve their learning goals. Despite the growing acceptance of online learning opportunities and the enthusiasm surrounding emerging educational

technologies, the importance of the teacher cannot be overlooked: The teacher remains a key factor in a child's education.

The decisions educators make regarding online instructional resources are perhaps more critical to students' success than decisions about print-based materials because learning occurs exclusively through and within this environment. That is, the interaction between students and teachers—a relationship at the heart of education—depends on a teaching and learning environment that is fully accessible to the widest possible range of learners. As a result, the tools in an online environment often determine whether or not students with disabilities will be able to access and participate in the learning experiences. Unfortunately, the many benefits associated with these technologies come with an array of accessibility challenges as well. Many online classes use resources that have not yet been closely examined for accessibility because teachers and parents often view the web as an equalizing and accessible platform. Nevertheless, this ease of access is simply not the case for many web-based tools and content. Therefore, knowing how to identify and select accessible online tools is critical to creating and implementing online learning environments for all learners.

Advantages of Online Learning Environments

A prominent feature of digital learning environments is the ability to present content in multiple ways—one of the major principles of universal design for learning (UDL; Rose & Meyer, 2002). The combination of audio, video, text, and other means to convey meaning has the potential to provide students, with a range of abilities and disabilities, greater access to curricula and learning opportunities and additional ways to demonstrate their understanding when multiple options for student expression are made available (Bruce et al., 2013).

With more immediate access to student performance data, teachers can customize the pace and focus of

Figure 1. Students Classified as Having a Disability in Virtual Schools and Schools Across the United States
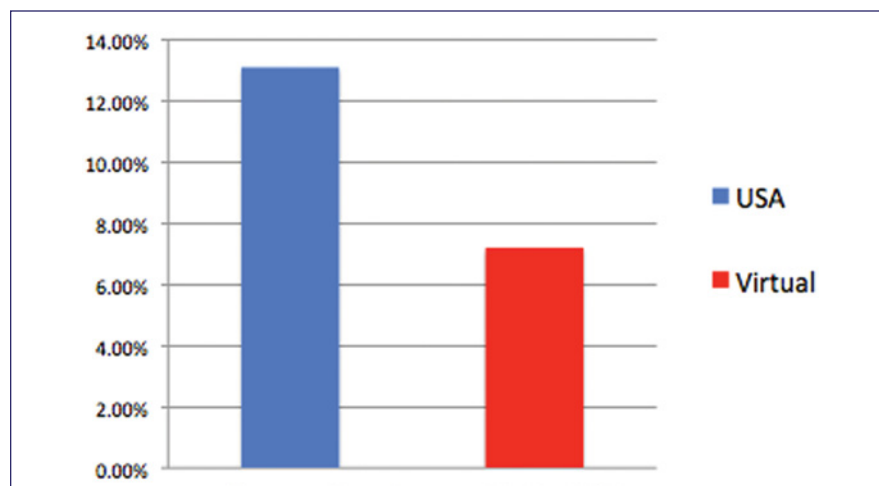
Note. Adapted with permission from *Virtual Schools in the U.S. 2013: Politics, Performance, Policy, and Research Evidence*, by A. Molnar et al., p. 28. Copyright 2013 by National Education Policy Center.

instruction to best meet students' unique learning needs (Bienkowski, Feng, & Means, 2012). These changes in the environment have the potential to help teachers individualize instruction based on student data, but these benefits can only be extended to those students who can access and participate in online learning. Too often, as Mrs. Pierce learned, the benefits associated with online learning remain out of reach for some students without accessibility in mind. The significant barriers presented by many online learning systems and resources currently limit the power and potential of online learning to transform education (Center on Online Learning and Students With Disabilities [COLSD] 2012).

Potential Barriers in Online Learning Environments

Although the digital divide is becoming narrower in the sense that students have greater physical access to technology, those who are unable to use it are at an even greater disadvantage because of the central role technology plays in society at large (Conole, 2012). Developing proactive approaches toward this goal means that decision makers must first be aware of accessibility barriers learners with disabilities can face within digital

learning environments. Only with this knowledge can teachers like Mrs. Pierce be prepared to make effective instructional decisions that will address students' learning needs within digital environments. COLSD—a federally funded organization exploring accessibility issues in elementary and secondary online environments—found that a vast majority of online learning systems designed for these grade levels present content that is not appropriately designed for, or accessible to, many students with disabilities (COLSD, 2012). Therefore, it is not surprising that students with disabilities are enrolled in full-time virtual schools at a rate that is about half of their enrollment in brick-and-mortar settings (see Figure 1; Miron et al., 2013). Students enrolled in virtual schools may also choose not to disclose their disability status, thus complicating efforts to measure the true participation and outcomes of students with disabilities in virtual schools. Although a small percentage of full-time online schools report a high number of students with disabilities, most have a smaller proportion of students with disabilities than exists in traditional classrooms. Many full-time virtual schools in particular and online learning environments in general do not have the capacity to adequately accommodate students with moderate to severe

disabilities (Shah, 2011). Although the number of formal special education and civil rights complaints relating to these issues are few, some evidence is emerging to suggest that this is an issue on the horizon (Martín, 2011). One reason for the low participation rates of students with disabilities in online learning programs may be the accessibility challenges these environments pose to students with disabilities, especially those who require accessible instructional materials (AIM).

Unfortunately, traditional approaches schools and teachers often use to provide students with AIM cannot easily be applied to online learning environments (COLSD, 2012). For quite some time, national, state, and private entities assisted educators in creating or acquiring accessible versions of print materials (e.g., National Instructional Materials Access Center [NIMAC], Bookshare, Learning Ally, American Printing House for the Blind). Print-derived AIM resources are well known to districts and help students with disabilities gain access to otherwise inaccessible instructional materials. In contrast to the well established networks that are used to create accessible print materials, digital environments designed without accessibility in mind are nearly impossible to retrofit due to the cost, expertise, and technology required for such an undertaking. As a result, educators wanting to leverage the benefits of digital learning environments need to know how to evaluate the accessibility of the online systems and resources they plan to use in order to select resources that are, by design, accessible to all students. Had Mrs. Pierce known more about accessibility requirements for online environments, she would have been better able to choose resources that could enable, as opposed to restrict, her students' participation in online learning.

Accessibility in Online Environments

Requirements for Accessible Online Resources

In 1998, the Rehabilitation Act of 1973 was amended by Congress to include enforceable standards to ensure that technologies—both hardware and software—purchased by the federal government are accessible to and usable by individuals with disabilities. Although Section 508 requirements apply only to federal government purchases, any state receiving funds through the Technology Related Assistance for Individuals With Disabilities Act of 1988 (better known as the "Tech Act") are also subject to these requirements. In recent years, the U.S. Department of Education's Office for Civil Rights (OCR) has been increasingly attentive to the challenges presented by inaccessible digital curriculum materials, their online delivery systems, and the mobile devices that deploy them (U.S. Department of Education, Office for Civil Rights, & U.S. Department of Justice, Civil Rights Division, 2010). In May 2011, OCR clarified the specific legal requirements relative to digital curriculum resources:

> —equal opportunity, equal treatment, and the obligation to make accommodations or modifications to avoid disability-based discrimination—also apply to elementary and secondary schools under the general nondiscrimination provisions in Section 504 and the ADA. The application of these principles to elementary and secondary schools is also supported by the requirement to provide a free appropriate public education (FAPE) to students with disabilities (OCR, 2011, p. 3).

Although the OCR guidance document does not restrict a school from acquiring or using inaccessible technologies (noting instead that an educational institution may provide students with disabilities other accommodations or modifications that provide educational benefits that are similarly effective and integrated), transforming inaccessible digital curriculum into accessible formats may well be beyond the scope and capabilities of most elementary and secondary schools. As a result, ensuring that digital materials, delivery systems, and devices are accessible from the outset is a far more cost- and time-effective strategy. To accomplish this practice approach to accessibility, educators need tools and resources that will be helpful in evaluating and identifying resources prior to purchase and implementation. Although Mrs. Pierce's district seemed to be aware of accessibility requirements at some level, she still would have benefited from having tools to help her choose more appropriate online resources for her students.

What Is a Voluntary Product Accessibility Template (VPAT)?

To help educators meet the expectations contained within Section 508, VPAT was created to share specific product accessibility information with educators and others seeking to acquire accessible materials. Too often it is difficult to gauge whether technology is accessible to individuals with disabilities and difficult to determine for which disability categories the accessibility features are designed to support. Section 508 requires that devices and software provide a functional alternative for product use for each of these sensory capabilities—vision, hearing, and speech—and an alternative to fine motor control and simultaneous actions. A well-designed VPAT should identify the ways in which a device or software can be used by individuals with visual impairments, hearing impairments, or who have limited mobility. Conversely, the tool could be used to identify a device or software platform that cannot be used by an individual with sensory or motor disabilities. In either case, an accurate VPAT is designed to help users understand important accessibility information that would not be immediately apparent from a typical product description or general evaluation.

Now that Mrs. Pierce knows more about accessibility, she is interested to learn whether or not a software product or device she is considering using has been designed with accessibility in mind, and if so, for whom. In this case, a VPAT is a good place to begin. As tablet devices such as the iPad are increasing in popularity, knowledgeable vendors are

producing detailed VPATs to assist teachers and other decision makers. In the case of the iPad, Apple's VPAT for the iPad4 notes that it comes equipped with a built-in screen reader called VoiceOver that allows a nonsighted user full navigation and touch screen control, voice recognition software in the form of Siri for user voice input, Zoom screen magnification, and output capability in braille-ready format (.brf) to a refreshable braille display via Bluetooth.

When trying to compare digital tools and other resources, a VPAT can provide a predictable and detailed product overview and make product comparisons much easier. A VPAT represents a developer's impressions of its product's access features that may or may not have been tested by individuals with disabilities.

VPAT Resources

To provide educators with a more direct way to obtain product VPATs, COLSD created and maintains a VPAT table on its website at http://centerononline learning.org/resources/vpat/.

This "Quick Guide to Accessible Products in Education" is a collection of over 70 products often used in elementary and secondary online learning: content and learning management systems such as Desire2Learn, Canvas K–12, and others; blogs; content area products such as Symphony Math, SuccessMaker, and so on document creation tools such as iBooks2 and Microsoft Word; eBooks and eBook readers; and other instructional materials. Products are displayed in a table format and categorized by the extent to which accessibility information is readily discoverable in their product information or on their respective websites (see Figure 2).

The table itself is dynamic and the column headers serve as clickable categories for rearranging the table according to the header type. For example, as shown in Figure 3, the table could be configured by product and vendor, VPAT status, note, category, etc.

Associated with each product is an Updated column that provides the date of the most recent product review; the Responded column refers to whether a product's vendor responded to the Center's inquiry asking if the product designation was accurate. The VPAT Table is designed to provide stakeholders—educators and vendors alike—with an entry point for determining the degree to which a product may be appropriate for use in a school or classroom that seeks the active and full participation of students with disabilities. Developing an awareness of issues related to online accessibility is a necessary step in helping ensure students with disabilities gain access to the online resources required for their success, yet it is insufficient— for meaningful change to occur. Before choosing online learning products and resources, teachers and other technology purchasers and implementers can refer to the VPAT table to determine whether resources intended for use are accessible by students with disabilities, then select the resources that allow all students to fully engage in the learning process.

Additional Accessibility Resources

In addition to the VPAT table, teachers can use other resources to help them evaluate and select accessible online resources. The site Wave.WebAIM.org hosts WAVE, a web-based tool to evaluate websites' accessibility strengths and identify aspects of a website that are in need of improvement. WAVE operates via the webaim.org website's browser-based interface and server(s). Users check a site by copying and pasting its web address into a search

box, and WAVE then scans the site for various accessibility features. Upon scanning a website with WAVE, a color-coded general summary of the site's accessibility features can be found on the left side of the screen (see Figure 4).

On the right-hand side of the screen, red, yellow, and green icons appear, shown as an overlay on pages throughout the website, and enable users to see which elements of the web page are accessible and which features might need further accessibility modifications. Red icons indicate blatant access errors, yellow icons represent potential areas of concern, and green icons identify accessibility features that are appropriately built into the website. The color-coded summary report provides individuals who are not accessibility experts an informative overview, while the more detailed page views provide additional details that can be helpful for those wanting to perform a more thorough evaluation. Teachers, whether online or using resources in class, can use this tool to ensure all students have access to content.

Although programmers do use the WAVE tool, educators can focus on three features that WAVE targets to help them better assess their web-based resources: selectable text (i.e., whether or not text can be identified and read by a screen reader), logical navigation order (i.e., the order in which items in the document would be voiced by screen readers), and text equivalents for images (i.e., the extent to which alternate text descriptions are provided for each nontext item such as images and videos). These are not the only features required by Section 508 guidelines, yet a quick scan for these basic elements will provide a snapshot of a website's accessibility. WAVE

Figure 2. VPAT Information Key

| Green | A Voluntary Product Accessibility Template (VPAT) was available on the product's website |
| Yellow | Product accessibility information was available but no VPAT information was listed |
| Red | No product accessibility information was listed |

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Figure 3. VPAT Table Sample

Product & Vendor	VPAT	Note	Category	Distribution	Updated	Responded
Adobe Acrobat XI Pro **Adobe Systems Incorporated**	VPAT Info		PDF Converter	Commercial	6/27/2013	Y
Adobe Digital Editions **Adobe Systems Incorporated**	VPAT Info		eBooks/eReader		6/25/2013	Y
Adobe Reader XI **Adobe Systems Incorporated**	VPAT Info		PDF Viewer	Commercial	6/27/2013	Y
ATutor **ATutor**	VPAT Info		Content/Learning Management	Open Source	6/25/2013	Y

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Figure 4. WAVE Summary Screenshot
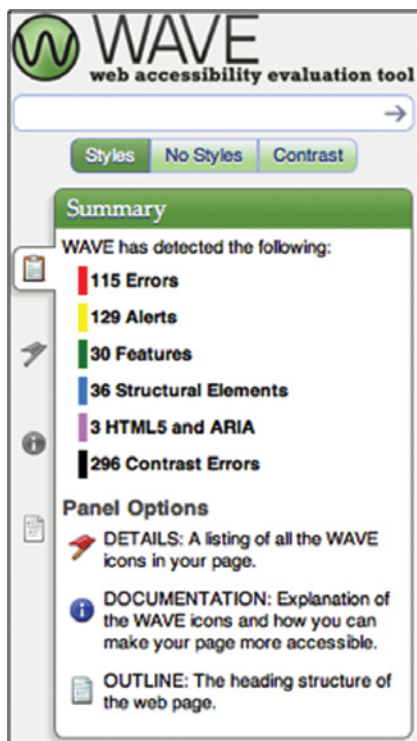
represents a valuable tool for teachers as web-based activities are increasingly incorporated into curricula for students across the K–12 spectrum, including face-to-face educational settings. By selecting resources that have the widest array of accessible features, teachers can ensure that their carefully crafted learning experiences will be supported—not thwarted—by the technology they choose to harness. Although these three features are by no means all encompassing, they represent some of the most common

barriers individuals with physical and sensory barriers face in online learning.

Just as teachers' roles within online learning environments are changing to reflect the facilitative nature of online teaching, parents too are assuming more active roles in their children's online education. Parents often support online learning activities to a greater extent than they would more traditional activities and may also benefit from increased awareness of online accessibility issues. Teachers in online programs might also consider how best to effectively share their knowledge and understanding of online accessibility so that students might be guided by informed adults at all points in their learning process. The approaches to assessing and selecting optimal online resources covered here could help teachers, parents, schools, students, and other stakeholders choose products and resources designed with accessibility and equity in mind.

The National Center on Accessible Instructional Materials (www.aim.cast.org) has initiated a Purchase Accessible Learning Materials (PALM) initiative that focuses specifically on reinforcing the importance of selecting and acquiring only materials, systems, and devices that incorporate accessibility. The PALM web pages offer a collection of handouts, PowerPoints, and general guidance documents targeting different audiences—educators, purchasers, families, and advocates—and provide sample language for curriculum materials purchasing contracts. With more educational technology available, schools need the input and expertise

from a wider array of stakeholders. Resources such as the VPAT, WAVE, and PALM are important tools to ensure accessibility remains at the forefront of the decision-making process and that educators have the means to select the most appropriate and accessible materials for teaching and learning.

Accessibility in Action

Mrs. Pierce's discovery, that aspects of the media-rich, interactive, and engaging curriculum materials available in her district's online school, while appropriate for many students, create significant barriers for others, is not uncommon. Currently, in brick-and-mortar classroom settings, teachers, paraprofessionals, library personnel, or assistive technology specialists routinely customize or transform print materials into accessible versions. As previously mentioned, applying these local and practical approaches to digital materials and delivery systems is generally well beyond the expertise and technical capabilities of educators. Consequently, educational materials and the systems that deliver them must have accessibility designed into them from the outset.

As a starting point, educators can use a variety of free tools to evaluate whether their existing digital resources are accessible, and also to ensure the new materials they create are designed in ways that allow the full array of learners to access and achieve. The following sections detail how these tools can be used to evaluate existing resources (see Table 1) and how teachers can create accessible digital

Table 1. Resources for Evaluating Accessibility

Domain	Evaluative Tool	Resource Location
Purchasing/materials acquisition	PALM guidance resources	http://aim.cast.org/learn/practice/palm#.UkERiRbT0ts
Learning Management Systems (LMSs)	VPAT Cannect	http://centerononlinelearning.org/resources/vpat/ http://projectone.cannect.org/online-education/lms-accessibility.php
Website content	WAVE	http://wave.webaim.org
Open Educational Resources (OER)	Achieve rubrics	http://www.achieve.org/files/AchieveOERRubrics.pdf

content (see Table 2). Different types of digital resources (e.g., learning management systems, LMSs; media files; websites) have specific accessibility considerations. Table 1 and Table 2 provide an overview of the different kinds of accessibility challenges teachers might face and suggest accessibility resources that can be used to address each kind of challenge. With this knowledge, teachers can take a more effective and proactive approach to integrating technology into their practice.

> **Just as teachers' roles within online learning environments are changing to reflect the facilitative nature of online teaching, parents too are assuming more active roles in their children's online education.**

Evaluating Accessibility: LMS

Mrs. Pierce decided to acquaint herself with the accessibility features of the LMS used by her district. For a foundational understanding, she was directed to a comprehensive resource, *Common Accessibility Issues With Learning Management Systems* created by Cannect.org. The Cannect resources are designed to support LMS access by students with blindness or visual impairments, and the accessibility required to meet the needs of these students may be more extensive than those required by students with other disabilities. Nonetheless, they offer a solid knowledge base for orienting educators to important issues presented by these systems. By exploring the Cannect resources, Mrs. Pierce discovered two factors related to the LMS that were immediately relevant to her students.

First, she discovered that onscreen selection and navigation elements (e.g., menus, buttons, hyperlinks, etc.) could be cycled through from top left to bottom right, using the keyboard's < tab > key, and that once highlighted, these elements could be activated by pressing the < return > or < enter > key. This discovery proved extremely useful, as she was aware of three students in her classes who often had difficulty using a mouse for this purpose. Second, she learned that all of the LMS's onscreen text—prompts, help pages, instruction, and others—was "selectable"; it could be highlighted and copied, meaning it was suitable for use with software that was designed to read text aloud. This meant that students who might struggle with reading or word recognition could augment their understanding by having the text read aloud to them, if necessary. With this heightened understanding of some of the accessibility issues, Mrs. Pierce was able to appreciate the fact that the district's LMS met Section 508 accessibility expectations and had, as a requirement of the district's procurement policies, a VPAT on record.

Evaluating Accessibility: The Content

In many online school settings, the LMS provides the structure through which curriculum content is delivered, and accessibility issues can emerge in either component. In Mrs. Pierce's class, the core fifth grade science content is

created by commercial vendors, and Mrs. Pierce supplements the core material with Microsoft Word documents, PowerPoints, and other web-based resources. She decides to establish and document a sequential approach to auditing these resources for accessibility.

Evaluating accessibility in commercial curriculum materials. Her first step with the core science content is to contact the product's sales representative and ask if the vendor has addressed accessibility and, if yes, whether that information is publicly available in a VPAT or other form. She knows that curriculum materials for science usually contain extensive images and graphs, and she wants to make sure that each of these visual depictions has an associated text equivalent—an essential feature for students who cannot see the graphic, and a beneficial feature for all students, as it provides multiple representations of information. Similarly, she wants to make certain that the video segments embedded throughout many lessons are captioned. A caption file is different than a transcript in that it contains time codes that allow it to be synchronized to the video file. Transcripts have no time codes. Although captioning videos is generally outside the scope of a teacher's responsibilities, free tools and services like YouTube's Add Captions functionality (https://support.google.com/youtube/answer/2734796?hl = en) may prove useful as an efficient way to address captioning needs for educators who create their own instructional videos. Unfortunately, many vendors of online materials do not produce captioned videos, nor do they offer caption files or transcripts, despite the fact that a

Table 2. Tools for Creating Accessible Resources

Domain	Creation Tool	Resource Location
Word documents	WebAIM How-to guide	http://webaim.org/techniques/word/
PowerPoint documents	WebAIM How-to guide	http://webaim.org/techniques/powerpoint/
Digital media files	AccessIt	http://www.washington.edu/accessit/articles?1251
Captions	YouTube help Add captions	https://support.google.com/youtube/answer/2734796?hl = en
Digital books	Center for Applied Special Technology (CAST) BookBuilder	http://bookbuilder.cast.org/
Curricular materials (general)	CAST UDL Studio	http://udlstudio.cast.org/
Website content (Advanced)	* Xerte Online Toolkits	http://www.nottingham.ac.uk/xerte/toolkits.aspx
	* FLUID	http://fluidproject.org/products/infusion/
OER resources	* FLOE Handbook	http://handbook.floeproject.org/index.php/Home

Note. An asterisk denotes more advanced application.

number of states and existing education and civil rights laws require them.

Evaluating OERs. When seeking out relevant science-related OERs, Mrs. Pierce has discovered large online aggregators of OER resources (e.g., Curriki, Ck-12, OER Commons, MyOER) provide a search function aligned to specific state or Common Core standards. In particular, she has come to view OER Commons as an extremely valuable resource due to its partnership with Achieve.org. The not-for-profit Achieve.org has created a set of eight rubrics to support the selection of OER resources (http://www.achieve.org/achieve-oer-rubrics). Achieve partners with OER Commons to host the rubric on its site as a resource evaluation tool. By using the Achieve rubrics, online tool ratings accompany the curriculum materials available from OER Commons. The Achieve rubrics are not only designed to assess OERs' alignment with the Common Core State Standards, but Rubric VIII is specifically designed to identify the accessibility features of the resource. Achieve.org has published a document detailing the best use of its rubrics, and this contains a detailed and valuable "Accessibility Checklist" that Mrs. Pierce uses, and she attaches a copy of

her resource accessibility review to her record of curriculum files.

Creating Accessible Materials

Teacher-made resources and OERs. Because Mrs. Pierce often customizes commercial resources by adding Microsoft Word or PowerPoint files, she recalls that the WebAIM project (developers of the WAVE tool referenced previously) offers two clear and easy-to-follow "how to" guides for creating accessible Word (http://webaim.org/techniques/word/) and PowerPoint (http://webaim.org/techniques/powerpoint/) documents. For both of these types of files, adding document structure—markers within the text that indicate a logical hierarchy, emphasis, or navigation feature—not only makes them usable by nonsighted students but enhances document layout and design. In the case of Microsoft Word, using elements from the Styles menu—heading Levels 1, 2, 3, etc.—creates a document that can be navigated header by header, and allows for the automatic creation of a Document Map and a Table of Contents, both clickable. Similarly, utilizing preformatted slide templates in PowerPoint assures that text elements on the visual slide appears

as text elements in the Outline view, which allows for the text to be read aloud in the correct sequence. In either application, text equivalents or captions can be created for graphic elements, further enhancing both accessibility and learning options.

With respect to web-based materials, Mrs. Pierce has learned that a quick scan using the WebAIM WAVE tool allows her to check to make sure (a) the text of the resource is selectable (and therefore able to be read aloud), (b) graphical elements have an accompanying text equivalent (usually referenced as < ALT >, which means "alternative text"), and (c) the resource has headings that give it a logical structure. If the resource contains videos or animations, she can also check for captions or transcripts: Depending on the media player or media format, she refers to the AccessIT resource, "How do I turn on captions and audio description in my media player?".

Creating accessible curriculum resources. Mrs. Pierce only occasionally creates her own instructional materials to supplement the commercial and open source science content she uses with her students, but her growing comfort with digital media leads her to think

she may do more of this in the future. A colleague who routinely creates digital materials for online learning, and who is aware of the importance of "designing in" accessibility supports from the outset, suggests some free resources.

Among its many offerings aimed at supporting teaching and learning for all students, CAST hosts two user-friendly content creation tools designed with both accessibility and UDL features in mind. The UDL BookBuilder (http://bookbuilder.cast.org/) and the UDL Studio (http://udlstudio.cast.org/) facilitate the creation of digital books and curriculum projects, respectively. The accessibility features ensure that resources developed with these tools are appropriate for students with physical and sensory access needs, whereas the UDL supports allow a content creator to embed learning scaffolds that enhance the saliency of important ideas and content, activate background knowledge, and create the right balance of support and challenge. Both online tools offer models for implementing the UDL Guidelines (National Center on Universal Design for Learning, 2011)—step-by-step instructions—and comprehensive background information on the effective use of differing types of digital media—text, audio, images, and video to achieve instructional goals.

BookBuilder specifically targets the creation of digital books that can be read online or off. Digital books created in BookBuilder can also be shared online or downloaded and distributed via CDs, flash drives, or other portable media. UDL Studio provides a frame for curriculum development with features that facilitate comprehension (e.g., highlighting, accessible text, vocabulary support), encourage action and expression (e.g., note taking, prompts for writing, drawing, and audio recording), and recruit and sustain engagement (e.g., video, teacher feedback, collaborative whiteboard). Similar to BookBuilder, UDL Studio projects can be saved in a private folder, shared with particular individuals or groups (e.g., departmental colleagues, grade-level teams, coteachers), or published to a public library of UDL Studio projects where others can browse, read, and interact with projects created by UDL Studio users and exchange ideas and best practices. Tools such as these can help teachers like Mrs. Pierce ensure they create accessible materials that will be usable by the widest possible array of learners, while reducing access barriers from the outset.

Mrs. Pierce is also made aware of two additional, but technically complex, open source content creation resources. First, the Floe (flexible learning for open education) Project at Ontario College of Art and Design (OCAD), University of Toronto, offers a resource for OER creators, the *Inclusive Learning Design Handbook* (n.d.). This resource guides the accessible creation of OERs using a wide variety of media: text, audio, images, and video. An associated content creation tool, FLUID Infusion (http://fluidproject.org/products/infusion/), is available for creating accessible web-based resources suitable for use with students, including those with disabilities.

Second, the Xerte Online Toolkits (http://www.nottingham.ac.uk/xerte/toolkits.aspx), from the University of Nottingham in the United Kingdom, offer a suite of open source templates and guides for creating interactive learning materials suitable for display on both desktop and mobile devices. Like Infusion, Xerte is built to address sensory and physical access needs, and Xerte projects have a range of accessibility benefits (e.g., color and font changes, keyboard access, and text to speech) built in from the beginning. Both Xerte and Infusion present a steeper technological learning curve than some other content creation tools, but they produce highly customizable and responsive resources as a result.

With an increasing emphasis on personal learning networks, ongoing professional development, and reflective teaching practices, online accessibility awareness can become a topic of school- and district-wide conversation as well.

Mrs. Pierce now believes that she has identified an array of practical and cost-effective approaches for reviewing and enhancing curriculum resources developed by others or that are in current use in her school. Moving forward, as she continues creating content for her classes, Mrs. Pierce is also confident that she herself can create digital learning materials that offer a high degree of accessibility,

enabling all students to benefit from her teaching. With a better understanding of the procedures and documentation process for both evaluating and creating resources with accessibility, Mrs. Pierce is now in a position to make more informed decisions about the digital learning resources she uses in her teaching.

Conclusion

The growing presence of K–12 online education programs is a trend that promises to increase flexibility, improve efficiency, and foster engagement in learning. Students with disabilities can benefit from dynamic online educational environments, but only to the extent that they can access and participate in the learning process. As students with disabilities' enrollment in full-time virtual schools may not be keeping pace with the enrollment rates of their typically developing peers, educators are becoming better at identifying the barriers to access that may be partly responsible for this current scenario. The future landscape of K–12 online education therefore represents both challenge and opportunity for students with disabilities.

As teachers hold immediate responsibility for implementing the goals and supports outlined in students' individualized education programs, their actions are a pivotal starting point from which informed instructional decisions can be made. With an increasing emphasis on personal learning networks, ongoing professional development, and reflective teaching practices, online accessibility awareness can become a topic of school- and district-wide conversation as well. The guidelines and resources identified here help decision makers reframe online resource selection in terms of accessibility—an essential first step in broadening participation in online learning programs. This perspective can also promote the selection of digital learning resources that emphasize inclusion and access needs over flashy products and strong product marketing campaigns. Ideally, the demands for accessible online learning resources will also spur educational programmers and

designers to create more online learning products that can level the playing field through enhanced accessibility, putting all students in a position where they can reliably benefit from the rising tide of online learning opportunities.

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