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Assistive Technologies to Support Students With Dyslexia

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Ronan, a bright fifth-grade student, has struggled significantly in reading and writing throughout his school career. Since his dyslexia diagnosis and determination of eligibility for special education services near the end of third grade, Ronan has been receiving intervention from Ms. Garcia, a special education teacher at his school. Ms. Garcia has worked closely with Ronan's general education teacher to ensure that the instruction he receives from her is reinforced in his regular classroom. Ms. Garcia has also worked with Ronan's parents so they can reinforce this instruction at home as well, but he is still reading at only a second-grade level. His decoding and fluency are weak, but his language comprehension is excellent. His thoughts are well organized when he speaks, but his spelling and handwriting skills are underdeveloped and prevent him from communicating effectively in writing. Ronan has become extremely frustrated trying to keep up with his fifth-grade classwork, and Ms. Garcia is at a loss as to what to do about it.

Individuals with dyslexia, like Ronan, face numerous challenges in school and daily life. Although effective intervention may reduce those challenges (Mather & Wendling, 2011; Shaywitz, 2003; Snowling & Hulme, 2012), most individuals with dyslexia benefit from additional supports that allow them to learn and function independently. The term *assistive technology* (AT) refers to the services and devices that enable people with disabilities to accomplish daily living tasks; assist them in communication, education, work, or recreation activities; and ultimately, help them achieve greater independence and enhance their quality of life (Dell, Newton, & Petroff, 2016; Individuals With Disabilities Education Improvement Act [IDEA], 2006).

The IDEA (2006) specified that it is the responsibility of the individualized education program (IEP) team to consider whether a student needs AT. In addition, this law also requires that schools provide accessible instructional materials (AIM), such as audio, large-print, or electronic books, to students with disabilities, such as dyslexia (Karger, 2010). In many cases, AT can be used to make materials accessible. For example, text-to-speech AT can transform a book's format from print to audio, enabling learners with challenges accessing printed text to access to the content.

The National Assistive Technology Research Institute found that although schools do tend to consider AT during IEP meetings, it is less common that they follow through adequately with assessment, selection, implementation, and evaluation (Bausch, Ault, & Hasselbring, 2015). This may be because most members of the typical IEP team have had little or no preparation specific to why or how assistive technology may benefit learners with different needs despite the fact that such training is mandated within IDEA (Edyburn, 2004).

Why AT for Students With Dyslexia?

Dyslexia is a neurobiological disability characterized by, but not limited to, challenges with accurate and fluent reading, word recognition, decoding, and spelling despite normal cognitive abilities and access to appropriate instruction (International Dyslexia Association, 2002). AT can be used to compensate for a disability, such as when nonverbal students use communication devices, or to mediate a disability, such as when students with print disabilities use text-to-speech programs (Kennedy & Boyle, 2017). AT for students with dyslexia most often mediates the disability in areas of challenge. Specifically, AT can mediate challenges with reading, writing, and spelling.

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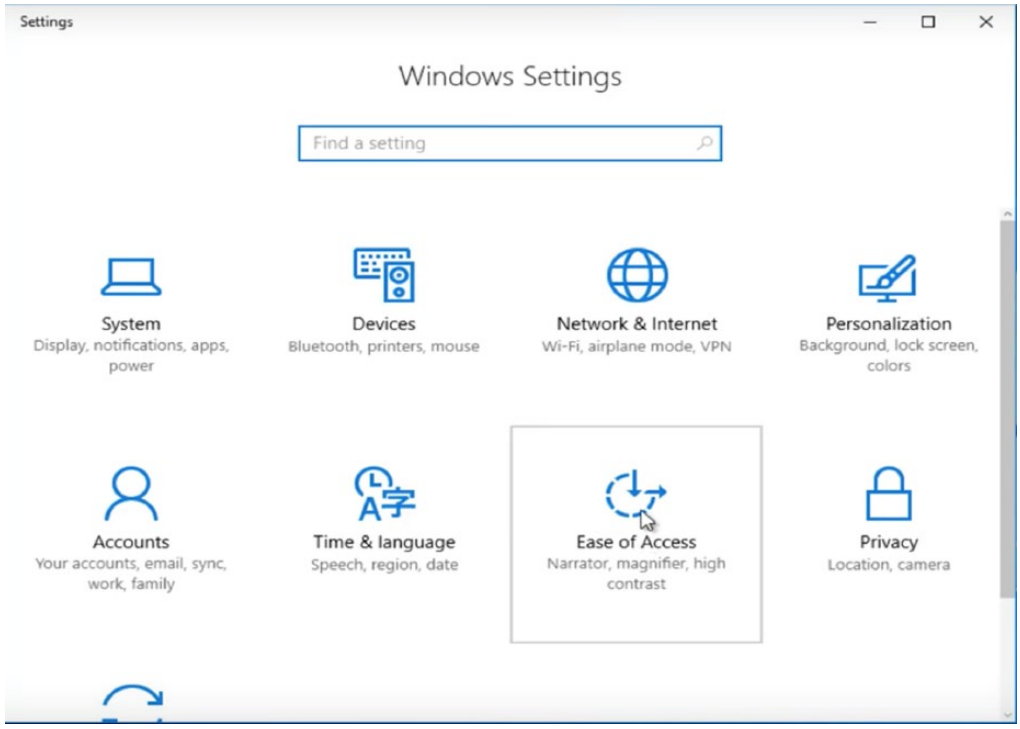
Reading

Students with dyslexia do not read as well as their peers despite having comparable intelligence and instructional opportunities to learn to read. This can present a challenge for teachers because students with dyslexia can often comprehend material more advanced than their reading achievement allows them to access. AT helps provide options for students to access content and information in different ways. Text-to-speech software, for example, can be beneficial for students with dyslexia who exhibit weak decoding skills, low levels of fluency, and strong listening comprehension skills (Parr, 2013; Wood, Moxley, Tighe, & Wagner, 2017). AT can also support students with dyslexia by providing options for interacting with and customizing text display. Devices such as e-readers can improve reading comprehension and reading speed when text is presented in shorter lines with more spacing and when key points are highlighted within on-screen text (Rello, Saggion, & Baeza-Yates, 2014; Schneps, Thomson, Chen, Sonnert, & Pomplun, 2013; Schneps, Thomson, Sonnert, et al., 2013). Although dyslexia is not associated with visual acuity, shorter lines and highlighting can help students focus their attention in appropriate places during reading. Combining on-screen text and spoken text may also facilitate more fluent reading for students with dyslexia (Schneps et al., 2016).

Writing and Spelling

Students with dyslexia also tend to struggle with writing throughout their lives (Harris & Graham, 2013; Sumner, Connelly, & Barnett, 2014). Students with dyslexia who have spelling challenges tend to use less robust vocabulary (Sumner, Connelly, & Barnett, 2016), exhibit slower writing speeds due to pausing more often (Hatcher, Snowling, & Griffiths, 2002), and produce shorter amounts of text compared to peers without dyslexia (Gregg, Coleman, Davis, & Chalk, 2007).

Figure 1. Ease of Access icon within Windows Settings



AT, such as word processors with spell-checkers, can help students with dyslexia improve spelling, writing organization and structure, and confidence in their writing (Hetzroni & Shrieber, 2004; Hiscox, Leonavičiūtė, & Humby, 2014). Talking word processors that translate written into spoken text and speech-to-text programs that allow students to convert their spoken language to writing can also improve writing and spelling performance (Cullen, Richards, & Lawless-Frank, 2008; Higgins & Raskind, 2004). Students with dyslexia are also often able to improve spelling and vocabulary usage through word prediction software (Evmenova, Graff, Jerome, & Behrmann, 2010; MacArthur, 1996). The effectiveness of this AT can be limited by students' ability to correctly identify the first few letters of a word; however, newer word prediction programs often take into account phonetic and inventive spelling when generating word lists. Writing instruction with iPads aimed at improving handwriting, spelling, and sentence composing and at engaging all four language systems (listening, speaking, reading, and writing) has also been shown effective for students with dyslexia (Berninger, Nagy, Tanimoto, Thompson, & Abbott, 2015).

Summary of Research on AT and Dyslexia

Researchers have found that AT may be able to mitigate challenges associated with reading, writing, and spelling for students with dyslexia. Specifically, AT may mediate reading challenges by providing options for accessing information and customizing the display of information. AT may also mediate writing challenges by providing options for expressing thoughts and knowledge and by supporting spelling.

Types of AT

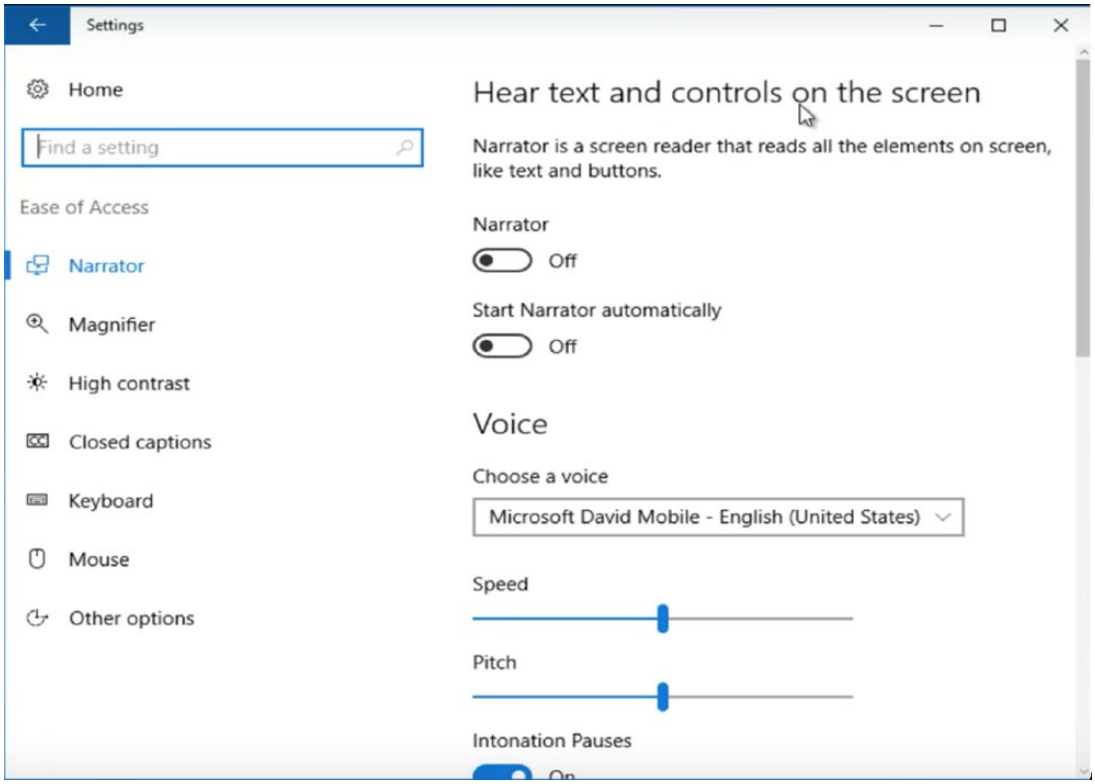
The sheer number of potential ATs for students with dyslexia can be overwhelming for educators. Having a little technical knowledge can help educators make sense of AT. Three common forms of AT for students with dyslexia include the preferences available within operating systems (called system preferences), extensions for web browsers, and apps. These readily available ATs can make a notable difference for students with dyslexia, but they often go unused due to lack of awareness among teachers and students.

System Preferences as AT

Some AT works only on certain operating systems (i.e., the software that runs the basic functions of a device). Knowing this information can streamline the process of searching for AT. Common operating systems include (a) MacOS and iOS, which run products like Macbooks, iPhones, and iPads; (b) Microsoft Windows, which runs products like Dell laptops, Microsoft Surface tablets, and Blackberries; (c) Android, which runs products like the Samsung Galaxy; and (d) Chrome OS, which runs Chromebooks.

System preferences within these major operating systems can be customized to improve the learning experience of students with dyslexia. The user can customize display preferences to control the display contrast, font style and size, size of icons, and other display characteristics. Text-to-speech and speech-to-text functionality are also available within

Figure 2. Ease of Access options including Narrator



these operating systems. For example, new Windows systems provide a basic screen reader application (text-to-speech) called Narrator, along with built-in speech recognition software, which allows the user to control the computer through a series of voice commands. These display features are available by clicking on "Ease of Access" within the Setting menu (see Figures 1 and 2). Newer MacOS systems also include text-to-speech capabilities and speech recognition through the VoiceOver preference. These options are found in the System Preferences folder under Accessibility on Mac devices (see Figures 3 and 4). On Chromebook and Android devices, the options are typically found under Settings within the Accessibility tab (see Figures 5 and 6).

Customizing the accessibility features within operating systems can be advantageous when students are working in 1:1 environments and always using the same device. This customization can be disadvantageous when students use different devices on different days or when multiple students use the same device. However, educators may find that certain features, such as large font size or text-to-speech options, are useful to a wide range of students. Customizability within operating systems tends to provide a basic level of functionality, but these preferences fall short of the more fully featured products that are available via third-party developers. In other words, customizing within operating systems can be helpful but not necessarily as robust as using AT designed for specific purposes. The best way to understand customization options is to explore the available operating systems.

Extensions as AT

Extensions are plug-ins or small software programs that appear as icons in web browser toolbars. Extensions improve the functionality of web browsers, and many extensions can be used as AT to support learners with dyslexia. For example, extensions can enable text-to-speech or speech-to-text functionality within browsers, support online note taking and annotations within browsers, provide instant definitions or synonyms for words on web pages, and allow users to customize how web pages are displayed. Some extensions are compatible with multiple web browsers, whereas others are browser specific. Strategies to locate extensions vary by web browser. For example, extensions are accessible via the Add-On Manager tab on the Mozilla Firefox toolbar, whereas extensions for the Safari browser are accessible under the Preferences tab. Extensions for Google Chrome are available via the Chrome Web Store (https://chrome.google.com/webstore/). Extensions are important in the K–12 environment because many schools use Chromebooks with their students, and much of the learning using Chromebooks is done in the browser. However, school or district technical support personnel should be contacted before extensions are installed, because policies on their use vary considerably by district.

Apps as AT

The word *app* is short for *application* and refers to computer programs

Figure 3. Accessibility icon within iOS System Preferences

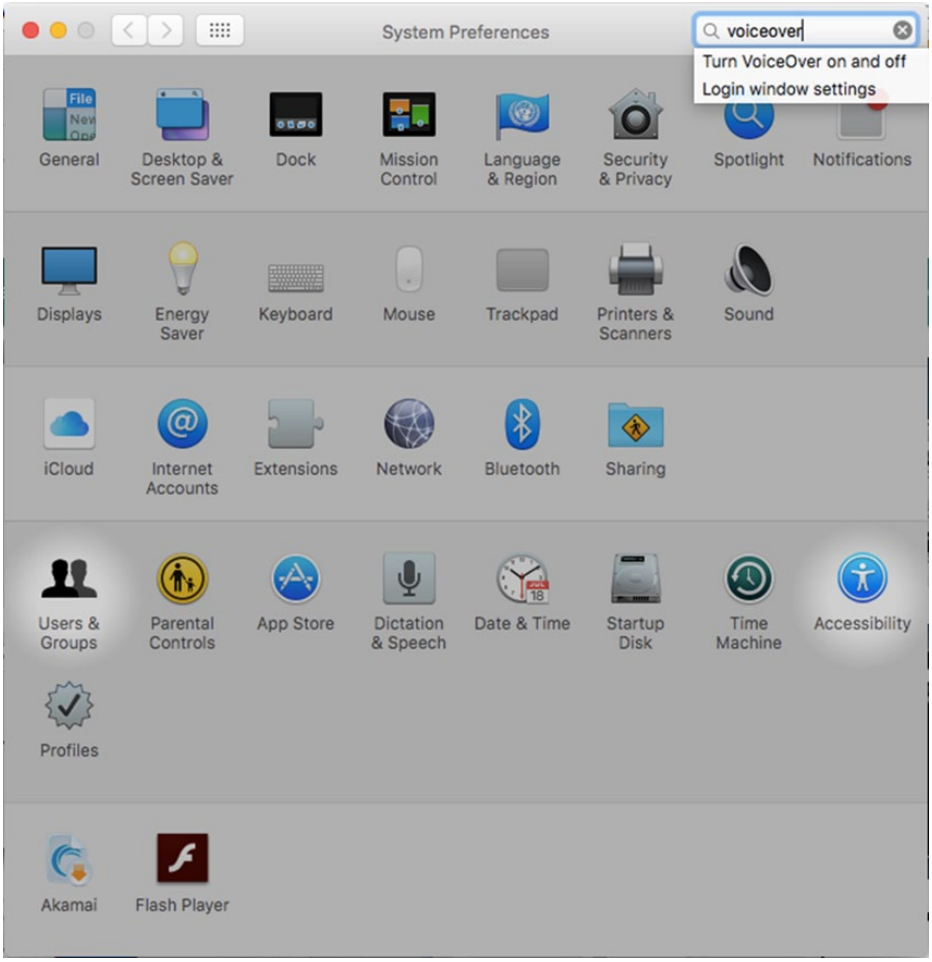


Figure 4. Accessibility options including VoiceOver

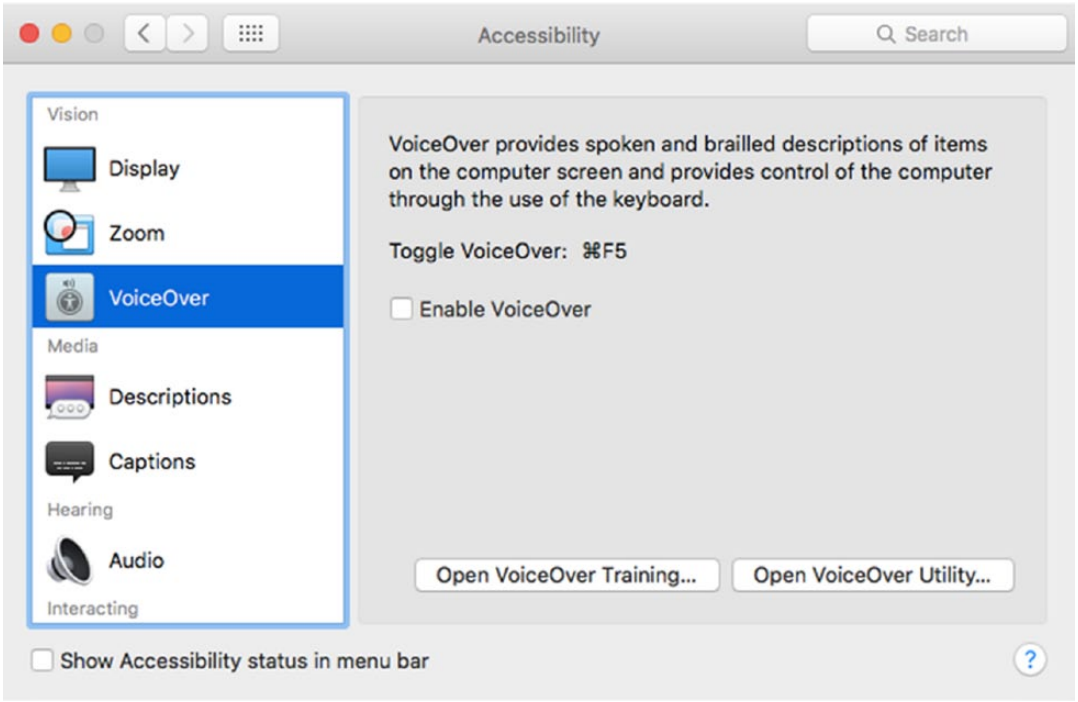
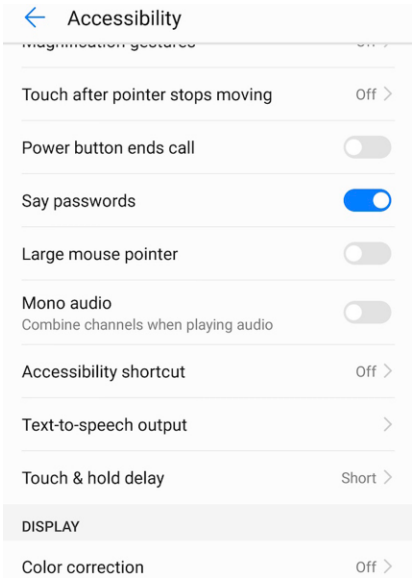


Figure 5. Accessibility icon within Android devices



designed to run on various devices. Desktop apps are applications that run on desktop or laptop computers, and web apps are apps that run in web browsers. Mobile apps are applications designed to run on mobile devices, such as phones and tablets. Some apps are designed to work across devices and operating systems, whereas others are designed specifically for certain devices and operating systems. Currently, mobile apps are the most commonly used apps and are available through two main digital distribution platforms: App Store and Google Play.

AT for Students With Dyslexia

It is likely that students with dyslexia will require more than one type of AT to mediate challenges and be fully accommodated. Certain types of AT address specific challenges related to reading and writing, whereas others offer multiple features to address more than one challenge within a single tool. Tools that offer multiple features may be appropriate for more learners within a classroom and may be economical for schools and districts to adopt in terms of cost and technical support. However, these tools may also overwhelm students unless teachers and students explicitly understand features of the tool. Tools that address specific challenges may be easier to teach and implement, but students with multiple challenges may need to learn to use more than one tool. More tools also necessitate more technical support, which may be problematic in certain contexts. Other considerations when selecting AT include cost related to the technology itself and to the professional development required for effective classroom implementation. The ATs highlighted below are used in many K–12 schools across the country and will likely be in existence for the foreseeable future. However, there are never guarantees in the world of technology, and the examples provided are representative and not exhaustive in terms of what is available.

Multifunction AT for Reading, Writing, and Spelling

Read&Write (Texthelp, 2016) is an AT that combines multiple features in one tool. Read&Write is widely adopted in K–12 schools because of its multiple features, its compatibility with multiple devices (i.e., it can be used as an extension or an app), and its

Figure 6. Accessibility options including Text-to-Speech within Android devices

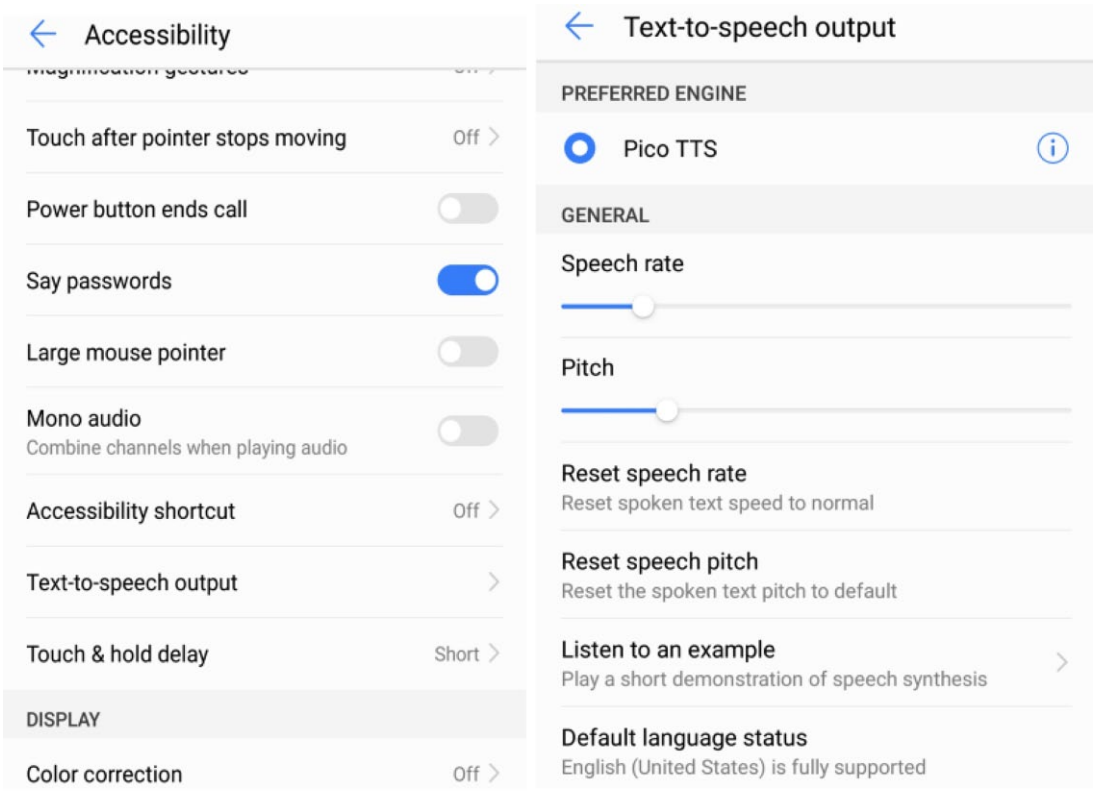


Figure 7. Screenshot of Read&Write for Google Chrome toolbar

simplicity. Read&Write provides a toolbar that allows users to select from numerous options, including many that can support students with dyslexia, such as options for text-to-speech, speech-to-text, word prediction, and simplifying the way pages display. To activate a feature such as text-to-speech, the user simply places the cursor in the selected location of the document or web page and then clicks the play icon. Read&Write also offers other options not necessarily aligned to challenges with dyslexia but potentially aligned to needs of other students, such as translation and vocabulary features. The toolbar looks slightly different depending on the device used, but the functionality remains similar across devices. Figure 7 shows the Read&Write toolbar as it appears with Google Chrome. Table 1 details the features within Read&Write that align with challenges often faced by students with dyslexia. Educators can request a 30-day trial to explore the tool and can continue to use certain features once the trial expires, although continued access to full functionality requires a subscription. The installation process varies slightly depending on the device used but involves downloading the tool from the Internet and dragging the icon to the appropriate location as specified after the download is complete. For example, Chromebook users drag the icon to the browser toolbar, whereas Mac users drag the icon to the Applications folder. The process is user-friendly, and numerous resources created by the company and by users are easily located.

It would be impossible to create an exhaustive list of ATs to mitigate specific challenges faced by students with dyslexia; however, Table 2 provides a list of some ATs that can be used to support students with dyslexia with reading and writing challenges.

AT for Reading Support

There are many text-to-speech ATs available, and they all serve the same purpose of helping users listen to text. This type of AT is most useful for students with dyslexia who have strong listening comprehension skills, but those with weaker listening comprehension skills may benefit from the combination of on-screen text and audio, too. Unfortunately, there is not a universal AT that enables text-to-speech functionality across all formats (i.e., web pages, digital textbooks, PDFs, Google Docs, etc.), and new products emerge almost daily. Educators may

Table 1. Assistive Technology (AT) Aligned to Challenges Faced by Students With Dyslexia

Challenge for students with dyslexia	How AT might support	Read&Write features to support the challenge
Reading	Options for accessing information	 The Text-to-Speech feature allows users to listen to content while looking at it on the screen
		 The Screenshot feature allows users to listen to the words within images, graphs and screenshots.
	Options for interacting with and customizing the display of information	 The Simplify feature strips away extraneous material so learners can focus on the content of a page.
Writing and spelling	Options for expressing thoughts and knowledge	 The Speech-to-Text feature allows users to put their thoughts into written words without becoming bogged down in handwriting, which can be cumbersome and inefficient for students with dyslexia.
	Options to support spelling	 The Word Prediction feature allows users to select from a list of possible words to use during writing. How many words appear in the list is adjustable.

Table 2. Assistive Technology (AT) to Meet Reading, Writing, and Spelling Challenges for Students With Dyslexia

Challenge for students with dyslexia	How AT might support	Possible AT
Reading	Options for accessing information	Speak it! Natural Reader Bookshare Audible
	Options for customizing the display of information	Mercury Reader Beeline Reader Voice Dream Reader
Writing and spelling	Options for expressing thoughts and knowledge and to support spelling	Standard word processors Voice Typing Co:Writer Universal Write:Outloud Siri

need to adopt multiple ATs to support students with dyslexia, especially if the curriculum requires use of multiple text formats. Similarly, students may prefer certain text-to-speech ATs to others, and it is ideal to allow them to select from multiple options. Table 3 describes four common text-to-speech ATs and where to find them.

AT can allow users to customize many features of digital text, including but not limited to fonts, font size, highlighting features, spacing, listening speeds, and page displays. Customizing the display of information does not automatically improve reading comprehension, but it can positively influence comprehension and reading speed for students with dyslexia (Rello et al., 2014; Schneps et al., 2016; Schneps, Thomson, Chen, et al., 2013;

Table 3. Examples of Assistive Technology (AT) That Provides Options for Accessing Information

AT	Description	How to find it
Speak It!	An extension that enables users to select text from web pages to be read aloud in Google Chrome or Mozilla Firefox. Text will not be read unless it is selected. Some students may find it a nuisance to select text before listening; others will like the flexibility of being able to select certain parts for listening.	Search "Speak It! Chrome" or "Speak It! Firefox" and follow the simple installation directions (Internet Explorer and Safari have built-in text-to-speech capabilities as well)
Natural Reader	A web page that allows users to drag and drop multiple file formats for listening (PDF, .txt, .doc, .docx, RTF, EPUB). Users can also copy and paste text for listening and convert text-based files into audio files. Many voice options are available in the free version, and many more are available in the premium versions. Requires an Internet connection for use.	https://www.naturalreaders.com
Bookshare	A repository of audiobooks funded, in part, by the Office of Special Education Programs within the U.S. Department of Education. Free to all students with documented print disabilities, such as dyslexia. Offers numerous academic texts and users can request others to be added. Most helpful when students need to access textbooks for class or when funding for professionally narrated books are not available. All narration is via electronic voice.	http://bookshare.org (must submit documentation of print disability for access)
Audible	A for-profit company that provides an audio library of classic and contemporary books and novels. Most useful when students are reading books other than textbooks. Involves a fee but professional narrators are used.	http://audible.com

Table 4. Examples of Assistive Technology (AT) That Provides Options for Customizing the Display of Information

AT	Description	How to find it
Mercury Reader	An extension for web browsers that removes ads and distractions from web pages so users can focus on content. Mercury Reader also allows users to disable noise and adjust the font, size, and color contrast of a web page. This extension works on most but not all web pages. Figure 8 shows an example of a website designed to teach young children about the solar system. Like many websites for children, the site includes many distracting features. Figure 9 shows how Mercury Reader strips away distractions so young readers can focus on content.	https://chrome.google.com/webstore/category/extensions (Mozilla Firefox, Safari, and Internet Explorer have similar built-in features)
Beeline Reader	This AT uses color gradients to guide readers from one line to the next. It is used within many platforms, including Bookshare, and is compatible with Chrome, Firefox, Android, iOS, PDF, and EPUB. It can be used in tandem with most text-to-speech AT. Includes a 2-week free trial, after which users have five uses per day free or unlimited use for a monthly fee. There are also educational licenses.	http://beelinereader.com (click on the icon for the format in which you want to use it, i.e., Chrome, Firefox, Android, iOS, PDF, or EPUB)
Voice Dream Weaver	This AT is a text-to-speech app for mobile and tablet devices that allows users to adjust the reading speed, font, spacing, color, and synchronized highlighting. It is compatible with nearly all file formats (excluding audiobooks using proprietary software) and includes multiple voice options. It also allows the user to listen to documents as if they were music files, with the option to play and pause the reading. There is a learning curve to set up some of the options, but the manual on the website is pretty thorough. It is not free.	For information see http://www.voicedream.com; download from the App Store or Google Play

Schneps, Thomson, Sonnert, et al., 2013). Table 4 describes three ATs educators may consider to support customization.

AT for Writing and Spelling

There are many ATs available to support writing. This type of AT is most useful for students with dyslexia who have the ability to orally tell a story or answer a comprehension question. These ATs support spelling, word finding, grammar, and other components of writing that often interfere with the ability of students with dyslexia to communicate effectively in writing. They also typically support transcription of text from the spoken word. Speech-to-text features are most useful when students have average to above-average articulation skills. As with other AT, ATs in this group require time to learn and perfect, and students will need support in figuring out how to use the features as part of their writing process. Features within this group of AT may also be useful to or preferred by other students without dyslexia. Table 5 describes four common speech-to-text ATs and where to find them.

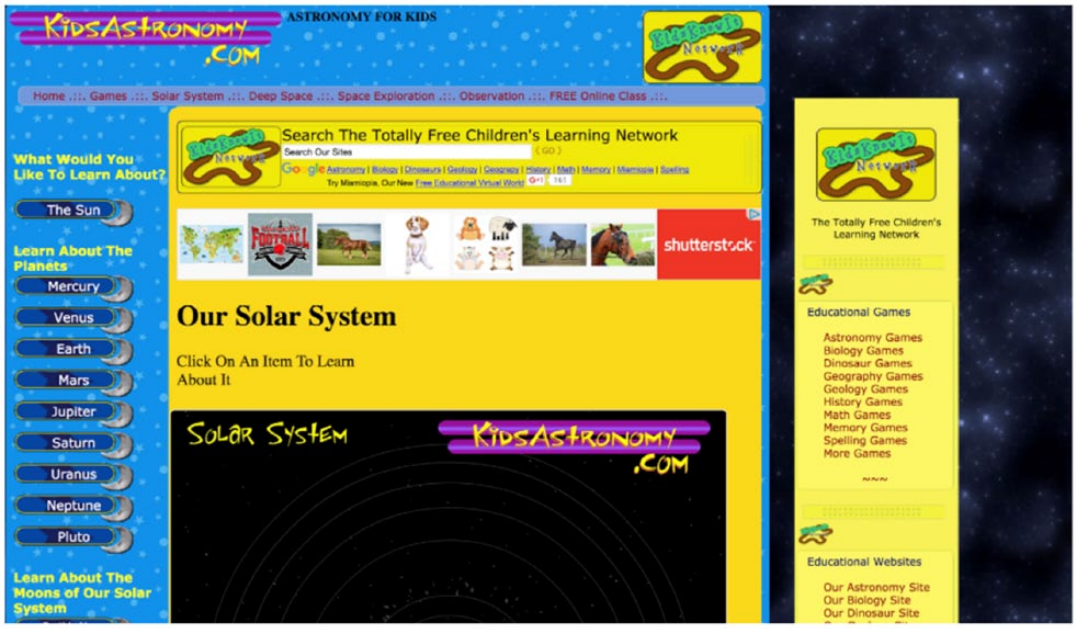
How to Find AT for Students With Dyslexia

Technologies are being developed more and more rapidly each year, and this is particularly true of technologies designed for individuals with dyslexia. For example, a recent study on mobile apps related to dyslexia identified 531 apps related to dyslexia in Google Play (for Android systems) and the App Store (for OS systems) (Dawson, Antonenko, Sahay & Lombardino, 2016). This large number does not even include technologies beyond mobile apps, such as desktop apps and web apps or extensions, all of which may serve as AT to support students with dyslexia.

One of the best ways to identify AT for students with dyslexia is for educators to speak with special education and technology experts in their schools or districts about what ATs are available and how others use them to support students with dyslexia. However, it is also helpful for educators to know where to look for AT because resource availability, AT expertise and knowledge, and expertise about dyslexia vary considerably across contexts. Although there are many websites, blogs, and online repositories to consult when seeking AT for students with dyslexia, three possible resources are DyslexiaHelp, SpedApps, and Tech Finder.

DyslexiaHelp (http://dyslexiahelp.umich.edu/tools/apps), curated at the University of Michigan, provides an extensive and carefully organized list of apps that may provide help to students, parents, or professionals affected by dyslexia. The site does not provide information on how frequently it is updated, but the associated blog is current (http://dyslexiahelp.umich.edu/latest).

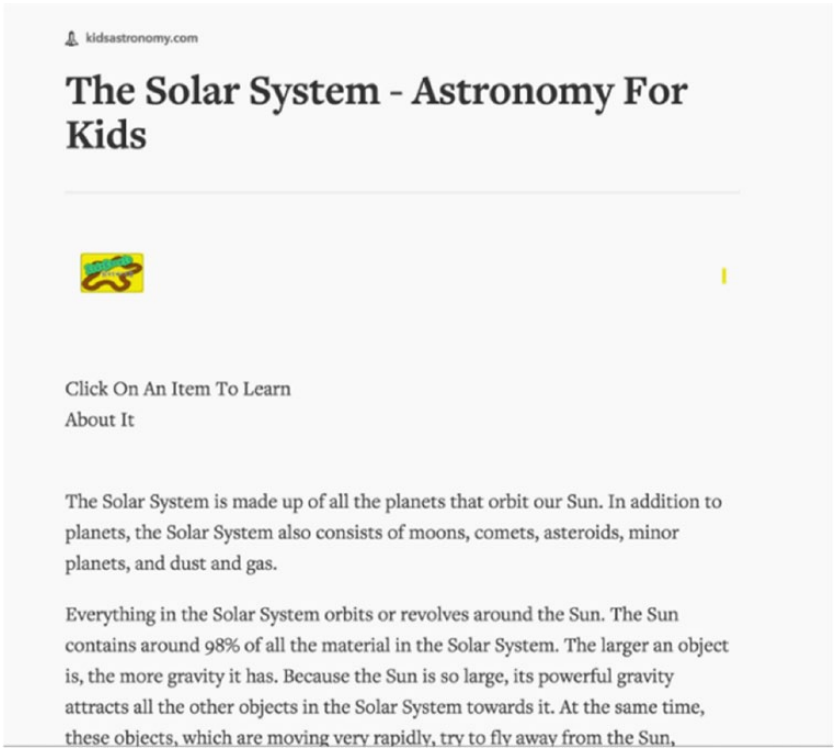
Figure 8. Solar system website for young learners



http://www.kidsastronomy.com/solar_system.htm

SpedApps (http://spedapps.kent.edu/index.php), a new initiative at Kent State University, is in the early stages of development and consists of a searchable website that catalogs high-quality apps for special education, especially those focusing on Science, Technology, Engineering, Arts and Mathematics (STEAM). Although not exclusively about dyslexia, an expert in each specific learning disability reviews each app. Apps are searchable by price, content, audience, and learning disability.

Figure 9. Solar system website using Mercury Reader



Tech Finder (https://www.understood.org/en/tools/tech-finder/), a component of Understood.org, allows educators to search by issue, including many specific to dyslexia, such as reading, writing, and organization. It is also possible to search for tools by grade level. Ratings are provided for each tool related to quality (5-point scale from "The Best!" to "Don't Bother") and learning (5-point scale from "Best" to "No Learning"). The site also includes information about price and compatibility, as well as commentary under the following headings: "What parents need to know," "What students can learn," "What's it about?" "Is it any good?" and "How can parents help?" Space for parent reviews is also provided, but this feature does not appear widely used.

Educators seeking resources such as these should keep in mind that quality resources typically include information about the authors' qualifications and expertise, how frequently the site is updated, details about the technology

Table 5. Examples of Assistive Technology (AT) That Provides Options for Expressing Thoughts and Knowledge and to Support Spelling

AT	Description	How to find it
Word processor	There are many different kinds of word processors, but most have spell-check and word prediction. Google Docs and OpenOffice are popular word processors for K–12 environments.	Word processors come preinstalled on many devices. A quick search for "free word processors" will yield many alternatives.
Voice Typing	Voice Typing is a feature within Google Docs that enables speech-to-text capabilities. Voice Typing is particularly popular given the rise of Chromebooks in K–12 classrooms. Voice commands allow users to include periods, commas, exclamation points, and question marks and to begin new lines or paragraphs. Voice Typing is not available in Google Sheets and is available only for preparing speaker notes within Google Slides.	Voice Typing is available in the Tools menu within Google Docs.
Co:Writer Universal	This AT works on almost any device. It enables speech-to-text and grammar check and uses technology that can predict words using correct, phonetic, and inventive spelling. It also includes topic dictionaries aligned to content typically taught in schools, and new topic dictionaries can be created.	Information about this AT is available at http://donjohnston.com/cowriter/. Free trials are available.
Write: Outloud	This AT is a talking word processor. It reads letters, words, and sentences back to the writer in real time with highlighting depending on the settings selected. Users can also listen to the entire composition by clicking the "Read All" icon. A talking spell-checker suggests words based on phonetic spelling, and a talking homophone checker reads different definitions for the user (i.e., *week* vs. *weak*). Co:Writer integrates with Write:Outloud.	Information about this AT is available at http://donjohnston.com/writeoutloud/. Free trials are available.
Siri	Siri is a personal assistant feature within iOS operating systems but can also be valuable as a speech-to-text AT. Its speech-to-text feature can support writing across a variety of applications, including e-mail, text, word processors, maps, and web browsers. Several Siri alternatives for Android and Windows devices exist, including Google Now and Cortana.	These are typically part of a device's operating system and can be customized as described earlier in this article.

tools, and informed critiques about if and when they may be appropriate. A major concern of any resource on technology is keeping up-to-date. Technology changes so rapidly that information about it can quickly become obsolete. Even as we write this article, we worry about the future accuracy of the information in this section because websites change so frequently. For example, only six of 10 resources for finding apps related to dyslexia identified in an article published less than 3 years ago (i.e., Reid, Strnadová, & Cumming, 2013) are still functional today, and of those six, only half have been updated within the past 2 years.

Recommendations for Helping Students With Dyslexia Use AT

Some considerations for selecting and using AT are relatively straightforward. For example, AT either works with a particular device or not, or a particular AT is available to students within a school or district or not. The complexity of using AT for students with dyslexia rests with finding appropriate tools that support the individual needs and preferences of students. Just because a tool meets the identified need of the student does not mean it will work for the student or that the student will like using it. In fact, students with dyslexia have been shown to exhibit different preferences for technology tools (Björklund, 2011), despite being identified with the same learning needs. Dyslexia is also a hidden disability (McKay & Neal, 2009) meaning that, unlike a physical disability or severe cognitive impairment, dyslexia is not an immediately obvious trait, and many students of all ages with dyslexia go to great lengths to hide their dyslexia and blend in with their peers (Stampoltzis & Polychronopoulou, 2009). Thus, students with dyslexia may view using AT unfavorably if it makes them stand out from their peers or otherwise stigmatizes them. Students with dyslexia may be most apt to adopt ATs

that blur the boundaries between AT and everyday technologies, such as text-to-speech programs (Israel, Marino, Delisio, & Serianni, 2014). In addition, even though the term *digital native* (Prensky, 2010) is used pervasively in K–12 education, research has shown that students do not intuitively know how to learn with technology (Kirschner & van Merriënboer, 2013).

Despite these challenges, the following recommendations can help teachers engage students with dyslexia in the process of using AT and develop a plan for knowing if the student's use of the AT is successful. These recommendations could also apply to other students who may benefit from AT, including those with other disabilities or English language learners.

1. Identify the professional development services offered in your district related to the IDEA (2006) mandate of educating teachers about AT.
2. Learn about a variety of ATs, and use them yourself in order to gain a better understanding of them.
3. Talk with students about what they feel are their biggest challenges related to reading and writing, and share possible AT solutions. If students are too young to articulate these feelings, then talk with their parents or guardians and observe them while reading and writing to identify challenges that may be mediated with AT.
4. Let students have a role in selecting AT. If there is more than one option (i.e., multiple speech-to-text tools), let the students try them out and tell you what they liked and did not like about each. Identify an adequate amount of time (likely several weeks) for students to learn the AT, and practice using it during class. Schedule a meeting at the end of this time frame to determine how the AT is working and make plans for the future. Future plans could include using the tool as is, making modifications to how the tool is used, discontinuing use of the tool, or making alternative plans.
5. Observe students working with the tool, and take notes on what you see. Debrief with students about how they feel it is going throughout the trial period, and share your observations if it makes sense to do so.
6. Collect other forms of data if possible. For example, keep track of comprehension scores when students read passages with and without text-to-speech software or of writing conventions with and without speech-to-text and spell-check software.
7. Make the AT available to other students when possible. Text-to-speech software may be a necessity for a student with dyslexia, but other students may prefer to read using it. The more the AT is integrated as part of normal classroom routines, the better.
8. Allow students to be experts in the AT and help peers with it when possible.
9. Involve parents and guardians in the process and if possible, ensure the selected AT is available at school and at home for homework.
10. Explore the accessibility features built in to high-stakes computerized assessments and provide students with dyslexia a chance to become familiar with them. Help these students make connections between the AT they use every day and the features available to them during assessments.

Conclusion

AT is not a replacement for effective intervention strategies in reading and writing. In fact, a comprehensive program must include both intervention strategies and AT implementation. However, it is important to understand that dyslexia does not go away with time. Students with dyslexia will likely face reading and writing challenges and lag behind their peers in these areas throughout their lives. Research has suggested that AT may help mediate some of these challenges. Students with dyslexia benefit when teachers understand how AT may mediate their reading and writing challenges, acquire basic technical knowledge, and learn about specific ATs, strategies for locating ATs, and suggestions for how to support students in using ATs.

Ms. Garcia learned about Read&Write, an AT that was already available in her district. She helped Ronan's teacher adopt this AT as part of her classroom instruction and helped Ronan and the other students in the class learn to use it through lessons that integrated the features of the tool with curriculum content. Ronan has been able to keep up with his readings much better through the text-to-speech feature, and his writing scores have also increased through the use of word prediction and speech-to-text. His improvements are likely due to a combination of the research-based interventions he continues to receive from Ms. Garcia and the support provided by using AT.

Ronan is pleased to be considered an expert in the class on this tool and frequently helps his peers who are also benefiting from its use. Ronan's parents report that homework time is less cumbersome and more productive and that he has even sought out additional content related to the curriculum by using the tool to access information far above his reading level. He is also reading for pleasure more often using

AT is not a replacement for effective intervention strategies...a comprehensive program must include intervention strategies and AT implementation.

Bookshare, another AT provided by the school, and through his parents' Audible account. Ronan's AT needs have now been documented on his IEP so he can continue to count on the supports provided as he enters middle school. The IEP also specifies the need to continue intervention services in middle school. The special education coordinator is currently analyzing the affordances of potential AT for other students with dyslexia and providing professional development to help educators like Ms. Garcia identify appropriate AT for their students. Most importantly, Ronan feels like he can, for the first time, learn and fully participate in class without constant help from his teachers, parents, and peers. ATs, in combination with consistent, research-based interventions, have given him independence and control over his own learning.

***Ronan is based on a true story about the first author's youngest son.*

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