



**Assistive Technology
in Practice:
Topics and Issues
to Help ETs Fold
Assistive Technology
Into Their Practices**

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**Understanding the Two Primary
Alternatives to Print Materials:
Audio Files and Electronic Text**

Assistive technology can help struggling learners leverage their abilities to bypass or reduce the impact of learning weaknesses—a valuable addition to an educational therapist's array of interventions. While knowledge of specific tools is important, that's only part of the story: Education professionals must also make informed decisions about tool selection, implementation, and advocacy. "Assistive Technology in Practice" will provide insights on topics and issues that are key to creating effective AT solutions. Anticipated future articles will address topics such as how to make assistive technology recommendations in reports and at school meetings, helping students manage digital distractions when they use technology, and features to consider when choosing task-management apps. This inaugural article will familiarize readers with important distinctions between the two primary alternatives to print: audio files and electronic text.

WHAT IS—AND ISN'T—ASSISTIVE TECHNOLOGY

As this is a new column, let's start at the beginning: What do we mean by "assistive technology"?

To paraphrase the official definitions in the IDEA and other federal legislation, assistive technology comprises two integral parts:

An **AT device** is "any item, piece of equipment, or product system...used to increase, maintain, or improve functional capabilities" of a child or individual with disabilities. Devices are the tangible "things" we typically think of when we use the term technology or tool (Individuals with Disabilities Education Act, 2004, Sec. 300.5).

An **AT service** is "any service that directly assists a (child or individual) with a disability in the selection, acquisition, or use of an assistive technology device." This includes assessment of AT needs, funding, training, coordination with education and therapies, etc.

(Individuals with Disabilities Education Act, 2004, Sec. 300.6). Key point: Without the requisite AT services, AT devices often don't "work"—that is, they may not provide the desired outcomes.

The defining characteristic that makes a device "assistive technology" rather than merely "technology" is its ability to help someone perform a task that might otherwise be difficult or impossible because of a disability. This critical distinction of assistive technology was summed up by Mary Pat Radabaugh, then-director of IBM's National Support Center for Persons with Disabilities, who in 1988 wrote: "For most people, technology makes things easier. For people with disabilities, however, technology makes things possible" (as cited in "Technology," n.d.).

Assistive technology can help individuals with physical, sensory, and cognitive needs in all aspects of their lives—mobility, communication, environmental control, computer access, recreation, daily living tasks, and more. This column, though, will focus solely on AT for individuals with learning differences—brain-based disorders that affect the cognitive processes needed to learn effectively.

AT devices aren't necessarily high tech or digital. For a student with illegible handwriting due to difficulty grasping a thin writing utensil, an appropriate rubberized pencil grip might make a significant difference, and is thus "assistive technology"—that is, a tool that assists them and without which they are unable to satisfactorily complete the task. Of course, that same student might also benefit from a high-tech AT solution like speech recognition (speech-to-text).

In the context of learning, AT is also different from educational technology (aka "ed tech"), which refers to using technology to facilitate teaching and learning, including delivery of educational content and instructional remediation. In contrast, AT helps a student *bypass* a personal learning obstacle so they can learn on a level academic playing field with their peers. For example, listening to an audiobook leverages a student's auditory skills to bypass possible decoding and visual tracking issues.

FORMATS FOR PRINT ALTERNATIVES

Students with dyslexia, or those with certain language or visual processing challenges, typically struggle with reading print materials as well as digital text—a major learning obstacle given how much instruction is provided via the written word (books, handouts, exams, webpages, text projected on the classroom screen, etc.). The need to mentally pause and decode words requires great cognitive effort, reduces reading speed, hampers comprehension, and often evokes frustration and anxiety.

A common and effective workaround for reading fluency problems is to "offload" some of that decoding and comprehension to the student's auditory channel by allowing them to listen to the text read aloud. Additionally, some students who have below average visual reading skills may have superior verbal comprehension skills, allowing them to listen to text-based materials several times faster than they can read and comprehend visually.

The two primary "print alternative" formats used for individuals with literacy challenges are audio files (typically audiobooks) and electronic text (e-text). Understanding the capabilities and limitations of these two formats can help you better equip clients with the proper reading materials, tools, and associated strategies to reach their reading potential.

AUDIO FILES

Audio files are simply recordings of a person reading aloud the text-based material. This includes professionally-narrated audiobooks like actress Anne Hathaway reading *The Wizard of Oz* (complete with different character voices) as well as digital voice notes of a teacher reading worksheet instructions, recorded on the spot and attached to the PDF worksheet.

The primary advantage of a human-read audiobook or other audio file is that the narrator can convey additional meaning through inflection, prosody, pauses, and emphasis that is not necessarily evident through text alone. For students who struggle with decoding and slow reading, the vocal variations provided by a human reader can significantly aid comprehension, especially for dialogue in novels, poetry, and Shakespeare.

However, pure audiobooks (such as those available through [Audible.com](https://www.audible.com)) are audio only. With the exception of chapter titles and other navigation information, the user sees no associated text (but see below about hybrid formats). A student can follow along in a print book, perhaps using a manual reading guide, while listening to the audiobook.

Since narrated audio requires recording a human reader and editing the files, most publicly available audio reading materials are audiobooks created and distributed by vendors and non-profit organizations. Purchased audiobooks typically must be played on dedicated apps to protect the work's digital rights and prevent illicit sharing. However, audio recordings of public domain works created by volunteer readers, notably those available through [LibriVox.org](https://www.librivox.org), may be played on standard digital media devices and apps such as iTunes.

ELECTRONIC TEXT (E-TEXT)

Electronic text, or e-text, is accessible digital text which can be accessed by text-to-speech (TTS) software, and thus spoken aloud. E-text can be accessed by other reading supports such as comprehension tools (dictionary, translator) and annotation, and e-text in editable documents (such as word processors) can be manipulated to adjust the font, size, colors, and spacing to increase visual readability.

Basic text-to-speech software is built into most digital device operating systems and thus free. In addition, virtually all literacy software for students with learning differences include text-to-speech.¹ For a list of options, see the tables for "Simple text-to-speech" and "Read, Write & Study Suites" toward the top of the [AT Toolbox](#) webpage.

¹ Windows, macOS, Chrome, iOS, iPadOS, Android

"DIGITAL TEXT" DOES NOT NECESSARILY MEAN "ACCESSIBLE TEXT"

Text-to-speech and other reading supports only work with accessible text. A common misconception is that all digital text (that is, text that appears on a digital device) is accessible, and thus can be read aloud by text-to-speech software. What's the difference?

Here's a general rule of thumb: If the text is selectable—that is, you can highlight individual letters and words, then copy and paste these into another text document—it is accessible and can thus be spoken aloud using TTS. Text-based PDFs and HTML (the text on most webpages) are accessible, as is text entered into word processor apps and other software. This journal article is distributed as a text PDF and thus can be used with TTS and other reading supports.

However, words in digital photos, most digital maps, decorative headers, and images created by scanning a document (e.g., image PDFs, print books) are not accessible text—they are merely pictures of text. For example, the words "Association of Educational Therapists" in the logo on the cover of this journal are actually images of those words, not accessible e-text.

This distinction is important because some digital e-books are merely images of the print pages, not e-text. Accessible e-books are typically distributed in formats such as plain text (.txt files), text PDFs, ePub (used by most digital publishers), and AZW (used by Amazon Kindle).

Although inaccessible text can be converted to e-text with optical character recognition (OCR) software, the accuracy of that conversion depends on the quality and the complexity of the original document. OCR errors can confuse the listener, while finding and correcting errors can be time consuming.

Text highlighting - In many text-to-speech tools, words and sentences are highlighted in different colors to aid visual tracking. Such dynamic highlighting of words as they are spoken can help students make an association between the word they see and what they hear.

Figure 1: Visual Tracking Aids

"Readability" affected by:
Font face, text size,
text and background colors,
column width,
spacing between lines, and
spacing between words.

Figure 2: Visual Aspects Affecting Readability

E-TEXT CAN LEVERAGE OTHER READING SUPPORTS

In addition to listening to reading materials with TTS, accessible e-text allows users to employ other reading supports. Depending on the tool used, they can:

- Use visual tracking aids such as dynamic highlighting (see Figure 1).
- Adjust the visual aspects of the text such as font, size, colors, spacing, and format to increase readability (see Figure 2).
- Click on unfamiliar or unknown words to look up or hear the definition (improves vocabulary and comprehension in the moment).
- Translate an unfamiliar word to their first language (aids English language learners, students learning a foreign language).
- Search the document for keywords or recurring themes (aids note-taking, critical thinking).
- Employ annotation strategies to improve critical thinking and retention (e.g., highlight text with colors, add text comments and voice notes, extract passages to separate study outline).

Table 1 summarizes important aspects of the reading experience for these two print alternative options.

	Recorded Audiobooks	Electronic Text plus Text-to-Speech
What is it?	Audio recording of person reading aloud text	Text-to-speech (TTS) software reads aloud electronic text (e-text)
Voice	• Voice of human reader (typical inflection, intonation, and prosody)	• Synthesized voice (some newer TTS voices are nearly human quality)
Typical Adjustments Available	• Reading speed	• Reading speed • Reading voice (including different accents and languages) • Pitch of reading voice • Visual appearance of e-text (font, size, colors, spacing)
Typical Noteworthy Features	• Bookmark pages, add bookmark notes • In some audiobooks, reader describes non-text items (images, graphs, equations) • Audio only—no synchronized text (user can follow along in print book)	• Reader both sees and hears text • Words/sentences visually highlighted as spoken • Access to comprehension tools (e.g., dictionary, translator) • Access to other reading supports (e.g., annotation, search)

Table 1: Comparison of Recorded Audiobooks and Electronic Text plus Text-to-Speech

CHOICE OF READING MODALITY DEPENDS ON THE STUDENT, THE TASK, AND THE CONTEXT

It may be tempting to pit these two auditory reading modalities against each other and conclude that one is "better" than the other, but that would not tell the whole story. Better for whom? For what types of learning needs? For what kinds of reading content (fiction, nonfiction) or reading tasks (read for pleasure, take notes and study)? The pros and cons of audio files and e-text

vary for different tasks, different contexts, and different kinds of learners. Consider:

- Human narration, with its nuances of intonation and rhythm to convey added meaning, may be preferred for dialogue-heavy fiction, poetry, Shakespeare, and text with lots of dialect.
 - Imagine listening to Mark Twain's Huckleberry Finn with text-to-speech: "*Well, it's a blame ridiclous way, en I doan' want to hear no mo' 'bout it. Dey ain' no sense in it.*"
- Text-to-speech voices, especially monotone voices, are typically more "understandable" at higher reading speeds and thus useful for skimming material or reviewing materials previously read.
 - Students with exceptional auditory skills may be able to read/listen to text-to-speech at speeds exceeding 300-400 words per minute.
- Listening to an audiobook with earbuds while following in the print version (along with their classroom peers) is preferred by some students because it's less conspicuous.
- E-text coupled with TTS affords additional reading supports like visual tracking aids, adjusting the text display, comprehension aids, and annotation.
 - The ability to annotate e-text while listening makes e-text and TTS a good choice for reading textbooks and creating study guides.
- Some students may actually comprehend and absorb content better by listening to audiobooks *without* the distraction of visual reading.
- TTS allows listening to text for which there is no recorded audio—for example: webpages, email, PDF files, and many books.

As with all assistive technology, choice of the "right" tool will depend on the goal of the reading task, the user's needs and preferences, and the context for performing the task (in class, at home, while bicycling). Most students will benefit from access to a variety of auditory supports and reading tools so that they have options available when needed.

WHERE TO GET PRINT ALTERNATIVES

Accessible audiobooks and e-text are available from several sources and may be free, purchased, or borrowed. For a table of sources most likely to have print alternatives of books used in education (textbooks, fiction, nonfiction), see "Resources for Alternatives to Printed Text - Electronic Text (E-text) and Narrated Audiobooks" on the [AT Toolbox](#) webpage. Armed with the book's title, edition, translation (if any), author, publisher, copyright date, and/or ISBN, one can determine if an e-text or audiobook version of the material is available.

Under the 1996 Chafee Amendment, which amends U.S. Copyright Law, certain authorized entities are allowed to

produce and distribute copyrighted works in accessible formats for persons with verifiable print disabilities. These Accessible Media Producers (AMPs) include organizations like Bookshare, Learning Ally, and the National Library Service. The following page on the Bookshare website explains more about eligibility: <https://www.bookshare.org/cms/bookshare-me/who-qualifies>

For qualified individuals, both Learning Ally (audiobooks) and Bookshare (e-text) are good sources for accessible textbooks.

WHAT ABOUT COMBINATIONS OF E-TEXT AND HUMAN NARRATION?

Some creators and distributors of digital books offer titles that combine e-text with human narration. The following are noteworthy examples.

Most audiobooks offered by Learning Ally are in "Classic Audio" format (audio only). However, nearly 9000 of their 80,000+ books are available in what they call VOICEtext format, where e-text is displayed in the Learning Ally app as the narrator reads. Depending on the book, either the sentence or paragraph being read is visually highlighted. In VOICEtext books, students can also access some tools specific to e-text (dictionary, highlight and add notes to selected sentences).

Amazon sells Kindle e-books that can be read on their Kindle E-Readers (physical devices) or on the Kindle reading app (free for PC, Mac, iOS/iPadOS, and Android devices). Since Amazon also owns Audible, which sells professionally-narrated audiobooks, they offer the ability to sync selected audiobooks and e-books through a feature called Whispersync for Voice. Users must have both the Kindle and Audible apps, and purchase the Kindle e-book, then the Audible audiobook (usually discounted for those who have the Kindle version). Going to a page in one app immediately goes to that same page in the other. [Some Kindle devices and apps](#) go a step further and offer Immersion Reading: Not only are the e-book and audiobook synched, but individual words are visually highlighted as they are spoken by the human reader.

"ACCLIMATING" TO TEXT-TO-SPEECH (TTS) VOICES

The listening options for reading with TTS are so much broader because there is no recorded audio for most text-based materials and accessible print alternatives for later grades are predominantly e-text (e.g., textbooks, teacher-created materials, print that is scanned and converted with OCR software). Also, e-text allows the students to read aloud text in different languages.

While students may prefer listening to human-read audio vs. synthesized text-to-speech voices for the reasons mentioned earlier, most are nevertheless able to use and benefit from TTS when a human reader is not available (e.g., listening to webpages). Thanks to recent technology advances, some of the newer TTS voices are incredibly natural-sounding in terms of pronunciation, fluidity, and inflection. These so-called "neural text-to-speech" voices are available in iOS/iPadOS 13+, macOS 15+, and Microsoft Immersive Reader.

A small number of students, however, may actively resist using e-text and TTS or refuse it. It is important to first determine if the student is actually unable to understand the text-to-speech, perhaps due to an auditory processing issue, or if the student understands it but either dislikes the voice or finds it distracting. In either case, explore how different voices and different reading speeds impact both understandability of the spoken text and the student's acceptance of it.

Virtually all text-to-speech tools permit changing the reading speed and the reading voice. Here are suggestions for helping students acclimate to reading with text-to-speech:

- Start by trying different voices, including those with different accents.
 - For example, most apps and devices with US English text-to-speech also offer variations with British, Irish, Australian, Indian, and South African accents.
- Allow the student to adjust the reading speed to their "Goldilocks range"—not too fast, not too slow (this may vary for type of reading material).
- Determine if the student's understanding and acceptability of text-to-speech voices depends on the material being read—e.g., a novel vs. a science textbook.
- Practice listening to and understanding text-to-speech with non-critical reading (personal email, non-school webpages).
- Use Kindle Immersion Reading or Learning Ally VOICEtext (human reader + highlighted e-text) as a stepping stone to TTS.

SUMMARY

In general, students will benefit from access to a variety of auditory supports and reading tools so that they can select the tools and methods that best fit their needs. Providing options and allowing them to explore what works will help them to become more self-confident and independent, and to develop lifespan technology skills that will serve them well beyond school.

REFERENCES

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RECOMMENDED RESOURCE

Haven, S. (2021). *Assistive technology tools for learning differences, ADHD, and executive function challenges*. Techpotential. <http://www.techpotential.net/attoolbox>

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