Text-to-Speech Software for Helping Struggling Readers

Ernest Balajthy

For a printer-ready version of this article, click here. Use your browser’s “back” button to return to the Reading Online site.

Abstract

For children and young people with reading difficulties, text-to-speech (TTS) software offers some of the benefits of a personal reader. The article provides an overview of the technology and its application, and then summarizes the research on benefits of TTS for struggling readers. The different kinds of TTS software available are described in three categories, according to sophistication, and information is given concerning how teachers can obtain electronic text materials for use with TTS. Finally, suggestions are provided for implementing TTS in the classroom.

Related Postings from the Archives

- Teachers’ Use of Technology in a Reading Clinic by Ernest Balajthy et al.
- Wait for Me! by Ofer Bergman
- Jumping off the Page by Bart Pisha and Peggy Coyne

What Is TTS? | Impact of TTS | Available Software | Available Texts | Practical Considerations | Suggestions for Use | References
What Is Text-to-Speech Software?

“I am a supervisor of teachers of learning-disabled students, and almost all of these children have reading problems. I’ve heard that text-to-speech software can help them with their reading. But what is the best text-to-speech program to use? Our school has funds available, but I’m not sure which of the many programs on the market I should be buying. Our teachers do not seem to be using the ones we have now. Are these programs appropriate for the kinds of students we have?”

Early research on computer-enriched textual presentations assumed that learning would be enhanced if students were provided texts that included aids for comprehension. Reinking and Schreiner (1985) and Reinking (1988), for example, demonstrated that students’ comprehension improved as they were taught to use adjunct computer-based materials such as a simpler version of the text, listing of main ideas, links to reference tools such as a dictionary and encyclopedia, note-taking tools, and an animated graphical presentation of key points. More recent work has focused on development of online textbooks that include such supporting or supplementary materials. Anderson-Inman (1999, online document) reports a positive impact on comprehension when such textbooks are used. A study with social studies online textbook material and text-to-speech (TTS) capability by Pisha and Coyne (2001, online document) likewise found positive results: “The affordance of TTS software was extremely popular with the weaker readers in the sample.”

Such efforts, however, require textual presentations that are specially designed and created, making them expensive and time-consuming. In another approach to computer-based text presentation, several commercial ventures are now making electronic book (e-book) files available for purchase and use with special text-reading software. The most widely recognized of these ventures is Microsoft Reader. Many titles are now available, including bestsellers.

Still another branch of research and development on computer-mediated text has focused on
simple “text to speech” (TTS), which uses voice synthesis software to provide oral reading of ordinary electronic text files, such as word-processed documents, text on webpages, and e-books. This approach has an advantage over methods that rely on specially designed content packages, in that reading material amenable for use with TTS software is readily available from a multitude of sources.

Some word processors have long had the capability to read aloud the text files they produce. The older KidWorks 2 (Davidson software) and Writing Blaster (Knowledge Adventure) are now out of production, but are often still in use in schools. Other TTS word processors that are still marketed include Write:OutLoud (Don Johnston), IntelliTalk 3 (IntelliTools), and KidPix 3 (The Learning Company). Users of Microsoft Word can download a free plug-in that converts Word documents for use with Microsoft Reader.

Talking word processors can be valuable in encouraging students’ writing, but they play a more limited role than general TTS software. Also called electronic readers, assistive reading software, reading machines, screen readers, computer text readers, or e-readers, TTS software packages are designed to be able to read aloud from a variety of file types. A user might, for example, find text at a website that he or she wants read aloud. The TTS software analyzes the text using a system of phonics and other word-identification rules, and then reads the text aloud through voice synthesis. Users are provided a synchronized visual and auditory presentation of the text as they see the text on the computer screen and hear it spoken. Reading speed can be adjusted according to the needs of the individual user. This is an important feature: Skinner, Johnson, Larkin, Lessey, and Glowacki (1995) found that some students respond better to slower and some to faster text presentation.

Numerous commercial TTS software packages are available, with sophistication and price varying widely. Several can be downloaded free of charge from the publishers’ websites, as noted below.
Does TTS Software Have a Positive Impact for Struggling Readers?

The face value of an electronic device that can read textual materials aloud is great. Reading aloud is a primary component of emergent and early reading and literacy efforts, of course, but it is also an important part of teaching methods targeted to struggling readers. Balajthy and Lipa-Wade (2003), for example, identified several teaching strategies involving reading aloud that would be useful for students who are severely challenged in reading, including the neurological impress method (Heckelman, 1969), echo reading (Anderson, 1981), and comprehension for decoding (Lipa, 1990). Students with learning disabilities are often provided instructional support—for example, as part of the requirements of their individualized education programs (IEPs) if they reside in the United States—and this frequently includes having text materials and assessments read aloud to them.

In addition, professional advice to continue reading aloud to students even as they reach adolescence is common in the literature (Trelease, 1989). Zirinsky and Rau (2001) note that

> As texts become more difficult and more obscure [in the high school years], perhaps oral reading would give a voice to texts that silent reading alone would render inaudible. To extend natural reading practices, our students will be helped by hearing works read aloud. (p. 20)

A variety of teachers have published reports on the use of TTS that present a positive picture of its effectiveness and also provide guidelines and suggestions. Howard (2004), for example, used TTS to make talking books on science themes for first graders: “At the end of the unit, and even well into a different study, my first graders still retained the knowledge they gained.... They begin to learn what works for them and what does not” (p. 29). Seegers (2001) used TTS software with a special education class of fifth- and sixth-grade students with learning and emotional disabilities. She reported, “I like it because low-level readers can access important information [on the Internet] for research as well as read and listen to classics and other
literature that they could not otherwise read” (p. 39). Michaels, Prezant, Morabito, and Jackson (2002, online document) carried out a survey of instructors actively involved with college students with disabilities and found that the average rating for usefulness of TTS software was 4.17 on a 5-point scale.

A limited number of studies have gathered and analyzed data on the effectiveness of TTS. Reitsma (1988) conducted a study that investigated computer technology that predates today’s TTS software. Students listened to an audiotaped story and followed along with a print version displayed on a pressure sensitive touch pad connected to a microcomputer. Students could press any word of the story in order to hear it pronounced again. Results indicated that the speed of first graders’ word identification was improved with the use of this device.

In a more recent study using contemporary technology, Hecker, Burns, Elkind, Elkind, and Katz (2002) found that results on a formal reading test did not vary between print format and TTS format. Their subjects were college students with attention-deficit disorders who had an average grade-equivalent reading level of 9.9. The research did find, however, that attention to text, as measured by number of distractions during reading, was improved greatly (by 54%) in the TTS format. Also, time spent reading passages was decreased by 29% when TTS was used.

Other studies have found that combined visual and auditory presentation of text by TTS software improves comprehension, especially for struggling readers. Leong (1995) found that below-average readers’ comprehension was improved by use of TTS. Wise and Olson (1994) worked specifically with students identified as disabled in reading and found that TTS improved comprehension. Disseldorp and Chambers (2002) studied the effects of TTS on readers of various abilities, finding an overall average of 7% improvement in comprehension, with poorer readers benefiting more than better readers. Montali and Lewandowski (1996) found that struggling readers performed as well as average readers when text was presented in this bimodal fashion.

Research carried out thus far on e-readers indicates that, as is often the conclusion in
educational research, individual variation merits greater attention than mere examination of group means (Hecker et al., 2002). The effectiveness of e-readers appears to be highly dependent on individual student traits. Disseldorp and Chambers (2002) found that, while there was an average overall increase in comprehension among TTS-using students, “the experiences of individuals ranged from improved to diminished performances.”

Little research has been carried out to determine specifically which students benefit from use of TTS, other than that indicating that poorer readers are most helped. Elkind (1998) looked at this issue, examining the impact of TTS on learning-disabled community college students. A regression analysis based on his results indicated that slower readers, those reading less than 176 words per minute, are helped in terms of reading rate by TTS, but that faster readers are actually slowed down. This research on effects of TTS on reading rate was tentative, however, because there were also indications that users’ rate improves when allowed to use TTS for extended periods beyond those formally studied in this research project.

Elkind’s 1998 study also included measures of reading comprehension, and the results were similar to those related to reading rate. Lower ability students (those reading below the tenth-grade level) experienced comprehension benefits from TTS, while higher ability students suffered comprehension losses.

What TTS Software Is Available?

ReadPlease 2003 and HelpRead are available as free downloads from the Internet, and they function adequately for simple text-to-speech purposes. The CAST eReader and TextHelp are moderately priced and provide more options. The Kurzweil 3000 and WordSmith are more expensive, but they include even more options, as well as built-in scanning and optical character recognition (OCR) software that enable efficient creation of digital files from printed texts.
Kurzweil 3000 is a stand-alone program, while WordSmith uses Microsoft Word for file-reading tasks and Microsoft Internet Explorer for text reading on the Internet. Other more specialized programs perform limited tasks. PDF Aloud, for example, provides a toolbar addition to Adobe Acrobat which enables PDF documents to be read aloud.

With a wait of only a few minutes for downloading, even over a telephone line with a standard modem, those who wish to experiment with TTS can install the latest version of ReadPlease on their hard drives for free. This software allows users to choose from four voices: two female and two male. Users select and copy text from a document, paste it into the ReadPlease window, and hear it read aloud when the play button is clicked. A sample is available here (832K .wav audio file). Font size can be automatically adjusted with the click of another button, as can speed of reading. Each word is highlighted as it is spoken. Reading can be paused or stopped at any time.

CAST eReader is published by a not-for-profit educational organization. While CAST does offer a Macintosh-based version, the company more fully supports its Windows version. eReader uses voice synthesis for HTML-based webpages and for RTF, or “rich text format,” files, the latter being a word-processing format usable by all major word-processing programs. It can highlight the text being pronounced at either the word, sentence, or paragraph level on the computer screen, and users can choose to have the reading stop at the end of every sentence or paragraph. eReader also allows students to open a second window in which they can take notes from the material they hear. At present, eReader costs a bit more than US$200 for a single license, but multiple licenses are available for about US$100 each.

The Kurzweil 3000 electronic reader is an example of an e-reader at the higher end of the price range. It includes a built-in web browser with which readers can simply point and click to have a webpage read aloud to them. It also has point-and-click reading aids that allow a user to click on a word and then on an icon at the top of the screen in order to obtain a dictionary definition, a list of synonyms, or a syllabic pronunciation in order to aid in word identification. Users can take notes by highlighting sections of the text and importing the highlighted material into a
separate text file. They can also attach notes to relevant sections of the text, write notes in an on-screen notepad, and add voice recordings of their own. A scanning component allows a textbook to be scanned and then displayed in color on the computer screen, complete with the original page layout, including pictures and graphics. Kurzweil 3000 costs about US$1000 per station with a multiple license.

What Texts Are Available to Use With TTS?

A huge amount of material is available in electronic text format. As noted above, text from the Internet and from word processors can be used by TTS software. Some TTS software will read PDF documents.

In addition to these possibilities, scanners sold for personal computers today come equipped with OCR software that can be used to scan printed documents, interpret the text, and transfer it in digitized form to a computer file. The file can then be displayed on a computer screen and read aloud using TTS software. Scanning can be time-consuming, however, especially when long passages, such as textbook chapters or entire books, are involved.

There is increasing recognition that publishers should make their textbooks available in digitized format to schools. This would allow schools to provide TTS capabilities to struggling readers, who can then work with digitized versions of the same print-based texts being used by their peers. In the United States, for example, the federal government is looking into the possibility of creating a national standard for such digitized files, one that could be used easily by all TTS software (CAST, 2004, online document; Stahl, 2003).

A variety of websites now make available extensive collections of digitized texts. These consist largely of materials that were published sufficiently long ago that they are now in the public
domain. For example, many of the writings of Mark Twain can be found, but J.K. Rowling’s Harry Potter series is not legally available.

Project Gutenberg has spearheaded efforts to put text materials on the Internet for free use. Michael Hart (2002, online document), its director, has predicted that in the next decade, the number of publications available for free on the Internet will increase to 18,000,000, much of it older material that is now available in the public domain only in print form. Today, Project Gutenberg already has a wide range of public domain materials available online.

Many other websites provide material that can be used with TTS:

- The World Factbook, produced by the U.S. Central Intelligence Agency, provides information on every country in the world
- Blackmask provides the text of the inauguration speeches of every United States president
- The University of Virginia’s Electronic Text Center provides an extensive collection of materials written by African American, Native American, and female writers
- The Internet Public Library, like Project Gutenberg, offers a tremendous array of electronic text materials, including KidSpace for elementary children and TeenSpace for adolescents
- Thousands of stories written by children and contributed for online distribution are available at KidPub

Those looking for additional sources can also use any Web search engine. Enter a title or topic and the term electronic text, as, for example, “Huckleberry Finn” AND “electronic text” or “African elephants” AND “electronic text.”

Back to menu

Practical Conclusions About Using TTS With Struggling Readers
As noted above, only a handful of studies have investigated the effectiveness of TTS software, so conclusions about its use are preliminary. Both researchers and teachers who have published their experiences, however, are unanimous in two conclusions:

- First, effectiveness varies according to the attributes of the student using the software. That is, we can safely draw the conclusion that some students will find electronic readers helpful, and others will not. For example, there is tentative evidence that poorer readers find the software more helpful than better readers. This makes sense, of course, since better readers can read the material on their own; their comprehension will not be improved much by having the text read aloud. Also, there is very tentative evidence that the engaging effect of the electronic readers may work well with students who exhibit attention-deficit disorders.

- Second, effectiveness varies according to the use to which the software is put. Again, this conclusion is educationally a safe one to make. Software that is purchased hastily, without a thoughtful plan of implementation, will go unused, just as much other educational technology goes unused. When use of the software is a central part of a student’s curriculum, it will play a much more powerful role than if it is an occasional add-on.

The major issue about TTS apparent in the literature has to do with practical classroom application. How much time would the typical teacher have his or her struggling readers actually reading and listening to electronic text files? With the widespread commercial availability of books-on-tape and the possibility of providing students with audiotapes recorded by the teacher or a volunteer, most teachers already have significant access to materials that play a similar function to TTS. Teachers find little or no time to use the TTS software they have unless they make a conscious and significant commitment to do so.

At first glance, TTS seems to present tremendous potential, especially for students who would like to use the limitless resources of the Internet. It allows them simply to log on, perform a search, and be supported by the read-aloud capabilities of the e-reader. In its actual operation,
TTS is quite awkward to use with browsers because of the nature of the search function. A fluent reader can perform a search, skim over the results, choose a few likely ones, and try them out. A struggling reader will be bogged down trying to use TTS with the results of a Google search, for example, that yields a hard-to-understand list of possible URLs. He or she will almost certainly need a great deal of help in identifying likely sites.

Once at a site, TTS usefulness is primarily limited to the word-recognition process. Content area reading, the focus of a great deal of Internet use in the classroom, requires sophisticated skills of recognizing an author’s organization and intent in order to spot key ideas. Comprehension requires well-developed background knowledge schemata. Help in word identification through TTS may be beneficial, but struggling readers may still not be able to understand the material without additional scaffolding from the teacher. This might include provision of important background knowledge, key questions, or a few vocabulary definitions.

**Suggestions for Using TTS**

1. Applications software — “tool” software — is often complex. Like word processors, spreadsheets, graphics programs, and database software, TTS software has a steep learning curve. Students need class time and teacher guidance to learn software operation, and unless the program is frequently used, students will quickly forget its features and operation. Hecker et al. (2002), for example, gave college students one to three hours’ training at the beginning of their study. Unless the teacher plans to make the electronic readers a regular and frequent component of the classroom curriculum, the effort needed to teach and learn its operation may not be worthwhile.

2. As in any implementation of technology in the classroom, formal planning should precede purchase. Too often, expensive technology is ordered with a vague hope that it will
somehow fit into the curriculum. It rarely does, as the teacher’s comments at the beginning of this article verify. First, identify the exact components of your curriculum that will allow for use of the technology, including actual tentative scheduling of its use with individual students. Then make a decision as to whether your plans are realistic. Only after that should the purchase order be placed.

3. Provide ongoing resources for any necessary scanning and OCR. Unless qualified staff members are provided time to do the tedious work, the scanning simply will not get done. A single textbook chapter in a biology book, for example, will take hours of scanning. Howard (2004) reported that it took her five hours to digitize four first-grade books.

4. Develop a formal library operation to save and make available relevant documents. Once a biology chapter has been scanned and converted to a text file, for example, it should be made available to all teachers in the school. Distribution of the text files to other schools would be a legally questionable issue, but use within a school is appropriate. As Howard (2004, p. 28) indicates, “The digitizing of copyrighted material that the school owns a legal copy of is permissible when used for instruction of students with special needs as long as the digitized copy identifies the copyright owner, includes the original date of publication, and contains a notice that further reproduction may infringe on the copyright owner’s rights.”

5. Provide ongoing resources for teachers to examine and evaluate potential websites relevant to their students’ needs. Unless teachers are given the time to do web browsing, their students will not be directed to appropriate websites.

6. Recognize that students will not be able to function independently with the electronic readers. Teachers or staff must be readily available to provide guidance and help.

7. In addition to standard TTS software, consider other tools that use text-to-speech
capabilities. For example, the Reading Pen II is a pen-like device that can be passed over a word or phrase of printed text. Reading Pen reads the words aloud through a small, built-in speaker or through earphones. A small screen on the pen displays the word divided into syllables. Users can also access Reading Pen’s software dictionary of 200,000 words to have definitions read aloud.

Readers interested in some hands-on investigating of the promise of text-to-speech can choose from a variety of easily accessible resources.

ReadPlease 2003 only takes a few minutes to download, even with a standard telephone modem connection to the Internet. The software allows you to take electronic text, paste it into a text box, and hear it read aloud using voice synthesis. The Kurzweil 3000 is one of the most sophisticated — and expensive — TTS programs. Kurzweil makes available a CD-ROM with a 30-day free trial of the software. It can be ordered from www.kurzweiledu.com.

References


484-498.


About the Author

Ernest Balajthy is a professor of education at the State University of New York at Geneseo, United States, where he teaches courses in reading and literacy, secondary education, and instructional technology. He taught for seven years in the New Jersey public schools. Balajthy is the author (with Sally Lipa) of Struggling Readers: Assessment and Instruction in Grades K–6 (Guilford, 2003), Microcomputers in Reading and Language Arts (Prentice Hall, 1986), and Computers in Reading: Lessons From the Past and the Technologies of the Future (Prentice Hall, 1989). He is the editor of the “Issues in Technology” column in the journal Reading and Writing Quarterly, and a past president of IRA’s Special Interest Group on Microcomputers.

For a printer-ready version of this article, click here.
