



Lerner DIGITAL™
interactive books

WHAT THE RESEARCH SAYS:

*How Lerner Interactive Books Support Reading
Comprehension and Content Knowledge Acquisition*

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WHITE PAPER

WHAT THE RESEARCH SAYS: HOW LERNER INTERACTIVE BOOKS SUPPORT READING COMPREHENSION AND CONTENT KNOWLEDGE ACQUISITION

The instructional value of reading to children has long been understood. In today's classrooms, however, time for such reading is limited and often takes place only in a group context. This in turn limits the benefits that students, particularly struggling readers, might otherwise be able to gain from this type of interactive reading experience.

Lerner Interactive Books represents one solution to this dilemma. These best-selling books for grades K–6 have now been released in an interactive, electronic format that allows students to read on the computer while listening and tracking the narrated text and viewing the illustrations.

The purpose of this white paper is to describe some of the research-supported instructional benefits related to reading comprehension and content knowledge acquisition that can come from use of this interactive format.

WHAT ARE LERNER INTERACTIVE BOOKS?

Lerner Interactive Books are books featuring audio support and interactive elements to promote learning. Key features include the following:

Focus on essential standards-based, age-appropriate content

Three speeds of audio narration that can be selected or turned off by students

Text that highlights as it is read aloud

The ability to double-click a word to hear it pronounced again

Tools that allow students and educators to write or draw, highlight, and erase on any page

Appropriate illustrations and full-color photography that support the development of content knowledge

Interactive glossary and index as appropriate for some books with a specific content focus

A comprehension quiz

Interactive activities that allow students to engage further with content covered in the books

COMMON MODELS FOR USING LERNER INTERACTIVE BOOKS

Common instructional models for using Lerner Interactive Books include the following:

Students read the Lerner Interactive Books independently on a computer or other device.

Struggling readers read the Lerner Interactive Books individually under the supervision or guidance of a teacher, ESL teacher or special education instructor, librarian, or aide.

A teacher, librarian, or aide guides a small group of students through a Lerner Interactive Book using a computer, set of computers, or interactive whiteboard while the rest of the class completes another activity.

A teacher or librarian uses a Lerner Interactive Book as a resource for large-group or whole-class instruction, using a computer projection system or interactive whiteboard.

Students read the Lerner Interactive Books on a computer or other device at home with parents (e.g., on school laptops available for checkout).

ABOUT THIS WHITE PAPER

The remainder of this white paper includes the following informative sections:

An executive summary presenting key findings from the body of research

Separate sections describing the research-based advantages of Lerner Interactive Books as a resource for:

- **Learning through sight and sound***
- **Immediate feedback encourages early readers***
- **Acquiring content knowledge despite decoding barriers***
- **Appropriate interactive features are not distractions***
- **Exposure to models of fluent reading***
- **Choice of narration speed***

Conclusion

EXECUTIVE SUMMARY—KEY FINDINGS

Research presented in the sections that follow support the following findings:

Research evidence suggests that simultaneous presentation of text visually and auditorily can aid comprehension, especially among struggling students (Montali & Lewandowski, 1996; Pearman, 2003; Magnan & Ecalle, 2006; Korat, 2010).

Reluctant and early readers need constant feedback to avoid making improper connections, and interactive books can support busy teachers unable to provide every student the individualized attention required by providing immediate feedback (Chen et al., 2003; Ciampa, 2012; Dalton, 2014; Doty, Popplewell, & Byers, 2001; Pearman, 2008).

Bi-modal presentation of text can help support student acquisition of age-appropriate content knowledge despite difficulties in decoding text (Ertem, 2011; Lefever-Davis & Pearman, 2005; Morgan, 2013; Pearman, 2008; Wood, 2005).

Research has observed that appropriate enhancements improve comprehension and learning while interactive books that employ excessive irrelevant animations, sound effects, and games are distractions from content (Chiong, 2012; Dalton, 2014; Ertem, 2011; Huang, 2012; Oakley, 2002).

Research-informed expert opinion suggests a value in helping students develop fluency by supporting student reading with the availability of spoken narration (Dalton, 2014; Hawkin et al., 2015; Lefever-Davis, & Pearman, 2005; Wood et al., 2010).

Research supports the value in reading-while-listening (RWL) activities of providing text that is spoken at roughly the same speed as the listeners' reading rate and of allowing students to select their preferred listening speed (Bergman; 1999; McMahon, 1983).

LEARNING THROUGH SIGHT AND SOUND

Reading is the foundation of all future learning, which makes achieving literacy to a proficient degree the goal of the early elementary grades. The National Center for Educational Statistics has estimated that 69% of fourth grade students do not read at proficient levels while 36% read below basic levels of understanding (2005). Students that continue to struggle to read as they enter fourth grade are unprepared because fourth grade is when the “shift from ‘learning to read’ to ‘reading to learn’ typically occurs” (Wanzek & Kent, 2012, p. 2). Therefore, a foundational goal of early education is literacy.

Research evidence suggests that simultaneous presentation of text visually and auditorily can aid comprehension, especially among struggling students. Montali and Lewandowski (1996) explained the theory behind this approach as follows:

Various studies have investigated individuals' task performance when they were given auditory, visual, or bi-modal stimuli. By measuring participants' reaction time...researchers have commonly found a facilitative effect of the bi-modal condition when stimuli presented to each sensory channel were the same or functionally related....Students with reading disabilities do not automatically acquire sound-symbol knowledge. Instead, they build incorrect connections....A bi-modal technique presumably would increase exposure to words via sight and sound, thereby increasing exposure to correct visual-to-auditory matches...and, hence, strengthening sound-symbol associations.

The value of listening as a learning mode for younger students has been attested by research. Montali and Lewandowski cited a recommendation that “teachers read to pupils as a means of enhancing their comprehension,” but went on to point out that “[u]nfortunately, it is not often practical for teachers to read to students one-on-one, due to shortages of time and human resources” (p. 272). Use of “bi-modal reading via computer”—reading words while hearing them spoken—was proposed as a possible solution to this shortage of resources (Montali & Lewandowski, 1996, p. 272).

Interactive books that provide narration synced to text highlighting have been developed, and researchers have examined their effectiveness under a variety of conditions. Findings have shown interactive books can lead to greater improvements in comprehension scores when compared to print, especially among struggling students (Doty, 1999; Doty et al., 2001; Matthew, 1997; Forgrave, 2002; Pearman, 2003; Korat, 2010).

Korat's (2010) study of 166 kindergarten and first grade students found that compared to print and traditional instruction, interactive books led to greater improvements in vocabulary and story comprehension (p. 30). Korat's research team designed the experiment's interactive text following the bi-modal approach by having each word in the text colored in synchronization with the narrator's reading (p. 26), and the difficult vocabulary words could be clicked on for “a short oral explanation” (p. 25). Korat's research team found that “both age groups benefitted from the e-book software developed compared to the control groups who did not work on this software and received their school's regular literacy program” (p. 29).

These positive results were not only supported by Korat's previous studies (Korat, 2009; Korat & Shamir, 2007; Korat & Shamir, 2008; Korat et al., 2007) but by the evidence produced by other recent studies supporting the ability of interactive books to improve kindergarten children's comprehension and vocabulary (Lewin, 2000; Segers & Verhoeven, 2002; Segers & Verhoeven, 2003; Segers et al., 2004; Verhallen et al., 2006). Agreeing with Korat that interactive books can benefit students of different levels and abilities, Magnan and Ecalte (2006) concluded from their study of kindergarten students with poor phonological awareness that interactive books “represent a good way of delivering literacy training adapted to the specific needs of both ‘reading-ready’ kindergarten children and reading disabled children” (p. 421).

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HOW LERNER INTERACTIVE BOOKS SUPPORT STUDENT LEARNING THROUGH SIGHT AND SOUND

By simultaneously providing written text for students to look at and spoken narration for students to listen to, Lerner Interactive Books support bi-modal learning. The highlighting of each word as it is spoken draws the reader's attention to the sound-symbol correspondence. These audio and visual features can be paused for convenience if desired. Students who do not need this extra level of support have the option to turn off the narration.

IMMEDIATE FEEDBACK ENCOURAGES EARLY READERS

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Reluctant and early readers need constant feedback to avoid making improper connections, and one-on-one instruction is often limited to short periods of time. In response, researchers have promoted interactive texts for their ability to provide immediate feedback to help support already-busy teachers who are unable to give instantaneous feedback to all their students simultaneously (Chen et al., 2003; Dalton, 2014; Doty, Popplewell, & Byers, 2001; Pearman, 2008).

Ciampa's (2012) study concluded that the immediate feedback of electronic text with audio and highlighting enhancements can remove many of the barriers to learning. The support features of the interactive texts “helped to capture all of the participants' attention (including the struggling readers), assist in the learning of new words, and sustain attentive listening during the entire read-aloud without being distracted or influenced by their peers or external stimuli” (p. 124). During classroom instruction, Ciampa observed that:

[S]tudent participants experienced delayed feedback when they completed postreading comprehension print-based activity worksheets and often waited a few days or even weeks to find out whether their responses were correct. By contrast, the multimedia-based postreading activities enabled student participants to receive instantaneous feedback. (p. 124).

In the student questionnaire, the children welcomed the ability to have immediate feedback and even articulated how these feature improve their performance:

Christopher's comment highlights this: “If I get a wrong answer [on the Childtopia website], then I fix my answers right away and do better” (Child Questionnaire 3, p.9). Similarly, students were asked, “Do you like knowing if you got a right or wrong answer quickly?” and all of the participants answered *yes* in response to this question. (p. 119–120)

Students in a larger classroom setting that are shy or embarrassed to ask a question during discussion will fail to receive the personalized feedback they might require. Ciampa observed that for some of the first grade participants “immediate feedback (in the form of positive reinforcement) and decreased rates of social comparison with peers may have a positive influence on their perceived self-efficacy and motivation” (p. 122).

HOW LERNER INTERACTIVE BOOKS PROVIDE IMMEDIATE FEEDBACK

Lerner's Interactive Books provide students with a model real-voice narrator that never tires of rereading a word or passage, and the reading pace can be adjusted to three speeds. Definitions are provided for challenging vocabulary, and the built-in quizzes and activities provide immediate results. Personalized instruction from the teacher can then be focused on students with the greatest needs.

ACQUIRING CONTENT KNOWLEDGE DESPITE DECODING BARRIERS

Reading is more than a set of essential skills children must master. Starting in the elementary grades and increasingly as children get older, reading is also an essential medium for learning about the world. Limitations in reading skill become bottlenecks for acquisition of other kinds of knowledge, thus making it more difficult for poor readers to learn in other areas as well. Because knowledge about the world in turn impacts reading ability, this can contribute to a vicious circle sometimes referred to as the “Matthew effect” in which poor readers find it increasingly hard to make up their deficits as they get older (Stanovich, 1986, as summarized in Weinberger, 2004, p. 3).

This gap between the content knowledge students need to develop and the reading skills needed to acquire that knowledge can be particularly large for beginning readers, struggling readers, and English language learners. In the upper elementary grades and beyond, the “gap between good and poor readers often widens because good readers tend to read more and gain skills and confidence through additional practice, while poor readers continue to be unsuccessful because they tend to avoid reading” (Morgan, 2013, p. 478). A first grade teacher noted:

My first graders have plenty of ability to comprehend text and ideas, but not all of them have the skills to decode at as high a level as they can comprehend....Selecting learning materials solely on the basis of students' decoding ability rather than their ability to comprehend the content can create an imbalance in students' reading skills as they get older (Howard, 2004, p. 27).

Pearman (2008) investigated interactive books' ability to support content acquisition despite decoding barriers by conducting a study of 54 second-graders. Pearman compared individual reading of print to the use of interactive books with audio and text highlighting. Pearman observed how readers could overcome decoding barriers and acquire content knowledge with the interactive support features:

Beginning readers or students that are struggling with developing reading skills may benefit from having unknown words immediately pronounced for them by the computer. To comprehend, readers need to be able to recognize many words in the text with a degree of automaticity. The rationale behind this concept is that young learners can only attend to one difficult task at any given time, so readers who must devote considerable time and energy to decoding have little or no attention left to direct toward processing meaning in order to gain comprehension (Tompkins, 2006). The computer-generated pronunciations remove this burden of decoding for less skillful readers and allow them to concentrate on constructing meaning from the text. The Discis books used in this study provided not only word pronunciations but also contextual definitions. (p. 600)

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”

Interactive book support features can be adapted to the user and remove decoding barriers per user choice, as Ertem (2011) observed:

CD-ROM storybooks provide reader control. The readers can make choices for themselves when and where they need help. The pronunciation, definition, hearing of the words provides minimum interruption in reader's comprehension (Lefever-Davis & Pearman, 2005). Also, these features help students to not spend too much mental energy to decode words nor do they have to struggle with new vocabulary. Therefore, students have more time and energy to process meaning for comprehension (Lefever-Davis & Pearman, 2005; Pearman, 2008). (p. 30)

Beyond removing the decoding barriers, interactive texts have been found to improve decoding abilities. Wood's (2005) study of 40 six-year-olds concluded that interactive books prove equal to one-on-one support from an adult in improving children's phonological awareness (p. 173). Wood further observed how children using the interactive books changed their approach to decoding:

[T]he younger children who had access to the computer software were less likely to mispronounce words that they were unable to read, indicating a shift away from unsuccessful attempts at letter-by-letter decoding. It would seem that these children were now more successful at their letter-by-letter decoding of words (p. 180).

HOW LERNER INTERACTIVE BOOKS SUPPORT STUDENT ACQUISITION OF CONTENT KNOWLEDGE DESPITE DECODING BARRIERS

Spoken narration supports students in learning from Lerner Interactive Books, even when their decoding skills are not up to the task of reading the individual words. Lerner Interactive Books present important age-appropriate content, thus helping to support students' acquisition of content knowledge. Such books support the kind of use described by Howard (2004), Pearman (2008), and Ertem (2011) but without the expenditure of teacher time to prepare the materials.

APPROPRIATE INTERACTIVE FEATURES ARE NOT DISTRACTIONS

There are many options for interactive books aimed at the education market, and besides text highlighting and narration, many provide extra hot spots that trigger sound effects and animations, criticized for "not directly relat[ing] to the story" (Chiong, 2012, p. 2). These features are often criticized by parents, educators, and researchers for bordering on edutainment or games rather than productive educational resources. Ertem (2011) points out inappropriate interactive books "can offer too many choices and too many animations that may distract and confuse struggling readers" (pp. 30-31 citing Coiro, 2003). Furthermore, Ertem explains that research has shown that "if the illustrations, games, attractive pictorial options included in the interactive storybooks do not support the story, they can distract and draw attention away the children's focus on the story rather than support the narrative's comprehension, could cause passive reading, and delay children's early literacy development" (Ertem 2011, p. 31 citing De Jong & Bus, 2002; Labbo & Kuhn, 2000; Matthew, 1996; Shamir & Korat, 2006; Underwood & Underwood, 1998).

In agreement, Dalton (2014) calls for caution when selecting interactive texts that offer features irrelevant to the text as “these kinds of media experiences can interfere with students’ comprehension” (p. 41). However, Dalton’s survey of current research shows strong evidence that “[w]hen sound effects and animations are connected to the storyline and content, the media tend to support vocabulary learning and comprehension” (p. 41 citing Labbo & Kuhn, 2000; Zucker, Moody, & McKenna, 2009).

Studies show interactive books and features are not equally effective or even beneficial to learning. Trushell, Maitland, and Burrell (2003) compared one group reading an interactive text and another group reading the same interactive text but with significantly more irrelevant features. They found a correspondence between excessive irrelevant features and “poor recall of propositions, particularly in episodes in the event structure” (p. 87). Oakley (2002) observed that reluctant readers and those with mild difficulties were distracted and tended to dwell on animations and sounds effects while reading interactive books. However, “when less glitz was available, these same students were happy to engage with educational rather than edutainment [interactive books], even electing to skip playtime and part of the lunch break to read them” (Oakley & Jay, 2010, p. 249 citing Oakley, 2002).

In Pearman’s (2008) study, it was found that the interactive version of a text improved comprehension scores more than the printed version, but perhaps more interesting is that Pearman found that the digital text focused reluctant readers more than the printed version:

Four students in the study were identified as having attention-deficit hyperactivity disorder. One student was identified as a member of the high reading group, one was a member of the medium reading group, and two were part of the low reading group. When these students were reading the traditional print text, they often flipped backward and forward in the book, looked around the room for long periods of time, traced pictures with their fingers, and tried to hold conversations with me. Contrary to both my expectations and the findings of the Project Literacy Instruction Through technology, these students were more engaged when reading CD-ROM storybooks. They clicked on words and pictures but kept their attention on the text instead of looking around the room. (pp. 599–600)

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The question for researchers is no longer whether digital texts and interactivity are effective but which interactive features are most effective.”

The question for researchers is no longer whether digital texts and interactivity are effective but which interactive features are most effective. In agreement with Dalton and Ertem, Huang (2012) is “convinced that the development of appropriate e-books can support children’s learning and may largely substitute printed books in the future” (p. 719).

HOW LERNER INTERACTIVE BOOKS ARE DESIGNED FOR LEARNING

Lerner takes great care to ensure its interactive books promote learning. Lerner Interactive Books don’t overuse the possibilities of the digital medium but focus on enhancements that encourage learning. Audio narration, text highlighting, definitions for challenging vocabulary, and words being clickable to repeat all come together to aid learning. All these features can be turned on and off, adapting to the reader’s needs.

EXPOSURE TO MODELS OF FLUENT READING

“**Simultaneously reading while listening (RWL)** has the potential to help improve student fluency, both by increasing automaticity of word recognition as noted above and by providing models for fluent reading.”

Simultaneously reading while listening (RWL) has the potential to help improve student fluency, both by increasing automaticity of word recognition as noted above and by providing models for fluent reading. Audio narration can also “improve vocabulary, encourage oral language usage, and increase comprehension” (Wolfson, 2008, p. 106). Though Text-To-Speech software has improved, many interactive book publishers have been recording with voice talent, “although it is more expensive and time-consuming to produce. This not only provides a fluent reading model but adds an emotional overlay that can further entice a reader into the world of stories, poetry, and nonfiction” (Dalton, 2014, p. 40). In their study of interactive texts with narration, Wood, Pilinger & Jackson (2010) observed how a fluent model improved early readers’ fluency:

[Y]ounger children in the talking books group appeared to change their approach to word reading. This was evidenced in the nature of the reading errors that they made, with the five-year-old children in particular showing a decreased tendency to mispronounce words they were attempting to read. Moreover, use of the ‘read the page’ function of the software was associated with a decrease in both mispronunciations and refusals to read an unknown word, and an increased likelihood to make word substitutions. (p. 191)

Lefever-Davis & Pearman (2005) conducted case studies on 11 first grade students using interactive storybooks. They observed that the modeling of the fluent voice narration improved the student’s fluency:

[D]igital pronunciations also provided a model of fluent reading for Gage. He struggled with the text when he read independently, but when he had the computer read the text first, his subsequent reading became much more fluent. The voice pronunciation feature was also used to confirm students’ predictions of words in the text. Natasha, who would read a word and then click on it to make sure she was correct, exhibited use of this function. She continued to do so throughout the text, clicking on words she had read with success previously. These children seemed to really embrace the benefits of the electronic features and understood the role that the computer could play in assisting them. In one of the stories, Gage clicked on an unfamiliar word purposefully, saying, “I just need a little help.” Clearly, Gage was using the electronic features as tools to support his reading. (p. 451)

Esteves and Whitten (2011) hypothesized that audiobooks could be more effective in improving fluency than the widely used practice of sustain silent reading (SSR) which “lacks sufficient evidence of effectiveness for students who struggle with reading” (p. 22 citing The National Reading Panel, 2000). Esteves and Whitten conducted a study comparing the two methods with 20 struggling upper elementary students using audiobooks accompanied by the printed version to replace SSR time (p. 25) and found that “both groups showed improvement in number of words read correctly per minute between the pretest and posttest periods; however, the treatment group demonstrated larger gains” (p. 30).

The ability to tailor narration to read the whole text, small sections, or specific words proves to be immensely valuable for students. Professional voice recordings are even comparably as effective to one-on-one instruction. Hawkins, McCallum, and Musti-Rao's (2015) study on fourth grade students that struggled with fluency compared the benefits of repeated reading (RR) with an adult tutor to reading while listening (RWL) with an audio recording of the text. While both RR and RWL led to similar results of 75% of students improving their oral reading fluency, "results suggested that [RWL] led to more rapid learning than RR" (Hawkin et al., 2015, p. 60). With the understanding that time and personnel are both limited resources, Hawkins suggests that RWL is a more effective and efficient intervention compared to the practice of RR (p. 62).

HOW LERNER INTERACTIVE BOOKS SUPPORT FLUENT READING

Narration in Lerner Interactive Books provides a model that students can listen to as they follow along in the printed text. Because each word is highlighted as it is spoken, students can easily follow the flow of the text. By clicking on individual words, students can hear them pronounced as often as desired.

CHOICE OF NARRATION SPEED

Recent interactive book studies have noticed that lack of narration speed control was a problem. Researchers like Oakley (2010) have found students stating in surveys that "there was not enough control over the speed of the narration" (p. 250). McMahon (1983) speculated that differences in results from various studies of reading-while-listening (RWL) activities could be explained by a mismatch in some cases between students' own reading rates and the speed of narrated text. This hypothesis was borne out by research with 15 first grade students and 15 third grade students. Asked to identify mismatches between the text they were hearing and what they read on the printed page, students at both levels "performed the task well at their own oral reading rates" (p. 38). Students also did "reasonably well" when the narration was 35% faster than their oral reading rates (p. 45). However, at narration speeds typical of published recordings for reading-while-listening in the primary grades (112 words per minute for first grade and 141 words per minute for third grade), "the skill observed ...seem[ed] to break down" (p. 46). This effect was particularly strong for first graders.

McMahon also found that oral reading rates among students in the study varied widely, from 18–50 words per minute among first graders and from 50–91 words per minute for third graders. These ranges in oral reading rates underscore the importance of providing variation in the narration speeds that are available to students, even within the same age and grade level.

Bergman (1999) tested the feasibility and effectiveness of allowing 69 first graders to select their own narration speed. Stories in Hebrew (the students' first language) were narrated at several different speeds, ranging from 30 words per minute to 90 words per minute. The average reading rate for students in this group was 53.4 words per minute—a little over half the average narration rate of 105 words per minute that the researcher reported in “Israeli tapes and software designed for this age group.” Bergman found that “having a choice of narration rates had a significant effect on the participants' comprehension and their accuracy in text reading....The overall results indicate with high significance that giving children a choice of narration rate had a positive effect on their learning with the RWL technique.”

Bergman also found a significant correlation “between the children's actual reading rates and the narration rate they selected,” suggesting that “children tend to choose realistically according to their abilities, overcoming their desire to hear the story at a faster pace.” Additionally, “participants found that reading with a narration rate they chose was ‘easier’ and ‘more fun’ than undertaking RWL with a fixed rate.”

Positive results were also found for 13 members of the group who were designated as “poor readers” based on test scores during the experiment and/or prior teacher assignment: “[C]hoice of narration rates had a significant positive effect on the poor readers' group in the area of reading accuracy (both text and word levels), but not for comprehension or speed.”

Bergman concluded:

The results of this study confirm the hypothesis that having a choice of narration rate is more effective than standard reading-while-listening for students in the initial stages of learning to read. The results indicate that, overall, control over narration rate yields improvements in reading comprehension and text-level reading accuracy. Results regarding word-list accuracy reached significance only for the poor readers....The positive effect on the children's performance under the control-over-rate condition was confirmed with high significance. (p. 11)

HOW LERNER INTERACTIVE BOOKS SUPPORT STUDENT CHOICE OF APPROPRIATE NARRATION SPEED

Lerner Interactive Books are unique among the market in offering three different narration speeds. Speed 1, the slowest speed, reads 30% below reading level and highlights words individually. Speed 2 reads at grade-appropriate reading level and highlights words individually. Speed 3 reads at a fluent level, as if being read by an adult, and highlights phrases as they are being read. Slower speeds typically fall within the range of oral reading rates found by McMahan for the appropriate grade levels.

“*Having a choice of narration rate is more effective than standard reading-while-listening for students in the initial stages of learning to read.*”

CONCLUSION

Lerner Interactive Books provide a valuable potential resource to help support student learning. Research evidence suggests that simultaneous presentation of text visually and auditorily can aid comprehension, especially among struggling students. Such bi-modal presentation of text can help support student acquisition of age-appropriate content knowledge despite difficulties in decoding text. Research-informed expert opinion also suggests a value in helping students develop fluency by supporting student reading with the availability of spoken narration. Such resources are particularly valuable if the narration is spoken at roughly the same speed as the listeners' reading rate and students are able to select their preferred listening speed.

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