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Learning to Read with Multimedia Materials

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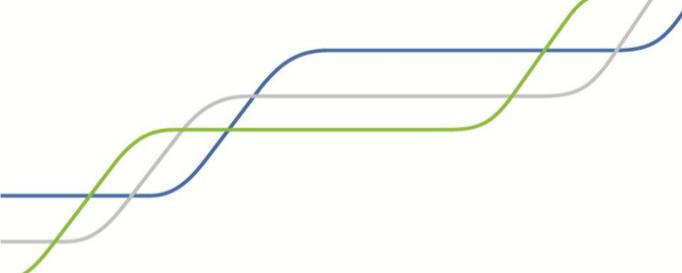
By: Center for Technology Implementation in Education
(CITEd)

The National Reading Panel (2000) identified three key elements of effective reading instruction: alphabets (phonemic awareness and phonics), fluency, and comprehension (vocabulary, text comprehension, and comprehension strategies). After evaluating the research base for each element, the panel determined that instructional attention to these elements is critical to the development of independent, motivated readers. Unfortunately, many students struggle with reading, and reading achievement remains a serious concern among educators and parents.

Technology and multimedia materials offer the potential for addressing the challenges of reading instruction. For more than 2 decades, researchers have been using innovative technology to engage students, build connections between oral and written language, prompt active reading, and provide supplemental tutoring. In the process, technology and the understanding of how to support reading instruction and achievement have both advanced.

Some educators and parents express concern that if digital texts are used too early in the process of learning to read, students may never become strong, competent, independent readers of print. However, there is a steadily growing body of research showing that digital text and multimedia environments can play a powerful supporting role in reading instruction.

Multimedia reading materials and environments offer a variety of flexible supports including text-to-speech, voice recognition, animation, music and sound effects, embedded dictionaries, linked videos to boost background knowledge and vocabulary, study tools such as highlighters and annotation capabilities, and animated agent tutors. They have the capacity to support choice of content and tools, adjustable challenge level, and adjustable practice and feedback. This Research in Brief article considers the research on the potential of multimedia materials and environments to support reading for struggling readers. We offer suggestions for choosing multimedia materials and integrating them into reading instruction effectively. The article includes four main sections: an overview of the research implications for integrating multimedia materials into reading instruction,



advice for choosing multimedia materials for reading instruction, a list of the resources cited in the article, and a more detailed description of the research literature.

Overview of Using Multimedia to Support Reading Instruction

In this first section, we offer suggestions based on the research for integrating multimedia materials and environments into reading instruction. The section is structured according to five key areas of reading research.

Phonemic Awareness

The goal of phonemic awareness instruction is to build students' awareness of the phonological structure—sound--of language and to help them understand that phonological elements can be manipulated. Young students, students new to English, and students of any age who are emerging readers need to have a firm grasp of the relationship between oral and written language. For many children, this awareness grows naturally through word play; for students with learning English or difficulties, it rarely grows without explicit instruction.

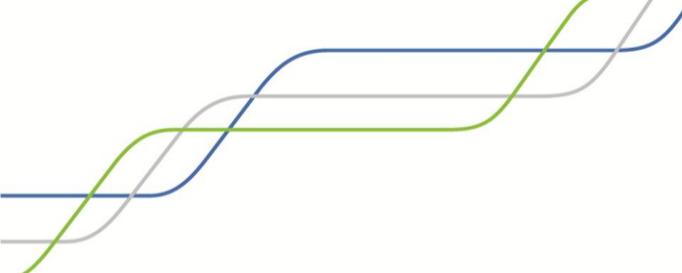
Teachers are always looking for ways to make instruction exciting for students; so are multimedia designers. For more than a decade, various multimedia programs have been used to teach phonemic awareness, and such programs have shown consistent promise, boosting users' phonemic awareness. Because they are able to animate the relationships between oral language and print, the concepts are less abstract.

Students with poor phonemic awareness need to practice and improve this fundamental skill. Conversely, students who have strong phonemic awareness most likely do not need additional practice. Therefore, individualized instruction is important. Educators are wise to select commercial software and web-based programs that offer individualized learning paths and/or progress monitoring.

Many commercial programs and free Web-based programs offer practice in phonemic awareness and other basic skills that draw attention to the features of print and language, reinforce classroom instruction, and increase engagement with print. Television and video programs that teach print concepts through multimedia are also engaging and reinforce rhyme and language play. For example, the award-winning PBS show, *Between the Lions*, supports emergent reading through activities, songs, and stories (discussed below in Research Support).

Multimedia programs should be considered a supplement to quality, explicit instruction. To promote transfer, the concepts in these programs should be reinforced





during instruction by, for example, adopting the terms the program uses and revisiting sample words from the program. Programs that focus centrally on print and language concepts (rather than bury these elements in other distracting elements) and programs that include progress monitoring features are best.

Phonics and Word Recognition

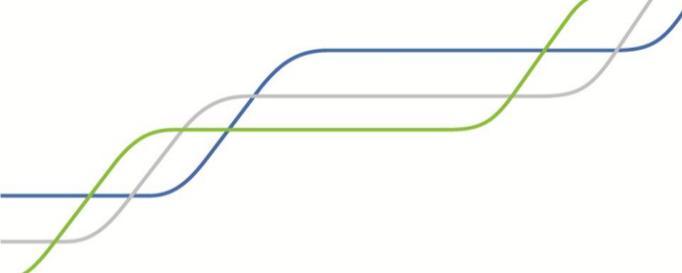
Emergent readers need to understand how the written language works, that is, the phonics rules and underlying orthography that are unique to English. Multimedia models of these relationships and rules can make them more comprehensible and concrete. Computer-based multimedia, video, and television programs have been investigated for their effectiveness in providing opportunities to experience language in an engaging, fun, and memorable way. Computer-based activities that animate the creation and manipulation of words, such as the programs described in the previous section, have been shown to improve students' word recognition (discussed below in Research Support). Thus, computer- or video-based activities are a good option to consider for providing students with targeted supplemental instruction and additional demonstrations and practice.

Fluency

Fluency is key to reading competence, enabling readers to devote their cognitive effort to comprehension and enjoyment of reading. For struggling readers who decode laboriously or ignore punctuation and natural phrasing, fluency instruction and practice are necessary and effective (Kuhn & Stahl, 2003). There are two important approaches to improving fluency: engagement with print (i.e., plentiful reading) and repeated reading (Meyer & Felton, 1999). By reading a familiar text aloud multiple times, students can begin to coordinate their decoding, semantic, and syntactic skills.

Students need to read engaging material silently and aloud and with ready support for words and concepts that they do not know. Researchers have investigated the effectiveness of providing fluency support in the form of multimedia environments that combine text-to-speech and speech recognition to listen to students' reading and provide targeted and differentiated feedback and guidance. These programs can function as an electronic tutor; some are designed with an animated agent that interacts with the student like a tutor. These programs have been found to be helpful to students and their instructors, providing students with needed word recognition and fluency support and parents and educators with progress monitoring information needed to tailor instruction. Given the limited supply of trained reading tutors and





specialists who can provide a fluent oral model and one-on-one tutoring, the effectiveness of e-tutors is encouraging. Educators should look for multimedia reading programs that provide supported practice. Online demonstrations of two e-tutors (discussed below in Research Support) are available: The [Reading Tutor](#) in Project LISTEN and [Scientific Learning](#).

Comprehension Strategies

Comprehension is the ultimate goal of reading, yet it is notoriously difficult to instruct. Multimedia environments can mirror and reinforce proven teacher-led strategy instruction through the use of pop-ups, linked questions, online resources, and animated reading coaches or e-tutors that engage in questioning, prompts, and think alouds.

Struggling readers' comprehension is often impaired by a limited reading vocabulary. Increasing vocabulary is an important goal and necessary component of comprehension. Multimedia texts with supports for vocabulary development, such as linked mini-videos demonstrating a concept or dictionaries and thesauruses with text-to-speech capabilities, can help students achieve this goal and improve comprehension.

Getting students to use supports effectively is a significant instructional challenge. Studies consistently show that students—especially those who are struggling—need prompting in order to access supports when they need them. Accessing appropriate supports is a skill and habit to be taught and learned. This can be accomplished through explicit instruction with a whole- or small- group activity. Students need to be prompted to regularly use supports while they are working, either through verbal reminders or study guides that accompany the reading assignment.

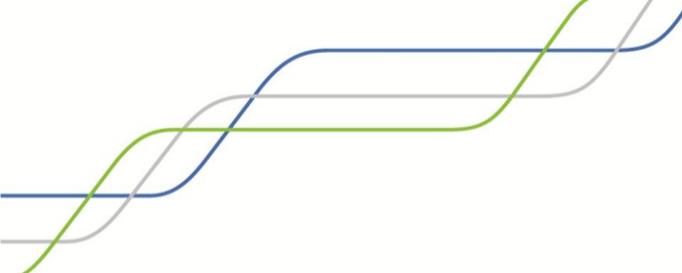
When strategy prompts and supports are embedded in the text, they are more timely and targeted for readers. These kinds of supports are just becoming commercially available. Two examples (discussed below in Research Support) are: [iSTART](#) and [Thinking Reader®](#), developed by Tom Snyder Productions, Scholastic.

Watch for new projects and products that prompt students to access supports, apply strategies, and stop to monitor their comprehension.

Engagement

Interest and engagement should be considered a significant outcome in literacy instruction and research as they are “a powerful determinant of the effectiveness of





any given literacy approach" (Strangman and Dalton, 2005, p. 559) and vital "to students' evolving feelings about reading itself" (p. 560).

Choice is key. Teachers can help students find motivating material among the growing selection of digital text available on the Web--for purchase or through subscription sites for students with diagnosed disabilities. Some Web-based sites embed supports into their selections. By importing text lacking embedded supports into reading programs, educators can leverage the multimedia supports with an increasing array of text.

Choosing a Program

No one program or approach will meet the needs of all students, so to engage students in their own learning it is wise to try a variety of interventions and supplemental activities and consult students in the process. Programs that are customizable and have a variety of digital texts will best meet diverse needs and interests. To promote transfer of learning, we recommend that educators look for programs that support the instructional strategies and goals already addressed in the classroom. Beware of programs that bury the elements of instruction in distracting animation or story lines. See the [TechMatrix](#) for reviews of commercial and Web-based reading programs and products.

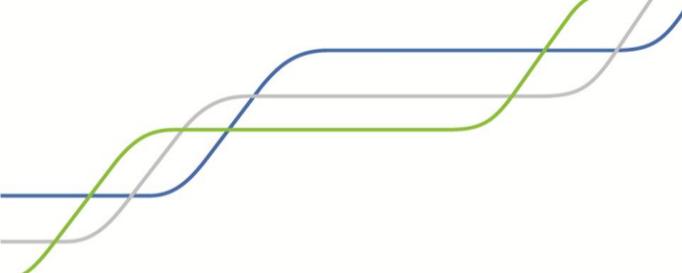
Research Support

Phonemic Awareness

For over a decade, researchers have investigated the effectiveness of multimedia computer-based programs for teaching and reinforcing phonemic awareness. Programs that provide emergent readers with visual and auditory examples of sound manipulation (i.e., say star without the s sound) can make these concepts much less abstract and help readers build connections between oral and written language. Computer-based practice with these concepts has been shown to increase struggling students' mastery of them (Baker & Torgeson, 1995; Heimann, Nelson, Tjus, & Gillberg, 1995; Mitchell and Fox, 2001).

Olson and Wise (2004) reflected on their decade-long investigation of computer-based remediation of phonemic awareness deficits in Colorado schools. They have developed and tested two programs that serve as facilitated supplements to classroom instruction, Accurate Reading in Context (ARC), where students spend 22 hours reading stories with speech recognition, and Phonological Analysis (PA), which provides explicit instruction of speech articulation in addition to animated storybooks





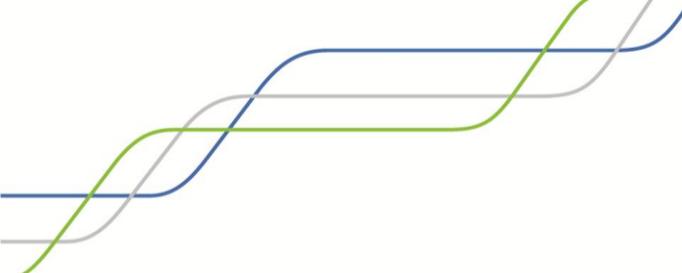
and other word-level analysis. These facilitated supplemental interventions require a trained teacher or instructional aide to prompt and monitor young students' interaction with the computer-based program and to deliver small-group instruction supportive of transfer. In a large study of elementary school students that included matched control groups, students who participated in the program demonstrated significant gains in phonemic awareness, decoding, and word reading which were maintained at a 1- and 2-year follow-up (Wise, Ring, Olson, 2000). Both programs produced similar results, suggesting that increased facilitated time spent reading—not the specific type of training—was key. They suggest that additional time and transfer activities would increase performance and retention of gains.

Phonics and Word Recognition

Wise, Ring and Olson (2000) found that students' word recognition significantly improved following facilitated supplemental training with their two programs (see previous section), which provided computer-based activities and small-group instruction. Lewandowski, Begeny, and Rogers (2006) found that 66 third-grade students' word recognition, reading speed, and accuracy scores improved similarly following practice with a very simple (no graphics or animation) computer-based reading program and work with a live tutor. Students' scores in a no-help condition did not improve. This study reinforces an earlier study in which Lewandowski and Montali (1996) showed that struggling elementary readers could perform as well as average achieving peers on word recognition and accuracy tests when provided audio plus visual input with computer-based practice.

Television or video segments offer another potential means to make early reading instruction comprehensible to young children. The Success for All program is a structured, research-based curriculum and school reform model. The program introduced a multimedia component to their standard one-on-one tutoring curriculum, which includes puppet routines and video segments intended to demonstrate reading concepts such as sound blending and segmentation. One hundred and eight-nine students who received tutoring embedded with multimedia components achieved higher reading performance than students who were tutored without the multimedia components (Chambers, Cheung, Madden, Slavin, & Gifford, 2006). The authors note that the secondary goal of creating these multimedia materials was to meet the ongoing need to provide professional development and models of tutoring instruction for the reading tutors.





Similarly, the PBS show [Between the Lions](#), which demonstrates reading and language concepts in entertaining skits combined with animated text, has been studied as a supplement to regular school instruction. Linebarger, Kosanic, Greenwood, and Doku (2004) studied the impact of the program on 164 kindergarten and first-grade students who were at risk, at moderate risk, or not at risk for reading failure. Although all children's print concepts and reading skills developed over the course of the investigation, the children who had already mastered some print concepts—the moderately at risk group—demonstrated the most growth. The authors reasoned that the content matched these students' emerging understanding of literacy concepts but may have been too high or too low for the other student groups.

Fluency

Fluency, particularly its relationship to comprehension, has been the focus of much reading research in the last decade. Readers who lack fluency have little cognitive resources left to monitor comprehension. The potential of technology-based approaches to improve fluency in struggling readers has received considerable attention. Three research projects involving multimedia programs are described here.

Wolf and colleagues have conducted a multi-year line of research into the RAVE-O program, a multimedia language and reading training program that addresses the specific deficits of young readers with language or learning disabilities. The program addresses three instructional goals within an engaging, game-like multimedia design: fluency and comprehension, orthographic and phonological awareness, and engagement. Interventions using this program have consistently shown a positive impact on students' reading skills and reading attitude, and the program has been adopted in further large-scale studies (Wolf, Miller, & Donnelly, 2000).

Project LISTEN's Reading Tutor uses advanced speech recognition and text-to-speech to listen to students as they read, providing corrective and neutral feedback and supports based on students' reading performance. Students can choose from texts of different challenge levels. Studies comparing the Reading Tutor to a human tutor demonstrated significant student progress in both settings. Further analysis revealed that the trained human tutor may have an advantage in being able to provide a more individualized challenge to students (Mostow, et al., 2003; see other publications at the project Web site above). Project LISTEN is not yet available as a commercial program, but is being used in several ongoing studies with normally achieving readers, struggling readers, and English Language Learners.





The Reading Assistant by Soliloquy is also focused on ways to support early readers in learning to read independently (Adams, 2006). A product video is online [here](#). The software program uses speech recognition and illustrated storybooks to provide fluency practice. The program features text-to-speech (to read the whole story or a single word or a word in context), inline dictionaries, Spanish translations, speech recognition to monitor children's reading, a digital recorder to record reading, and sophisticated progress monitoring features for tracking which words are decoded fluently.

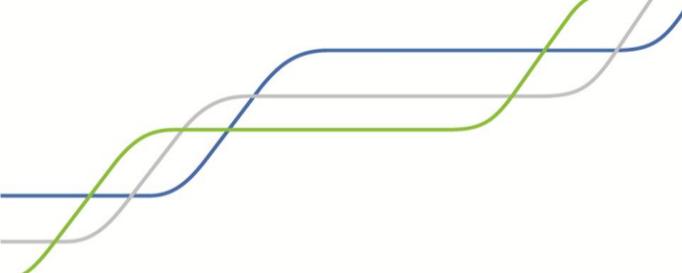
The research on commercial programs in this area of reading development is slim, however, the research on fluency practice is robust. Most researchers agree that what is needed is not more research on fluency, but more trained teachers and tutors to listen to and support young readers (Adams, 2006). The promise of multimedia programs is to address the lack of fluent oral models and supportive listeners in order to provide more and better practice opportunities.

Comprehension

Building comprehension skills requires more than just practice; strategy instruction requires modeling of the reading strategy, guided practice with well-chosen texts, and reflection on the flexible use of a range of strategies (Duke & Pearson, 2006). The application of comprehension strategies to complex texts is an enormous challenge for struggling readers, who must coordinate all their reading skills and monitor their understanding. Here we discuss three projects that offer strategy support and other scaffolding within digital texts.

The iSTART project delivers comprehension strategy instruction and practice based on the Self-Explanation Reading Training (SERT) model. It was developed at the Center for Cognitive Science and Educational Practice at the University of Memphis in order to help youth and young adults read, study, and comprehend science-based texts. iSTART is a Web-based module that uses a variety of animated agents to model and provide guided practice in the comprehension strategies of self-monitoring, paraphrasing, and making inferences, predictions, and elaborations. Across several studies, the training module has demonstrated significant success with adolescent and young adult readers (Graesser, McNamara, and Van Lehn, 2005; see other studies at the project Web site). Students who participated in the training improved their comprehension of the texts; students with low knowledge of the science topic at the pretest consistently benefited more than students with high knowledge at the pretest.





Thinking Reader® is a commercially available product developed by Tom Snyder Productions, Scholastic. It embeds strategy instruction into award-winning novels for intermediate and middle school students. It is based on a research prototype that was demonstrated to improve struggling adolescent readers' comprehension (Dalton, Pisha, Eagleton, Coyne, & Deysher, 2001). A product video is online [here](#). The books are digitized and embedded with multiple supports including human voice narration, text-to-speech, a multimedia glossary, hyperlinks to support background, strategy instruction, and a worklog. Animated agents prompt the students to apply reading strategies and provide corrective feedback on their performance. [BookBuilder](#) is a free, online tool from CAST for teachers to develop books with three different, programmable agents (the teachers types in what the agent should say and where they should appear in the text). There is even an agent to help authors create the books.

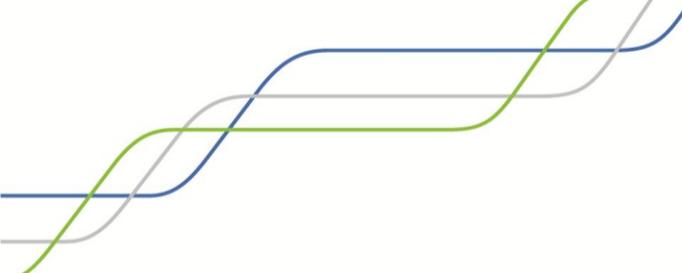
Anderson-Inman and Horney (1998) have created a [digital library](#) of texts with embedded supports. Their research shows that while digital supports such as hyperlinked dictionaries, glossaries, annotations, and text-to-speech, can be helpful to struggling readers, students do not always access them strategically. They recommend strategies and supports be taught explicitly.

Engagement

Many investigations of the use of technology, including multimedia environments, emphasize student interest, motivation, and engagement (Reinking, 2004). These elements are especially important for students who are reluctant or struggling readers. Strangman and Dalton (2005) suggest that choice, including the ability to customize viewing and interaction, contributes to student engagement and motivation, but they lament the lack of choice in most technology-based reading research studies.

A few studies have incorporated choice in their research design. Mitchell and Fox (2001) allowed young students to choose between two computer programs and activities. The Reading Tutor in Project LISTEN (Mostow et al., 2003) takes turns with students making selections of articles from *Weekly Reader* and other high interest texts at students' reading level. Fastig and Halaas Lyster (2005) and Lynch, Fawcett, and Nicolson (2000) both investigated the introduction of a scan and read program into regular class instruction; students used the program for their daily reading assignments and personal choice readings. Both studies demonstrated a positive impact of choice on student engagement.





Resources

Check out the demonstrations and product videos of the programs discussed in this article.

Between the Lions

The PBS show [Between the Lions](#) presents animated interactions with words, word parts, sounds, stories and songs within the setting of a library. Online games allow users to interact with the show's characters and activities.

The Reading Assistant

[The Reading Assistant](#) by Soliloquy is a reading software program that focuses on fluency and decoding within children's literature using text to speech and voice recognition. There is a product video on the website, demos available upon request.

iSTART

The [iSTART](#) (Interactive Strategy Training for Active Reading and Thinking) offers online modules based on research on reading comprehension and self-explanatory teaching. Pedagogical agents provide students with interactive and adaptive training to use active reading strategies.

Thinking Reader

[Thinking Reader](#)® product video demonstrates the embedded agents that offer strategic prompts and available resources, differentiated by proficiency level.

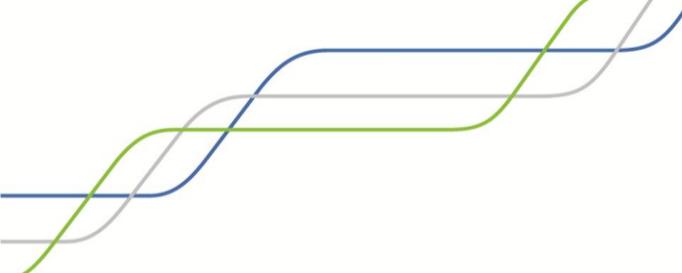
Digital Library

[Project INTERSECT's digital library](#) of supported digital books and textbook chapters, created by the University of Oregon for ongoing study on the use of supported e-text and studying.

Bookbuilder

[BookBuilder](#) is an online tool to develop e-books with three different embedded agents that offer strategic comprehension prompts. There is even an agent to help authors create the books. This library will grow as users post the books they have created.





Reading Matrix

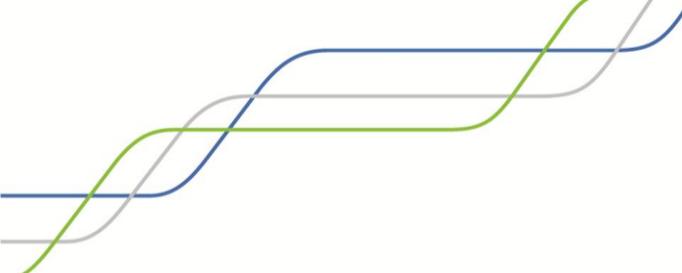
See reading products reviewed for the inclusion and usability of over 30 features related to supporting instruction and research related to the use of such programs in the [Reading Matrix](#).

International Children's Digital Library

The [International Children's Digital Library](#) contains beautifully illustrated children's literature in a wide variety of languages. Search the library by language, genre, appropriate age level and more. The reading interface for students is extremely user-friendly.

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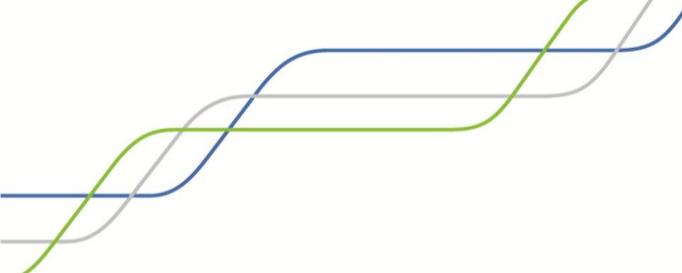
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