Emerging Reading and Writing Strategies Using Technology

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Many students with disabilities exhibit problems with reading fluency, text comprehension skills, vocabulary learning, and abstract reasoning from text presentations (Scruggs & Mastropieri, 1993). Educators have turned to computers and electronic materials to assist students who have difficulties reading (Higgins & Boone, 1997; Kulik & Kulik, 1991). Currently, educators are beginning to look at emerging technologies, such as the Internet, as viable tools for reading, writing, and general content education, as well (see Figure 1).

The number of Web sites available for literacy instruction is increasing daily. The potential for teachers and parents to find and use electronic text-based materials for literacy instruction has evolved (Jeffs & Castellani, 1999). The need to address issues of accessibility for literacy instruction is multiplied by the vast amount of digital and electronic material on the Internet. We can now develop many customized electronic instructional materials and techniques that provide student access to textual information in universally accessible formats necessary for individualization and accommodation (Orkwis & McLane, 1998).

Universal accessibility is a relatively new term meaning that “a curriculum should include alternatives to make it accessible and applicable to students, teachers, and parents with different backgrounds, learning styles, abilities, and disabilities in widely varied learning contexts” (Orkwis & McLane, 1998). Currently, there is little research to support claims of the utility of the Internet for instruction.

This article describes research-based strategies that may help teachers use the Internet in both general and special education classrooms. Figure 1 provides a rationale for investing in the Internet as a tool for literacy instruction.

PROVIDING REPEATED OPPORTUNITIES FOR STUDENTS TO BUILD THEIR READING AND WRITING SKILLS THROUGH AVAILABLE TECHNOLOGY TOOLS STARTS BY HAVING STUDENTS CHOOSE THE MATERIALS THEY WOULD LIKE TO READ.
Access to electronic text is important for several reasons, as follows:

- Text that is available in electronic format assists in accommodating people with disabilities who use screen or text readers (Orkwis & McLane, 1998). With electronic text, teachers, parents, and tutors can easily change its size, appearance, and layout to accommodate a student’s particular needs (Castellani, 2000b).
- Teachers can easily augment electronic text by screen readers, text readers, and many other speech synthesizers (Higgins & Boone, 1997; Raskind, Goldberg, Higgins, & Herman, 1999).
- Reading resources and writing activities are widely available on the Internet (see box, “Literacy Links”). These Internet sites often contain graphics, sound, video, and animation that help motivate students and can easily be used to enhance literacy instruction. As a result, the Internet provides teachers and students with an enormous amount of curriculum materials and the opportunity for authentic learning.

**What Is Authentic Learning?**

Authentic learning is defined as realistic, complex learning experiences that encourage richer knowledge structures, not simplified, abstract content (Cognition and Technology Group, 1992; Spiro, Feltovich, Jacobson, & Coulson, 1992). Authentic learning typically involves students with case studies, themes, problems, issues, real events, and the real world. Authentic learning environments promote a more active role for the learner and require students to engage more actively in the learning experience (Hasselbring, 1994). If students are to remember information, teachers must encourage students to self-select learning materials and to work on specific skills. If a child is allowed to search for material that is self-selected, the text often becomes more authentic to a child.

Why is authentic learning important? Children read what is interesting to them (Jacobson & Spiro, 1995). Researchers have found that varied media assist in literacy development by providing intrinsically motivating activities and cognitive scaffolds for learning and representational literacy (Cognition and Technology Group, 1992).

The use of graphics and alternative media support the expression of ideas through pictures, drawings, graphics, and other visual illustrations (Behrmann, 1998; Castellani, 2000; Lewis, 1993; MacArthur, 1997). In this way, multimedia is providing new learning tools for students who have difficulty with textual materials.

Multimedia have expanded to include the use of the Internet for teaching and learning in the special education classroom, specifically for students with high incidence disabilities (Center for Applied Special Technology, CAST, 1996). One major finding of the CAST report was that teachers used the Internet to amplify the learning situation and to provide additional resources for classroom instruction. Given the increasing number of students with disabilities and the heterogeneous array of student deficits, the Internet, multimedia, and hypermedia are viewed as highly effective tools for teachers, parents, and students who work with students on reading and writing activities. Interest enhances motivation to learn and links personal experience to new features of software, word processing programs, and the Internet for text checking, organizing, illustrating, and formatting.
information. For children who have difficulty reading and writing, self-selection becomes even more critical because it serves as an initial point for learning to read and reading to learn.

**Authentic Learning, Technology Tools, and the Internet**

How can we integrate authentic learning strategies with technology tools and information on the Internet? Teachers and parents can more easily use authentic text for reinforcing basic reading and writing skills because a student’s motivation to perform academic tasks increases, providing more opportunities for teachers to engage in repeated readings, as well as isolated skills instruction (Castellani, 2000a). Although the same holds true for self-selected print material, the combination of authenticity, usability, and adaptability of Internet-based textual materials can be extremely powerful. Many students with disabilities have adapted easily to electronic text that can be read with programs such as TextHelp, Kurzweil, Sappy Speech, and Macintalk, as well as other commonly used speech synthesis software (Higgins & Boone, 1997).

**Tools of the Trade**

Tools to enhance reading and writing instruction have changed over the past few years. As technology tools change, techniques for teaching and learning in the classroom evolve. Teachers are taking advantage of technological advances that can be implemented smoothly into the classroom. This article outlines teaching strategies for reading, writing, technology integration, and using Internet-based electronic materials. Here are a few of these tools:

1. **Text-reading software**—integrates word prediction by letter, word, and sentence; highlights and scans words as text is read; provides auditory feedback and speech synthesis; offers definitions, spell-check, and thesaurus support for highlighted words; and abbreviation expansion for commonly used words, phrases, and/or large text blocks.

2. **Word-prediction software**—offers beginner, intermediate, and advanced user dictionaries; predicts by letter, word, and sentence; highlights and scans words as text is read; provides auditory feedback and speech synthesis; and can often be used with switch/alternative keyboard access.

3. **Visual concept-organization software**—provides graphic templates and character webs; offers visual structure for understanding events; cause and effect, and writing outlines; allows for individual user templates; and support for brainstorming.

**INTERNET SITES OFTEN CONTAIN GRAPHICS, SOUND, VIDEO, AND ANIMATION THAT HELP MOTIVATE STUDENTS.**

4. **Graphic-based writing software**—provides story-boarding and framing: works with pictures, sound, music, voice recording, and text for story representation; provides spell-check and speech feedback; and integrates pictures found on the Internet into writing products.

5. **Writing templates**—provide structural frameworks for letter, resume, outlines, checklists, and report writing.

6. **Fundamental-skills software**—word attack, sentence mastery, symbol recognition, switch-activated communication software, phonics, electronic storybooks, and simulation software.

7. **Alternative input devices**—switch access, Morse code, alternative keyboards, touch screens, voice recognition, and on-screen keyboard (see http://chd.gse.gmu.edu/telecomm/main.html).

How can reading and writing activities be combined with available technology tools? There are many methods to teach children with disabilities to read and write. Regardless of the reading approach, once students have chosen authentic materials, teachers can decide the best method to work with a student on any given text passage. Providing repeated opportunities for students to build their reading and writing skills through available technology tools starts by having students choose the materials they would like to read. Then adapt these materials so that students can work independently.

Because children with disabilities have difficulty organizing thoughts, getting through difficult words, working with difficult text selections, reading and rereading text, and summarizing and writing about what they have read, teachers should use technology tools to help these students become independent and provide opportunities for success. Following a designated process for reading and writing provides the student with a logical sequence to work with the authentic materials they choose.

**Prereading Strategies—Interest Inventories**

Interest inventories are an essential part of the reading and writing process. An interest inventory serves two purposes:

1. Provides information for the teacher of the student’s likes and dislikes.
2. Builds a conceptual framework for the student to reflect on the topics that are interesting and motivating.

Developing an effective interest inventory requires questions that enable the student to reflect on broad aspects
of their individual ideas, future goals, leisure and school-time activities, and relationships. The interest inventory provides a blueprint for selecting writing and reading topics to research on the Internet. For example, a student may have a strong interest in historical events and sports. Knowing this, the teacher can help the student select areas of focus for exploring and learning, by going directly to History Online or the National Basketball Association home page.

Searching for Information on the Internet
Finding useful information on the Internet for literacy instruction, based on a student’s interest, can be a daunting task. It is important to find information that is on a student’s individual reading level that is of high interest, recognizing that sometimes Internet material that is of high interest is not on a student’s individual reading level. Text readers can help with tracking and text...
Regardless of the reading approach, once students have chosen authentic materials, teachers can decide the best method to work with a student on any given text passage.

to-speech feedback and, in this sense, enable students to work with higher-level passages or unknown vocabulary. In any case, teacher preparation is essential for a successful digital reading experience. The teacher and student need to find several different sites on a topic and have these ready in case a Web page is unavailable or the student is frustrated or bored with a particular site. This is especially helpful for extending the reading activity.

To facilitate their planning, teachers can arrange “bookmarks” or “favorites” by individual student, based on topics, or several topics on similar reading levels. In addition, searching the Internet for useful educational text can be overwhelming, given the current limited time for planning. As a result, it is critical to find sites that are updated consistently and provide vast amounts of curricular materials (see box, “Literacy Links”).

If students are searching the Internet on their own, teachers should help the students develop word lists—spelled correctly for entering into Internet search engines. Teachers can help find kid-friendly search engines or simply guide students to reading sites that contain many individual stories. Often, characters and stories found in current trade books can also be found on the Internet. If a student has identified with a character or a story, searching for Web sites that relate to print-based materials can serve as a motivation for reading. Motivation will be important as students work through story ideas and details during reading and postreading activities.

**Picture Walk**

Because the Internet offers information in the form of media (graphics, pictures, and video), it is useful to “walk” a child through pictures, video, or audio when available. This helps students make predictions about what is going to happen, promotes prior knowledge about a topic, and doesn’t rely on purely textual information. At this point, capturing photographs and other media will be important for organizing the reading activity and developing prediction questions. It is useful to put pictures in order within a graphic-based writing program or just a simple word processor and attempt to walk through these pictures with the students, asking questions like these:

- What do you think this story is about?
- What do you think is going to happen in the story?
- Who are the main characters?
- How do you think the main characters are feeling?
- Can you describe what the people are doing in this picture?

You can easily enter these questions—and the students’ answers—into graphic organizers through software like Inspiration Software, Inc. (2001) to generate the organization of concepts and ideas.

**Reading Activities**

Teachers and parents can use many different strategies to help students process text. Because information retrieved from the Internet is already in electronic format, text readers can highlight words and speak back selected text. It is important, when reading, to provide the student with different opportunities to read and reread text. While reading, students with disabilities often encounter unknown vocabulary or ideas. Hearing or isolating the difficult word in the context of a reading passage is important for comprehension.

Technology can help students learn new vocabulary words. When not using the computer, a teacher or student can highlight or circle unknown words, create word lists from a reading passage, or look up words in a dictionary. Text found on the Internet, however, is already in digital format and can be easily manipulated by software programs. Text readers have built-in features to allow students independence while working with text through automatic highlighting, text-to-speech feedback,
and built-in thesauruses and spell checkers.

Web browsers have the built-in capacity to enlarge, change the color, spacing, and number of words on a line. Each of these features can help students with visual perception difficulties by reducing barriers to reading and comprehension. This, in turn, increases student attention and motivation, provides opportunities for students to practice reading strategies, and allows students to independently work with text (Castellani, 2000b).

**Postreading Activities—Writing Guides**

Concept maps, outlines, and prewriting activities establish within the learner an opportunity to look at the chosen topic in segments. Breaking down the larger tasks into smaller tasks (sometimes called chunking) is especially useful for students with disabilities. One useful educational tool is the software program Inspiration Software, Inc. (2001), which is a graphic-based flow-charting tool used in many schools (see http://www.inspiration.com). This program, and others like it, allows the student to organize, map, and define the relationship of specific details of a topic. For example, suppose a student has chosen the topic of USA Women’s Soccer team and World Cup. Using the questioning strategies, the student must ask the questions who, what, when, where, and how in relation to the United States Women’s Soccer Team and World Cup (see Figure 2).

Students can quickly and easily turn organization maps into outlines. These outlines, used as writing guides, can act as a structure for converting thoughts, questions, and details from previous readings into sentences, paragraphs, and narratives (see Figure 3).

If students have difficulty with a primarily text-based approach to writing after they have worked with a specific reading passage, it is helpful to use graphic-based writing software. In most of these programs, users can work with pictures, video, audio, and voice recordings to get ideas down on paper. The key to successful postwriting activities in such software programs is the high motivation level that students often gain from them. In addition, these programs allow students to work with media and text, rather than text alone. Students can organize pictures into storyboards, or within their graphic organizer, and retell the story in their own words, through voice recording or by writing key ideas under each main story scene (see Figure 2). Pictures can be retrieved (downloaded/saved) from the Internet site where a reading passage was found, in addition to sound and video. Using graphic-based software and media obtained from the Internet allows students to publish their finished material based on their own creative process (see Table 1). When students and teach-
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<td>Before</td>
<td>• Recognize reading level</td>
<td>• Recognize writing level</td>
<td>• Complete Interest Inventory</td>
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<td></td>
<td>• Identify vocabulary and begin creating word list for new or difficult words,</td>
<td>• Use visual concept organization software, such as Inspiration, graphing software</td>
<td>• Scan for pictures</td>
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<td>prepare prediction questions or questions specific to the text you have</td>
<td>(Flowchart)</td>
<td>• Prepare (preview) links ahead of time, book marks</td>
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<td>found on the Internet</td>
<td>• Use fundamental skills software</td>
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<tr>
<td></td>
<td>• Use fundamental skills software (Laureate)</td>
<td>• Use graphic-based writing software</td>
<td>• Find materials for grade level (Flesch-Kincaid or 90% rule)</td>
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<tr>
<td>During</td>
<td>• Use text readers, grammar, abbreviation expansion</td>
<td>• Turn questions and answers into sentences</td>
<td>• Find information on the Internet, based on student preferences or by conducting</td>
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<td></td>
<td>• Reread text, have computer read, take turns reading with student</td>
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<td>individualized student searches (using browsers that automatically spell check,</td>
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<td></td>
<td>• Use an available electronic dictionary, thesaurus</td>
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<td>etc.)</td>
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<td>After</td>
<td>• Provide comprehension activities with extended activities through different</td>
<td>• Publish and share work with others on the Internet</td>
<td>• Make decisions about interest and authenticity of materials and student</td>
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<td>• Look at suggested readings on similar topics by the same author</td>
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**References**


Assessing One and All: Educational Accountability for Students with Disabilities

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Stephen N. Elliott and Jeffrey P. Braden

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Assistive and Instructional Technology Resources

Closing The Gap at www.closingthegap.com and Able Data at www.abledata.com are two sites that are comprehensive database resource directories that contain over 20,000 different assistive and instructional technology devices and software products. All of the products in this article can be found within these two sites. Type in the appropriate search term and look through the respective database. For individuals interested in exploring products for persons with disabilities, these are two very important resources.

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