

Emerging Reading and Writing Strategies Using Technology

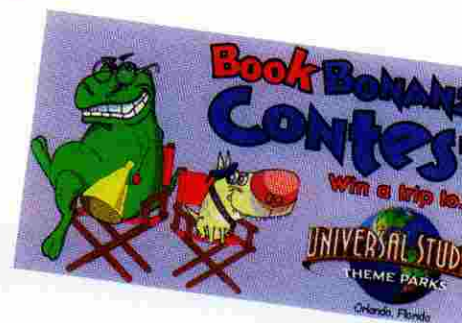
THE MATH FORUM
Where there is math, there is geometry. Johannes Kepler

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Accessibility and Digital Reading Environments

Have you noticed the recent proliferation of electronic text, talking storybooks and trade books, and Internet-based textual materials? What we may not realize is their value for literacy instruction for students of all ages. Educators are beginning to understand how they can use various media and technology tools for literacy instruction with students with disabilities, based on how each student reacts to text-based information.

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).

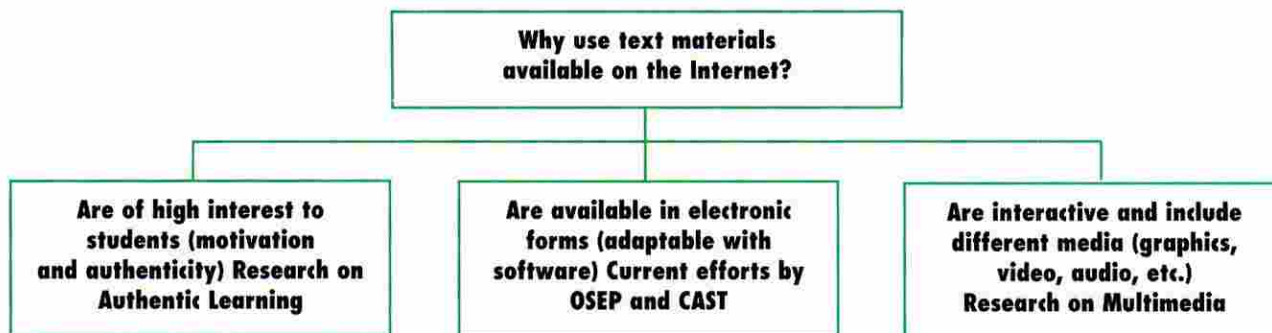
Universal accessibility is a relatively new term meaning that "a curriculum should include alternatives to make it accessible and applicable to students, teachers, and parents with different backgrounds, learning styles, abilities, and disabilities in widely varied learning contexts" (Orkwis & McLane, 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.

HISTORY HAPPENS

Figure 1. The Internet and Electronic Educational Materials



Note: OSEP = Office of Special Education Programs, U.S. Department of Education; CAST = Center for Applied Special Technology.

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, 2000b; 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

TAKE ADVANTAGE OF BUILT-IN 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 recogni-

IT IS CRITICAL TO FIND SITES THAT ARE UPDATED CONSISTENTLY AND PROVIDE VAST AMOUNTS OF CURRICULAR MATERIALS.

tion, 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

TEACHERS CAN EASILY AUGMENT ELECTRONIC TEXT BY SCREEN READERS, TEXT READERS, AND MANY OTHER SPEECH SYNTHESIZERS.

Literacy Links on the World Wide Web

KIDLINK

<http://www.kidlink.org/>

A place where students from around the world meet to talk about issues, present their ideas, and respond to other children. This site also includes a chat forum with live message exchange.

MATH FORUM

<http://forum.swarthmore.edu/>

Available for students in K-12, with varying ability level questions and activities. Students can work on math as well as reading through the content. The math problems and student activities include directions, problems, and extension questioning activities.

LIFELONG LEARNING ONLINE

<http://www.otan.dni.us/>

Site for working on issues for older students with lower reading levels. Registration required (free). Includes work, family, and community issues, as well as vocabulary training and questioning and talking text with RealPlayer®.

NINE PLANETS

<http://www.seds.org/nineplanets/nineplanets/>

This site explores the solar system and provides a multimedia tour of planets and moons in our solar system. Includes hyperlinks to useful vocabulary and pictures to use in writing extension activities.

THE KEY: NEW READERS NEWSPAPER

<http://www.keynews.org/>

Provides stories on all different topics at beginning, middle, and advanced reading levels. Does not include too many pictures; however, the site includes an extensive archive of articles over the past 10 years. These stories can be enhanced by having students conduct Web searches based on vocabulary found in the stories.

STORY PALACE

<http://storypalace.ourfamily.com/>

Provides an extensive collection of well-known kids' tales and folk stories, like "The Three Little Pigs." Includes full-text pages, but not too many graphics. The long text pages make this site useful for older students who are working on reading passages at lower reading levels because the text-only feature helps the material maintain its age-appropriateness by not having "kiddy pictures."

THE CHILDREN'S LITERATURE WEB GUIDE

<http://www.acs.ucalgary.ca/~dkbrown/>

Features story listings, rhymes, fiction and nonfiction; resources for parents, teachers, and authors; and a listing of other extensive literature Web sites. There is an online discussion area and links to listings of offline reading resources by grade level.

BOOK ADVENTURE

<http://www.bookadventure.com/>

Useful for identifying books of interest by reading level and topic. There are also some online comprehension questions.

TELECOMMUNICATORS RESOURCES

<http://chd.gse.gmu.edu/telecomm/main.html>

A Web page developed at George Mason University, Fairfax, Virginia, with many more links to literature and activities. There are also "downloadable" Intellikeys overlays and Discover switch scanning arrays for students using alternative keyboards and input devices to access the Internet.

HISTORY HAPPENS

<http://www.ushistory.com>

History Happens uses music video and an interactive Web site to teach American history. Drawing on the power of music to enhance learning, this site turns the great stories of American history, such as the Underground Railroad, into original music videos. This site is a project of Electron Farm Publications, Lexington, Kentucky, and the Kentucky Humanities Council.

BIBLIOMANIA

<http://www.bibliomania.com/>

This site contains many of the classics, like *Little Women*, poetry, fiction and nonfiction, and even full-text Shakespeare. Since the content is purely textual, it is easily accessible for students with sensory impairments or learning disabilities who are using screen readers, text readers, or simply text-to-speech software programs.

TALKER

<http://www.mvpsolutions.com/PlugInSite/>

[Talker.html](#)

This site provides links to Web pages that talk using the Talker PlugIn for the Mac only. There is information about downloading and installing the plug-in and directions for using it. The site also provides links to songs and stories.

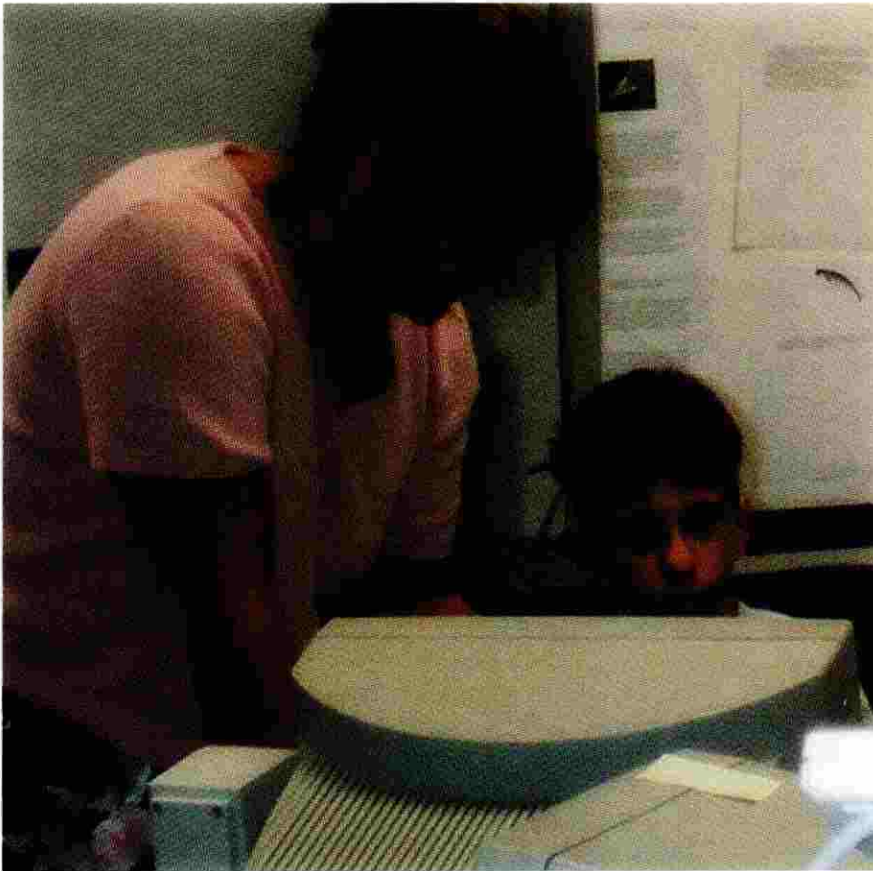
of their individual ideas, future goals, leisure and school-time activities, and relationships. The interest inventory provides a blueprint for selecting writing and reading topics to research on the Internet. For example, a student may have a strong interest in historical events and sports. Knowing 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 pre-

dictions 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

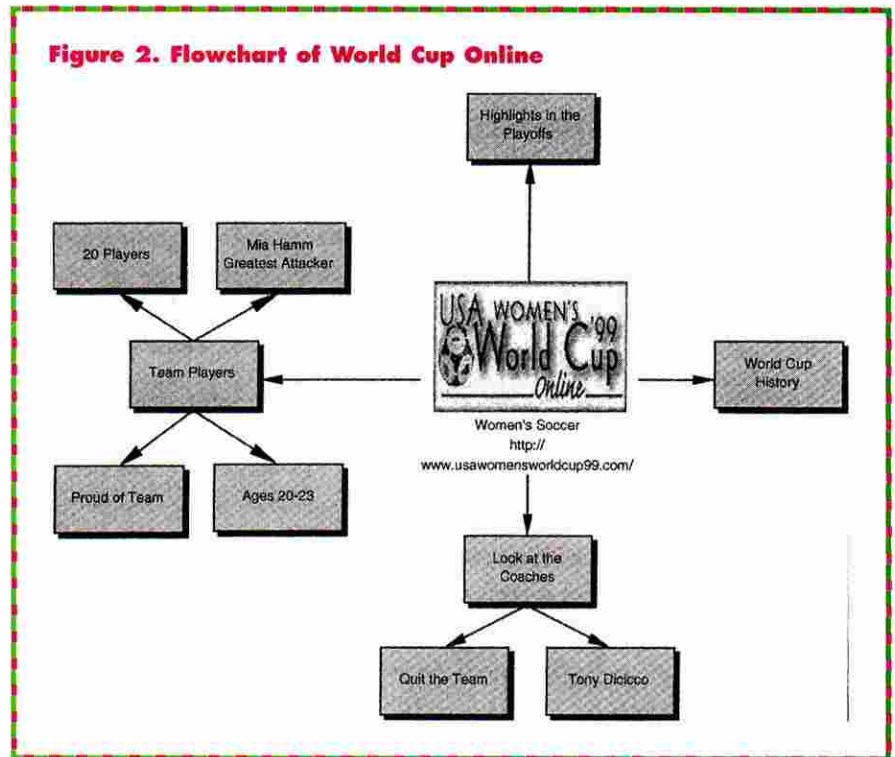


Figure 3. Example of Postreading Activities: Writing Guides

Women's Soccer
<http://www.usawomensworldcup99.com/>

- I. - World Cup History
- II. - Team Players
 - A. - 20 Players
 - B. - Proud of Team
 - C. - Mia Hamm
Greatest Attacker
 - D. - Ages 20-23
- III. - Highlights in the Playoffs
- IV. - Look at the Coaches
 - A. - Quit the Team
 - B. - Tony Diccico

Team Players of the 1999 USA Women's Soccer Team
 The Women's Soccer Team consists of twenty players from the ages of 20- 33. My favorite player is Mia Hamm. She is awesome. Mia plays forward and she is the greatest attacker. The rest of the players are great too! I am very proud of the Women's Team because they showed the world that they could win!

A Look at the Coaches
 There is only one coach for the team. Tony is the coach and he is the greatest! Did you know that he resigned after the team won the cup? He wanted to begin working on being the greatest dad in the world, too cool! He has worked very hard!

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 a their own creative process (see Table 1). When students and teach-

Table 1. Reading and Writing with the Internet

Time Frame	Reading Activities	Writing Activities	Using the Internet
Before	<ul style="list-style-type: none"> • Recognize reading level • Identify vocabulary and begin creating word list for new or difficult words, prepare prediction questions or questions specific to the text you have found on the Internet • Use fundamental skills software skills (Laureate) 	<ul style="list-style-type: none"> • Recognize writing level • Use visual concept organization software, such as Inspiration, graphing software (Flowchart) • Use fundamental skills software 	<ul style="list-style-type: none"> • Complete Interest Inventory • Scan for pictures • Prepare (preview) links ahead of time, bookmarks • Search for information, locating text sites on grade level • Find materials for grade level (Flesch-Kincaid or 90% rule) • Find information on the Internet, based on student preferences or by conducting individualized student searches (using browsers that automatically spell check, etc.)
During	<ul style="list-style-type: none"> • Use text readers, grammar, abbreviation expansion • Reread text, have computer read, take turns reading with student • Use an available electronic dictionary, thesaurus 	<ul style="list-style-type: none"> • Answer questions to expand on story and provide detail • Use writing templates and word-prediction software • Use graphic-based writing software • Turn questions and answers into sentences 	<ul style="list-style-type: none"> • Make decisions about interest and authenticity of materials and student motivation • Transfer pictures and text to a disk or word processor for further work with information
After	<ul style="list-style-type: none"> • Provide comprehension activities with extended activities through different learning modalities • Look at suggested readings on similar topics by the same author 	<ul style="list-style-type: none"> • Publish and share work with others on the Internet • Create a literacy portfolio for each student 	<ul style="list-style-type: none"> • Create booklets on Internet sites and have students rate the story site (rate the stories) • Search for related future reading activities and extensions

ers publish items from the Internet, it is necessary to follow appropriate copy-right guidelines.

Final Thoughts

The Internet helps teachers implement authentic learning strategies in the classroom by allowing the learner to choose reading materials based on their own interests. Blending reading and writing strategies with available technology provides powerful and meaningful tools for literacy instruction. The result is increased student motivation and success with the reading and writing process. In turn, students can build self-esteem through publishing their final creative project and through ideas that are meaningful and original.

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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.

Educators Program, 6740 University Drive, Columbia, MD 21046 (e-mail: jcastell@jhu.edu).

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Assessing One and All: Educational Accountability for Students with Disabilities

A Book and Web-Based Inservice Course

Stephen N. Elliott and Jeffrey P. Braden

Assessment of student achievement is one of the most frequently discussed topics in education, particularly in light of state standards, the educational reform movement, and the requirements of IDES '97. This book and accompanying Web-based course meet the need for proven and usable methods to ensure meaningful assessment within educational accountability systems. Aimed at practitioners at all levels, this multimedia package:

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