

USING COMPUTER TECHNOLOGY TO ENHANCE LITERACY INSTRUCTION FOR NATIONAL TRANSFORMATION

REV. ENGR. DR. DAVID DIMOJI & MR. OJU ONUOHA

Department of Computer Science,
Abia State Polytechnic, Aba;
Nigeria.

dimojionyiidd@yahoo.com, ujuonuoha@yahoo.com

Abstract

Educational technology is nudging literacy instruction beyond its oral and print-based tradition to embrace online and electronic texts as well as multimedia. Computers are creating new opportunities for writing and collaborating. The Internet is constructing global bridges for students to communicate, underscoring the need for rock-solid reading and writing skills. By changing the way that information is absorbed, processed, and used, technology is influencing how people read, write, listen, and communicate. Although technology promises new ways to promote literacy, educators' reactions to it have been mixed. Some have embraced technology with unbridled enthusiasm while others have held it at arm's length with a healthy skepticism. Yet the growing influence of technology has caused many educators to acknowledge that they need information on teaching literacy skills in the Digital Age. To serve that need, this paper offers research, best practices, and resources that support integration of new technologies into literacy instruction in technical education.

Keywords: Technology, literacy, technical education, internet, digital.

1.0 Introduction

Literacy instruction traditionally refers to the teaching of basic literacy skills—reading, writing, listening, and speaking. In today's digital world, however, technology has contributed to an expanded understanding of literacy. Besides having basic literacy skills, today's students also need technology skills for communicating, investigating, accessing and using information, computing, thinking critically about messages inherent in new media, and understanding and evaluating data. As policymakers and educators ponder what it means to be literate in a digitized society, an array of literacy definitions is emerging. Among them are the following examples:

- **Information Literacy:** The ability to access and use information, analyze content, work with ideas, synthesize thought, and communicate results.
- **Digital Literacy:** The ability to attain deeper understanding of content by using data-analysis tools and accelerated learning processes enabled by technology.
- **New Literacy:** The ability to solve genuine problems amidst a deluge of information and its transfer in the Digital Age.

- **Computer Literacy:** The ability to accurately and effectively use computer tools such as word processors, spreadsheets, databases, and presentation and graphic software.
- **Computer-Technology Literacy:** The ability to manipulate the hardware that is the understructure of technology systems.
- **Critical Literacy:** The ability to look at the meaning and purpose of written texts, visual applications, and spoken words to question the attitudes, values, and beliefs behind them. The goal is development of critical thinking to discern meaning from array of multimedia, visual imagery, and virtual environments, as well as written text.
- **Media Literacy:** The ability to communicate competently in all media forms—print and electronic—as well as access, understand, analyze and evaluate the images, words, and sounds that comprise contemporary culture.

The widespread use of technology is changing the way we work, learn, and communicate—even the way we carry out our regular, daily activities. In higher education, technology has had a dramatic impact on teaching and learning, including service-learning experiences. Service-learning classes and activities can be augmented through the use of technology to provide more effective experiences for faculty, students and community participants. With their ready access to new technologies, higher educational institutions are well-positioned to take advantage of rapid changes in the field. The environment within which technologies are applied to education has also been changing. The process towards digitization has brought a convergence between different media and technologies. Schools and colleges all round the world have begun to use the Internet. At the same time, the process has been far from uniform and there is a widening gap between those with, and without, access to computer-based technologies. In many parts of the world communications have also been deregulated and privatised, offering new kinds of access to communication technology but sometimes reducing the free access previously enjoyed by educators. Within the world of development communication there has been a new emphasis on participatory methodologies which has affected programmes of basic education, especially in out-of-school settings. One significant change in the formal sector has been the new legitimacy of open and distance learning, marked by the establishment of open universities in many countries but affecting education at all levels.

1.1 Research on Technology and Literacy

Educational researchers and practitioners alike assert that the potential of new technologies for learning is likely to be found not in the technologies themselves but in the way in which these technologies are used as tools for learning (Means & Olson, 2005; Owston, 2007; Valdez et al., 2009). In literacy instruction, technology has both traditional and authentic uses (Singh & Means, 2004). A traditional use of technology is skills reinforcement; for example, students who need additional practice in reading might work individually on computers equipped with reading-comprehension software. An authentic use of technology is using it as a tool to accomplish a complex task; for example, students who are creating a written report might use the Internet for research, word-processing software to write and format the text, and hypermedia software to add images. Therefore, it makes sense to consider the variety of uses as they illustrate best practices.

Although many reviews of empirical studies and volumes of observations relate to the use of new technologies in support of literacy education (Kamil, Intrator, & Kim, 2010; Leu, 2010), two challenges emerge when educators look for evidence that might anchor recommendations for using technologies in literacy instruction. These challenges are the "moving target" problem that is inherent in the subject being researched, and the scarcity of comprehensive literacy studies offering informed commentary.

1.1.1 Research Question

Considering that literacies and learning are evolving with the ever changing technology available in today's society, our research will ask the following question: How will the use of computer technology by lecturers in the higher institutions enhance their instructions of literacy in the classrooms?

1.1.2 The "Moving Target" Problem

Much of the evidence that the researchers have been able to generate with regard to educational technologies is about innovations that aptly are described as a "moving target" (Valdez et al., 2009). In other words, even as researchers begin to describe empirical evidence supporting the effects a particular technology on an educational practice, that technology itself is changing and in some cases even becoming obsolete. In addition, the evolving nature of educational technologies precludes any efforts to predict the success of, and establish guidelines for, subsequent educational practices. "As newer technologies of information and communication continually appear, they raise concerns about the generalizability of findings from earlier technologies. It is important to be cautious about generalizing findings from traditional texts to different forms of hypermedia because each technology contains different contexts and resources for constructing meanings and requires somewhat different strategies for doing so (Leu, 2010).

2.0 Scarcity of Comprehensive Literacy Studies

Not only does technology change faster than guidelines for innovations can be established, but relatively few thorough studies have evaluated the efficacy of new technologies for literacy education. Some researchers suggest that the challenges related to technology and literacy must become more integral to mainstream literacy research. Collins (2002), for example, suggests that research should shift from an emphasis on traditional summative evaluation (in which data is acquired at the end of an activity) to include more formative design approaches (which are informed by data acquired during the planning and development of the activity). In fact, the formative-design experiment approach—in which research questions focus on the resources needed to make a specific implementation succeed is likely to become a trend in future educational research (Reinking & Watkins, 2006). As Kamil and Lane (2008) comment, "It is too late to ask questions such as whether we should allow students access to the Internet. Rather, we should be conducting research that asks questions such as, 'What does it take to use Internet connections successfully in teaching literacy?' ". Some educators believe that schools should provide students with exposure to current technologies used in the business world regardless of whether those technologies have been proven effective through research. Leu (2010) states, "It may become unimportant to demonstrate the advantages of new technologies for educational contexts if it is already clear those technologies will define the literacies of our students' futures".

2.1 Technologies That Support Students' Reading Development

Educational technologies that support the development of students' reading skills include audiobooks, electronic books and online texts, electronic talking books, and programmed reading instruction.

Audiobooks: Audiobooks, sometimes known as *books on tape*, are professionally recorded, unabridged versions of fiction or nonfiction books. They are available on regular audiocassettes or four-track cassettes that require a special cassette player. Audiobooks promote students' interest in reading and improve their comprehension of text, notes Beers (2008). They also have been used successfully by students who cannot read traditional printed books because of visual or physical handicaps. When used in conjunction with written texts, audiobooks help improve children's reading skills. Children can listen to the audio version of a book and follow along silently with the printed version. Also, they can gain practice in reading aloud the text in conjunction with the audio. "Hearing text read aloud improves reading ability," states Beers (2008). "The use of audiobooks with struggling, reluctant, or second-language learners is powerful since they act as a scaffold that allows students to read above their actual reading level. This is critical with older students who may still read at a beginner level."

Electronic Books and Online Texts: Electronic books, also known as *e-books*, are electronic texts that are presented visually. Whether available on CD-ROM, the Internet, or special disks, electronic books always provide the text in a visual component. Some electronic books incorporate text enhancements, such as definitions of words or background information on ideas. Others offer illustrations that complement the story. The downside of electronic books is that they can be viewed only with a computer or a special palm-sized digital reader; often the text resolution is poor. In terms of their advantages, Anderson-Inman and Horney (2009) note that electronic books are searchable, modifiable (for example, font sizes can be increased to meet the needs of the reader), and enhanceable with embedded resources (for example, definitions and details). Online texts are those that are available on the World Wide Web. With access to an Internet-connected computer, students can find a wide variety of free online reading materials, including books, plays, short stories, magazines, and reference materials. This benefit is especially useful for students in schools that have few resources for the acquisition of new books.

Electronic books and online texts often are equipped with *hypermedia*—links to text, data, graphics, audio, or video. As students read the text, they are able to click on the links to access definitions of words, additional information on concepts, illustrations, animations, and video—all of which can increase their understanding of the material. Research indicates that hypermedia software has positive effects on student learning and comprehension (Anderson-Inman & Horney, 2008; Anderson-Inman, Horney, Chin, & Lewis, 2004; Hillinger, 2002; Hillinger & Leu, 2004; Leu & Hillinger, 2004). The use of hypermedia to improve student comprehension of text likely is related to its ability to respond to the needs of an individual learner for information, which results in an increased sense of control over the learning environment and higher levels of intrinsic motivation (Becker & Dwyer, 2004). That is, the interactive features of hypermedia and the users' control of their direction within these information environments may explain some of the learning gains in comprehension.

Electronic Talking Books: The term *electronic talking books* has been coined by some researchers to refer to electronic texts that also provide embedded speech. The speech component offers a digitized reading of general sections as well as pronunciations of specific

words within the text; it supports and coaches students as they read the text of the story (Leu, 2000; McKenna, 1998). Although research is ongoing about the effectiveness of electronic talking books, there already is much to be said in their favor. "Computers, especially those equipped with devices that produce artificial speech, may provide an effective means for increasing decoding skills and reading fluency," (Reinking and Bridwell-Bowles, 2006). McKenna (2008) notes that electronic talking books increase motivation to read as well as promote basic word recognition. According to some research, the use of talking books has shown positive results as an aid to help children improve their comprehension of texts (Hastings, 2007; Lewin, 2007; McKenna, 2008; Reitsma 2008). In addition, students' decoding skills have been shown to improve with the use of talking books (Olson & Wise, 2002). For slightly older readers, talking books feature glossary entries, explanatory notes, and simplified rewordings that provide additional background information needed to understand new concepts in texts (Anderson-Inman & Horney, 2008). In general, electronic talking books have been found to support reading instruction by providing background information, extended response actions, play actions, and explanatory notes. Talking books also show promise of accelerating reading growth by offering readers immediate access to a word's pronunciation—thus easing the need of the student to rely on context cues to understand new words. They also can be equipped with a tracking system for troublesome pronunciations; this system can provide feedback to teachers, enabling them to identify particular categories of words for further student study.

Programmed Reading Instruction: Various types of software programs, computer-assisted instruction, and integrated learning systems offer programmed reading instruction for students. This skills-based instruction ranges from letter recognition to phonics instruction to vocabulary building. A study by Barker and Torgeson (2005) also indicated that computer-assisted instruction is valuable in improving the phonological awareness of even 6-year-olds. The computer program helped the children learn to discriminate and sequence the sound in words, which improved their word-reading ability. Although programmed reading instruction was one of the first uses of technology in literacy instruction, this area is generating new developments as technology becomes more sophisticated. Recent developments in software programs for literacy instruction include voice-activated reading software and software for culturally mediated instruction.

2.2 Technologies That Support Students' Writing Development

Educational technologies that support the development of students' writing skills include word processing, desktop publishing, multimedia composing, online publishing, and Internet communication.

Word Processing: Word processing is the pioneer application of educational technology used in writing instruction. Although it requires the mastery of basic keyboarding skills, word processing allows many students to write and edit their work more easily. In addition, word-processing tools such as spelling checkers are useful aids that improve the quality of student writing. Research indicates that students who are comfortable with word processing write longer papers, spend more time writing and revising, and show improved mechanics and word choice (Lehr, 2005). Nevertheless, research also indicates that using a word processor does not by itself improve student writing. Rather, the teacher has a critical role in guiding the writing process, providing feedback, and encouraging revision (Reinking & Bridwell-Bowles, 2006). The general claim behind the need to shift from typing or pen-and-paper compositions to word processing is that the latter is more efficient, and therefore the offloading of the mechanics of writing by word processing will improve the quality of

writing. The use of the computer for word processing also promotes collaborative writing among students. The computer screen enables students in small groups to see the writing that has been input, discuss its fine points, and make suggestions that will improve the quality. Wood (2010) notes that when using computers collaboratively "students worked together more than they normally would to write, search the Web, or create multimedia presentations".

Desktop Publishing of Student Work: An extension of word processing is desktop publishing, in which students learn to format text, plan the layout of pages, insert charts and graphics, and produce a professional-looking final copy. As students are mastering word-processing skills, they can gain practice in desktop-publishing their reports, stories, and poems. Teachers also may require students to keep an electronic portfolio of their work, which can be printed at the end of the year and used to show improvements in each student's writing skills.

Multimedia Composing: Besides text-based writing, technology encourages students to integrate visual and aural multimedia in their school projects. Various software programs allow students to insert images, sounds, and video, thereby creating complex, multilayered compositions. For students who have difficulty with writing, multimedia composing presents a means of self-expression and provides support for development of reading and writing skills.

Online Publishing of Student Work: Providing opportunities for online publishing of students' work is another means to motivate student writing. Karchmer (2010) noted that "Publishing online is a motivating factor when completing classroom assignments, and students feel their work could have far-reaching effects, which in turn encourages them to put more effort into it". One way to accomplish online publishing is through the school's Web site.

Internet-Based Communication: Another way to promote student writing is through electronic mail (e-mail), electronic bulletin boards, and e-mail lists. Such Internet-based communication can be with peers, adults, or professional experts from around the world. Students in classrooms across the country can become online penpals (sometimes called *e-pals* or *keypals*). Some classrooms enjoy pairing up with older adults who live in retirement homes. Still another use is online communication with adult experts who have agreed to answer students' e-mail questions.

Writing to an authentic reader has a positive effect on students' writing performance and motivation (Reinking & Bridwell-Bowles, 2006). "Simple exchanges of e-mail can get students writing and reading with the same intensity they bring to the most exciting video game," noted Meyer and Rose (2010).

2.3 Technologies That Support Students' Research and Collaboration Skills

Technologies that support students' research and collaboration skills include Internet search engines, online tools for evaluating Web-based information, and Web sites that offer collaborative activities.

Internet Search Engines: The Internet has gained momentum as the infrastructure on which international knowledge is created and shared. Use of the Internet search engines can promote students' research and investigation skills and enable them to locate online information on any possible topic. Students also can access online journals, magazines, newspapers, encyclopedias, and informative Web sites. Unfortunately, some information on the Web is neither accurate nor reputable. Students need to learn how to evaluate this information.

Online Tools for Evaluating Web-Based Information: The need to evaluate online information sources is gaining importance as a basic literacy skill. Online tools for evaluating online information provide strategies for determining the accuracy, quality, and timeliness of online information.

Web Sites That Offer Collaborative Activities: Educational technology has expanded the instructional potential of collaboration. In the recent past, student collaboration in literacy activities might have meant one classroom joining with another classroom across the hall to engage in joint reading, writing, listening, speaking, or research projects. Today, educators can access and share a global curriculum-development laboratory with other educators. They can engage their class with another in literacy-based projects without geographic boundaries. Although collaboration in itself does not necessarily promise to improve literacy skills or guarantee learning, it has proven to be a powerful motivation tool for students. Anecdotal evidence abounds from teachers who cite measurable improvements in reading, writing, listening, and speaking skills among students whose classroom walls have widened to embrace the global community.

3.0 Professional Development in Technology and Literacy

Requirements for professional development in literacy are aptly summarized by Leu (2010), who reflects on the rapidly changing nature of what it means to be a "literate" person in the 21st century:

"Traditionally, we have selected teachers who were already literate and could pass their literacy along to our children. Now, however, the very nature of literacy is regularly changing because of new information and communication technologies. Many teachers literate in older technologies quickly become illiterate as newer technologies of information and communication replace previous technologies.... We must begin to develop strategies to help each of us keep up with the continually changing definitions of literacy that will exist in our world."

The importance of ongoing professional development in educational technology has been reiterated by researchers reviewing not only the needs of teachers of language arts and English but also those of educators across all curricular contexts (Means & Olson, 2005; Valdez et al., 2009). Leu (2010) notes the necessity of "staff development to continually support teachers as new technologies regularly appear". Many literacy educators feel the surge of new technology rumbling under their feet while they try to maintain a firm footing on the solid ground of basic reading, writing, and speaking instruction. The challenge is how to continue teaching traditional literacy skills while simultaneously learning new technologies and instructing their students in those technologies. In general, teachers need ongoing, hands-on training in various literacy-based technologies. This training should enable them to become proficient in word processing, basic computer skills, e-mail, classroom conferencing, and electronic bulletin boards. It also should provide exposure to literacy software programs and computer-assisted instruction, electronic books, audiobooks, and multimedia composing. Of utmost importance is learning how to effectively integrate these technologies into literacy instruction. Other important components of effective professional development include adequate time, curriculum-specific applications, technical assistance and support, and a connection to student learning.

As educational technologies move the classroom toward a student-centered model, the role of the literacy teacher becomes that of coach, facilitator, or mentor. In this model, responsibility

for learning is shared as students engage in peer mentoring, reflection, and self-evaluation. The literacy curriculum in particular is likely to be a primary model for this situation because the skills of reading, writing, listening, and investigating lend themselves to self-development and peer work to reach measurable learning goals. Professional development in this context is likely to occur within the learn-by-doing venture. Although numerous technologies currently are available to support the development of literacy skills, educators are wise to be aware of the strengths and weaknesses of each type. Future developments no doubt will continue to provide improvements in the quality and value of such technologies, but the value of traditional literacy instruction will remain. "Computers should and will play a major role in the reading classroom but will almost certainly not replace books or teachers. They will influence and perhaps even redefine traditional books, literacy, and the role of teachers, but all three will survive and thrive," state Meyer and Rose (2010). Developing a clear-sighted, open-minded understanding of both old and new technologies will help develop a complementary relationship between them.

4.0 Implementation Pitfalls

Educators may confront the following challenges as they try to integrate technology into literacy instruction.

- When using word-processing software, students sometimes get carried away by the features of the software and forget that their real task is to write. They may spend much of their time selecting fonts, adding graphics and icons, and choosing backgrounds. To help students focus on their writing, the teacher may wish to turn off some of the software's available features.
- Students who are unmonitored in their technology use may not reap real benefits in literacy. They need continued challenges and connections with the teacher to ensure that they are attaining higher-order thinking skills. Healy (2008), for example, warns that the activities offered on software programs often require only shallow processing and do not contribute to students' real learning. She notes that the act of watching a screen and making selections from limited options is "a pallid substitute for real mental activity". She adds, "We must make sure that computer use includes the important step of requiring students to 'elaborate' their knowledge—thinking aloud, questioning, communicating ideas, or creating some kind of original representation about what they are learning".
- Students who are working in small groups on technology-based projects may focus on some tasks to the exclusion of others. Although cooperative learning with computers has many benefits, Healy (2008) encourages teachers to promote students' individual participation in the processes of reading, writing, and reasoning. She notes, "With much hypermedia experience occurring as group work, those who choose not to read or write can often avoid these skills entirely by relying on the good readers and writers to do this part of the job". Teachers should monitor group processes to ensure that all children are participating in the reading and writing activities of each project.
- In their zest to complete assignments, students unthinkingly may download, copy, and paste writing from the Internet directly into their school reports and projects. To prevent students from presenting someone else's materials as their own, schools need to develop firm policies on plagiarism and ensure that students, teachers, and parents are aware of these policies. Also, teachers can help students learn to summarize, rephrase, and acknowledge another person's ideas.
- Overemphasis on electronic texts may reduce students' use and enjoyment of printed books. A study by Gavriel Salomon indicates the importance of introducing students

to books instead of relying only on electronic media. Salomon's study suggests that "students who learn in one medium (screen vs. page) will always be inclined to prefer the one in which they learned" (cited in Healy, 2008).

- Technology is most effective when it is used as an adjunct to traditional reading instruction. "A consistent finding from investigations of reading curricula is that brief, but regular, computer-based reading lessons can enhance reading achievement," noted Reinking and Bridwell-Bowles (2006). The results of these investigations, however, are based most often on the use of computer-based activities that supplement rather than replace conventional reading instruction.
- Educators know the value of extending relationships beyond the confines of the classroom to connect with other students and mentors worldwide. Few educators dispute that students are better motivated to read for comprehension and write to be understood when they are engaged in making real-world connections. But the value of these relationships is only as beneficial as the time and attention devoted to them. Whether within the confines of the classroom or on a worldwide basis, the development of connections requires the careful tending of savvy educators and interested students.
- Electronic bulletin boards and e-mail correspondence create communication avenues for students, but those students require rules of the road. Unlike traditional communication avenues, such rules are works in progress. Educators need to help students become aware of the rules of online etiquette and appropriate forms of expression. Other important considerations include the acceptability of a fictitious identity, the role of self-regulation in public online forums, and the application of freedom of speech to all Internet interaction. Such considerations add a dimension to online communication that is both a challenge and an opportunity.
- With thousands of programs and titles from which to choose, educators and library-media staff may need direction in selecting literacy software for students. Information on how to evaluate learning software may be helpful to anyone involved in the selection process.

5.0 Action Options

Administrators, teachers, library-media specialists, and community members can take the following steps to promote technology for enriching students' reading and writing skills.

Administrators

- Develop strategies for increasing the use of technology within the curriculum as it supports literacy-based teaching and learning experiences.
- Develop and make explicit to teachers, students, and community members the global guidelines for the integration and use of new technologies within literacy programs.
- Develop firm policies prohibiting student plagiarism of online materials.
- Ensure that all students have equal access to literacy-based technology to improve their reading and writing skills.
- Become familiar with the evolving Technology Standards for School Administrators and participate in ongoing professional development in technology use.
- Review current research and best practice on technology and literacy. Use those materials that best suit the needs of schools as springboards for professional development opportunities.

Teachers

- Participate in the development of the school technology plan to ensure that literacy goals are well-integrated throughout the plan.
- Be involved in discussions and selection committees to choose specific technologies and software that support the literacy curriculum.
- Consider technology tools as an extension of—not a substitute for—traditional literacy instruction in the classroom.
- Determine how electronic books can be used in the classroom.
- Besides integrating video and audio cassettes into literature programs, go beyond these resources to embrace newer technologies for enhancing literacy.
- Develop strategies for using microcomputers in elementary language arts instruction.
- Monitor and reinforce the literacy skills that students are learning through classroom software.
- Follow appropriate guidelines for computer-assisted reading instruction in the classroom.
- Use computer-assisted writing instruction to promote students' writing skills.
- Guide students' writing, provide feedback, and encourage word processing for revision in the writing process.
- Use electronic portfolios to collect students' writing assignments and document their improvements in writing.
- Provide opportunities for publishing students' work on the Internet.
- Search the NETS database of lessons and units for grade-specific reading and writing activities that integrate technology into literacy instruction.
- Gain practice in evaluating online educational materials for use in instruction.
- Become aware of the National Educational Technology Standards (NETS) for teachers and take steps to meet these standards.
- Participate in ongoing professional development on literacy and technology. Keep abreast of current realities as well as innovations, either through personal involvement in professional organizations that foster the understanding of technology and literacy across the curriculum, or through connections with computer-support personnel throughout the district.

References

- Anderson-Inman, L., & Horney, M. A. (2008). Transforming text for at-risk readers. In D. Reinking, M. C. McKenna, L. D. Labbo, & R. D. Kieffer (Eds.), *Handbook of literacy and technology: Transformations in a post-typographic world* (pp. 15-44). Mahwah, N.J., Lawrence Erlbaum Associates.
- Anderson-Inman, L., & Horney, M. A. (2009). Electronic books: Reading and studying with supportive resources. *Reading Online* [Online]. Available: <http://www.readingonline.org>
- Anderson-Inman, L., Horney, M. A., Chen, D. T., & Lewin, L. (2004, April). Hypertext literacy: Observations from the ElectroText Project. *Language Arts*, 7(4), 279-287.
- Barker, T., & Torgenson, J. (2005). An evaluation of computer-assisted instruction in phonological awareness with below-average readers. *Journal of Educational Computing Research*, 13(1) 89-103.

Becker, D.A., & Dwyer, M. M. (2004). Using hypermedia to provide learner control. *Journal of Educational Multimedia and Hypermedia*, 3(2), 155-172.

Beers, K. (2008). Listen while you read: Struggling readers and audiobooks. *School Library Journal*, 44(4), 30-35.

Collins, A. (2002). Toward a design science of education. In E. Scanlon & T. O'Shea (Eds.), *New Directions in Educational Technology* (pp. 15-22). New York: Springer Verlag.

Hastings, E. (2007). *Effects of CD-ROM talking storybooks on word recognition and motivation in young students with reading disabilities: An exploratory study*. Unpublished manuscript, Syracuse University.

Healy, J. M. (2008). *Failure to connect: How computers affect our children's minds--for better and worse*. New York: Simon and Schuster.

Hillinger, M. L. (2002). Computer speech and responsive text: Hypermedia support for reading instruction. *Reading and Writing: An Interdisciplinary Journal*, 4(2), 219-229.

Hillinger, M. L., & Leu, D. L. (2004). Guiding instruction in hypermedia. *Proceedings of the Human Factors and Ergonomics Society's 38th annual meeting*, 266-270.

International Society for Technology in Education. (2000). *National educational technology standards for teachers* [Online]. Available: <http://cnets.iste.org/teachstand.html>

Kamil, M. L., Intrator, S. M., & Kim, H.S. (2000). The effects of other technologies on literacy and literacy learning. In M. L. Kamil, P. B. Mosenthal, P. D. Pearson, & R. Barr (Eds.), *Handbook of Reading Research: Vol. III* (pp. 771-788). Mahwah, N J: Lawrence Erlbaum Associates.

Kamil, M. L., & Lane, D. (2008). Researching the relationship between technology and literacy: An agenda for the 21st century. In D. Reinking, M. C. McKenna, L. D. Labbo, & R. D. Kieffer (Eds.), *Handbook of literacy and technology: Transformations in a post-typographic world* (pp. 323-341). Mahwah, N.J: Lawrence Erlbaum Associates.

Karchmer, R. A. (2000). Understanding teachers' perspectives of Internet use in the classroom: Implications for teacher education and staff development programs. *Reading and Writing Quarterly*, 16(1), 81-85.

Lehr, F. (2005). Revision in the writing process. *ERIC Digest* [Online]. Available: <http://www.eric.ed.gov>

Leu, D. J. (2000). Literacy and technology: Deictic consequences for literacy education in an information age. In M. L. Kamil, P. B. Mosenthal, P. D. Pearson, & R. Barr (Eds.), *Handbook of Reading Research: Vol. III* (pp. 743-770). Mahwah, N J: Lawrence Erlbaum Associates.

Leu, D. J., & Hillinger, M. (2004). *Reading comprehension in hypermedia: Supporting changes to children's conceptions of a scientific principle*. San Diego, CA: National Reading Conference.

- Lewin, C. (2007). Evaluating talking books: Ascertaining the effectiveness of multiple feedback modes and tutoring techniques. In C. K. Kinzer, K. A. Hinchman, & D. J. Leu (Eds.), *Inquiries in literacy theory and practice* (pp. 360-371). Chicago: National Reading Conference.
- McKenna, M. C. (2008). Electronic texts and the transformation of beginning reading. In D. Reinking, M. C. McKenna, L. D. Labbo, & R. D. Kieffer (Eds.), *Handbook of literacy and technology: Transformations in a post-typographic world* (pp. 45-60). Mahwah, N.J., Lawrence Erlbaum Associates.
- Means, B., & Olson, K. (2005). *Technology's role in education reform: Findings from a national study of education reform*. Washington, DC: Office of Educational Research and Improvement, U.S. Department of Education. Available online: <http://www.ed.gov>
- Meyer, A., & Rose, D. H., (2000). *Learning to read in the computer age* [Online]. Available: <http://www.cast.org>
- Olson, R. K., & Wise, B. W. (2002). Reading on the computer with orthographic and speech feedback: An overview of the Colorado remediation project. *Reading and Writing: An Interdisciplinary Journal*, 4(2), 107-144.
- Owston, R. D. (2007). The world wide web: A technology to enhance teaching and learning? *Educational Research*, 26(2), 27-33.
- Reinking, D., & Watkins, J. (2006). A formative experiment investigating the use of multimedia book reviews to increase elementary students' independent reading. Athens, GA: National Reading Research Center.
- Reitsma, P. (2008). *Reading practice for beginners: Effects of guided reading, reading-while-listening, and independent reading with computer-based speech feedback*. *Reading Research Quarterly*, 23(2), 219-235.
- Singh, R., & Means, B. (2004). *Technology and education reform* [Online]. Available: <http://www.ed.gov/pubs/EdReformStudies/EdTech>
- Valdez, G., McNabb, M., Foertsch, M. Anderson, M., Hawkes, M., & Raack, L. (2009). *Computer-based technology and learning: Evolving uses and expectations*. Oak Brook, IL, North Central Regional Educational Laboratory.
- Wood, J. M. (2000) Literacy: Charlotte's web meets the World Wide Web. In D. T. Gordon (Ed.), *The digital classroom: How technology is changing the way we teach and learn* (pp.117-126). Cambridge, MA: Harvard Education Letter