Using technology to assist in the teaching of reading instruction

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Using technology to assist in the teaching of reading instruction

Abstract
A professional literature review was conducted on the use of technology in assisting teaching of reading instruction. Technology reviewed was categorized according to the essential elements of reading as defined by the No Child Left Behind Act (i.e., phonemic awareness, phonics, fluency, vocabulary, and comprehension). Vygotskian and Piagetian theories were used to evaluate the technology reviewed. The review ends with a series of recommendations for teachers who may consider integrating technology into their curriculum.
USING TECHNOLOGY TO ASSIST IN THE TEACHING OF READING INSTRUCTION

A Graduate Review
Submitted to the
Division of Literacy Education
In Partial Fulfillment
Of the Requirements for the Degree
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Abstract

A professional literature review was conducted on the use of technology in assisting teaching of reading instruction. Technology reviewed was categorized according to the essential elements of reading as defined by the No Child Left Behind Act (i.e., phonemic awareness, phonics, fluency, vocabulary, and comprehension). Vygotskian and Piagetian theories were used to evaluate the technology reviewed. The review ends with a series of recommendations for teachers who may consider integrating technology into their curriculum.
Introduction

To introduce the topic, using technology in assisting the teaching of reading, a rationale was developed. One major research question emerged from the rationale. Additionally, terms were given clear definitions.

Rationale

For over two years, the National Reading Panel (NRP) reviewed research-based knowledge on reading instruction and held open panel meetings in Washington, DC, and regional meetings across the United States. On April 13, 2000, the NRP concluded its work and submitted its report, “The Report of the National Reading Panel: Teaching Children to Read,” at a hearing before the U.S. Senate Appropriations Committee’s Subcommittee on Labor, Health and Human Services, and Education. It is this report on which the early literacy portion of the No Child Behind Act of 2000 was based.

In their report, the NRP states that there are five key reading skills that need to be learned at an early age: Phonemic awareness, phonics, fluency, vocabulary, and comprehension. According to this report, all of these skills are essential, but none are sufficient in their own right. They must be integrated with each other to be fully effective. According to the NRP website, one way to do this is through the use of computer technology. Research tells us that computer technology used to aid in the early literacy portion of the No Child Behind Act of 2000 can be defined in terms of software (i.e., CD-Rom storybooks or e-books) and the Internet and that with each there are certain guidelines that should be followed. Whether using software or the internet, there are certain aspects of each to look for and certain aspects of which to beware. The question
this paper hopes to answer, then, is how to use computer technology both appropriately and effectively to successfully teach the aforementioned key reading skills.

Research Question

How can computer technology be used both appropriately and effectively to successfully teach all five essential elements (phonemic awareness, phonics, fluency, vocabulary, and comprehension) of the early literacy portion of the No Child Left Behind Act? To answer this question, a review of professional literature was conducted.

Definition of Terms

The NRP (2000) defines the five essential elements mentioned above as the following terms with definitions: Phonemic awareness is defined as the ability to hear, identify, and manipulate sounds in the spoken language. Phonics is the relationship between the letters of the written language and sounds of the spoken language. The difference between the two is that phonemic awareness only deals with the sounds, while phonics associates those sounds to their written form. Fluency is the capacity to read text accurately and quickly. Vocabulary is defined as the words students must know to communicate effectively. Finally, comprehension is the ability to understand and gain meaning from what has been read.

These five essential elements have other references in the research, as well. For instance, phonics is referred to as instructional programs that attempt to teach the relationships between the written letters and their sounds (Shefelbine, 1990). Wolf and Katzir-Cohen (2001) refers to fluency as the reading of text with a flexible rate of speed and prosody (i.e. the intonation, rhythm, and lexical stress in speech), as well as accuracy
and quickness. Hickman, Pollar-Durodola, and Vaughn (2004) refer to comprehension as being dependent upon vocabulary and prior knowledge in order to understand and gain meaning from what has been read.

Methodology

Selection procedures were defined in the methodology section. Additionally, an analysis of research is stated and characteristics and selection criteria are explained.

Selection Procedures

To conduct this literature review, professional literature was used that dealt with information that the report of the National Reading Panel and the No Child Behind Act describe as the five essential elements involved in reading and the integration of early childhood literacy and technology. The search for this literature was conducted through the Rod Library databases of the University of Northern Iowa. Specifically, Education Full Text (Wilson Web), and ERIC (EBSCO) databases were used. Search terms included the words “Kindergarteners,” “kindergarten,” “technology,” “software,” “Internet,” “literacy,” “literacy development,” “reading,” “writing,” “early childhood education,” “young children,” “National Reading Panel,” “report,” “No Child Left Behind Act,” “phonemic awareness,” “phonics,” “vocabulary,” “comprehension,” “fluency,” and “definition.” These searches yielded professional articles from such journals as The Reading Teacher, Reading Research Quarterly, T.H.E. Journal, and several others.

Searches were limited in that search terms were combined to find more research articles that were specific to the research question. Such combinations included the
following: (a) “kindergarten” and “literacy development,” (b) “kindergarten” and “technology,” (c) “literacy development” and “technology,” (d) “National Reading Panel” and “report,” (e) “National Reading Panel” and “technology,” (f) “No Child Left Behind Act” and “National Reading Panel,” (g) “No Child Left Behind Act” and “technology,” (h) “No Child Left Behind Act” and “literacy development,” (i) “No Child Left Behind Act” and “early childhood education,” (j) “phonemic awareness” and “definition,” (k) “phonemic awareness” and “technology,” (l) “phonics” and “definition,” (m) “phonics” and “technology,” (n) “vocabulary” and “definition,” (o) “vocabulary” and “technology,” (p) “comprehension” and “definition,” (q) “comprehension” and “technology,” (r) “fluency” and “definition,” and (s) “fluency” and “technology.” While each combination uncovered either hundreds or thousands of hits, the hits that were used were those that either gave definitions, guidelines, ways to integrate the two terms, or referenced other search terms used.

Analysis of Research on Literacy and Technology in Kindergarten

Research was analyzed using a logical process. Initially, each article was read and notes were taken. After this initial reading, the articles were read again and notes were compared with a focus on looking for common domains or concepts. As a result of this second reading, the following domains were found: a) guidelines for effective use of technology in instruction, b) phonemic awareness and technology, c) phonics and technology, d) fluency and technology, e) vocabulary and technology, and finally f) comprehension and technology. Each of these domains is addressed in the following discussion section.
Characteristics and Selection Criteria

Research articles were found on various modern, new, and up-to-date technologies, but if the articles either were not related to literacy development or were dated as being older than ten years, that is, the year, 1997, they were not used. Types of articles used for this research were formal research articles based upon studies conducted within the topics of phonemic awareness, phonics, fluency, vocabulary, comprehension and/or technology, as well as articles based upon descriptions of the authors personal and professional knowledge and experiences.

Analysis and Discussion

The relationship between No Child Left Behind, National Reading Panel (NRP), Reading First, and reading instruction is explained. The relationships between computer technology and reading instruction, phonemic awareness, phonics, and technology, fluency and technology, vocabulary and technology, and comprehension and technology are also explained. In addition, the overall benefits of technology and reading are also explained.

No Child Left Behind, NRP, Reading First, and Reading Instruction

Reading is critical to achieving success in today’s society. It is the key to learning about literature, geography, math, science, history, and much more. Those who are good readers do well in these subjects, plus they enjoy reading for pleasure and build self-esteem and confidence (U.S. Department of Education, 2007b). It is for this reason that No Child Left Behind (NCLB) not only places a heavy emphasis on reading, it also
defines what good reading instruction should include. The basis for what should be included as “good reading instruction” comes from a report written by the National Reading Panel (NRP, 2000):

In 1997, Congress asked the Director of the National Institute of Child Health and Human Development (NICHD) at the National Institutes of Health, in consultation with the Secretary of Education, to appoint a national panel to assess the effectiveness of different approaches used to teach children to read (National Reading Panel, 2000, p.2).

For over two years, the NRP reviewed research-based knowledge on reading instruction and held open panel meetings in Washington, DC, and regional meetings across the United States. On April 13, 2000, the NRP concluded its work and submitted "The Report of the National Reading Panel: Teaching Children to Read," at a hearing before the U.S. Senate Appropriations Committee's Subcommittee on Labor, Health and Human Services, and Education (National Reading Panel, 2000). According to this report, good reading instruction includes an integration of phonics, phonemic awareness, vocabulary, comprehension, and fluency. Using the report of the National Reading Panel as a basis for NCLB, the NCLB Act “links a large portion of its funding to scientifically proven methods of reading instruction through the President’s [George W. Bush] Reading First Plan.” (U.S. Department of Education, 2007a). Reading First is the grant program for students in kindergarten through third grade in under-performing schools that is funded by the No Child Left Behind. According to the Report of the National Reading Panel (2000), those five essential elements are defined as follows:
• Phonemic awareness: the ability to hear, identify, and play with individual sounds - or phonemes - in spoken words.

• Phonics: the relationship between the letters of written language and the sounds of spoken language.

• Fluency: the capacity to read text accurately and quickly.

• Vocabulary: the words students must know to communicate effectively.

• Comprehension: the ability to understand and gain meaning from what has been read.

*Computer Technology and Reading Instruction*

The NRP report (2000) mentions that the integration of technology would be beneficial in teaching the essential elements of reading, but does not explicitly state how to do this. Reading First does not necessarily address the integration of technology. The report of the National Reading Panel (NRP) of 2000, which the No Child Left Behind Act (NCLBA) is based upon, tells us that computer technology is not an instructional method in itself, but that it should be examined.

Until recently, teachers taught students how to use computers, but there was little emphasis in looking at the educational quality of the programs. Shamir and Korat (2006) conducted a literature review to help teachers judge the quality of CD-ROM storybooks. The result of their research was that specific design characteristics in CD-ROM storybooks do make a difference in the literacy development of children. Their research found that by applying Vygotsky’s work to children who use computers as a scaffolding process, children were able to master tasks independently that they otherwise would not
have had the opportunity to do so. Shamir and Korat's (2006) research also found that in 2003 the National Association of Educators of Young Children (NAEYC) cited the Piagetian theory, in which children are builders of their own knowledge through exploration and discovery, in their declaration that software should actively be used by young children as a tool for learning and extending their abilities. By using both Vygotsky and Piaget's theories it is assured that the technology will be both appropriate and effective. This review of literature will examine how computer technology can be used both appropriately and effectively to teach all five essential elements of the early literacy portion of the No Child Left Behind Act listed above. The review is categorized into descriptions of the following categories: (a) courseware: and (b) internet sites that have been evaluated according to criteria drawn from Vygotskian and Piagetian learning theories.

Phonemic Awareness, Phonics, and Technology

Phonemic awareness is defined as the ability to hear, identify, and play with individual sounds in spoken language. Phonics is defined as the relationship between those sounds of the spoken language and the letters of the written language. In 1998, the International Reading Association (IRA) Board issued a position statement on phonemic awareness, stating the following:

Nursery rhymes, riddles, songs, poems, and read-aloud books that manipulate sounds may be purposefully used to draw young learners' attention to the sounds of spoken language. Guessing games and riddles in which sounds are manipulated
may help children become more sensitive to the sound structure of their language. (§ 7).

The IRA (1998) also stated the importance of phonics in a comprehensive program. Forbes (2004), Labbo (2004, 2005a), and Wepner and Cotter (2002) not only agree, they give educators ways to incorporate technology both appropriately and effectively into the instruction of phonemic awareness and phonics through both scaffolding and hands-on experimentation.

Software and CD-Rom/Electronic Storybooks. Labbo (2005a) suggested software programs such as Blue’s Clues ABC Time Activities (Viacom & Humongous Entertainment), Alphabet: Play With the ABC’s (Library Video Company), and I Spy: School Days (Scholastic). These programs have multimedia features which enable students to listen to and practice rhyming skills and phonics, interact with letters, and listen to riddles and hunt for the on-screen objects associated with those riddles.

According to Wepner and Cotter (2002) the interactivity of computer graphics in electronic storybooks is important to help students connect what is read aloud (phonemic awareness) to the written text (phonics). IntelliTools Reading: Balanced Literacy is one such program that uses interactive graphics. “This early literacy program uses animal themes across nine units with guided reading and word study activities. Each unit concentrates on a different sound using onset and rime” (p. 3). In addition, each writing section has “students create sentences that include a specific rime [and] pictures from that lesson’s book are used to reinforce students’ sentence construction” (p. 4).
When students use computer programs such as the ones mentioned above, they are provided with scaffolding opportunities in which they listen to and practice (and with hands-on experiences in which they interact with, and create) phonemic awareness and phonics they may otherwise have not had the opportunity to do so. In addition, the research of Shamir and Korat (2006) found e-books to be especially helpful for kindergarteners’ emerging literacy skills, particularly in respect to verbal abilities and word recognition.

*The Internet.* Letter identification is a precursor or component of phonics instruction. Forbes (2004) suggested that practice using Web-based bookmarks, the mouse, links, the browser toolbar and content material are all ways to integrate letter identification into practical hands-on computer use. For example, using the letter identification skills of being able to identify the appropriate letter, students could be asked to look for a link that starts with a W (such as WebMuseum). Once the students click on that link, they are asked to click on a link that starts with a V (Vincent van Gogh). This takes them to Vincent van Gogh’s painting entitled “The Starry Night.” Using “The Starry Night,” students learn about stars, planets, and the moon (science content). Using Web-based bookmarks in such a manner, students can learn letters, blends, sight words, and vocabulary, as well as content area material. Web-based bookmarks are also a safe, non-overwhelming, teacher controlled way for students to use the Internet both appropriately and effectively. In comparison to using traditional text, the Internet and Web-based bookmarks also provide visual cues, high-interest, meaningful
No Child Left Behind, Technology and Reading Instruction

reading material, more resources, and reduce time wasted looking for resources (Forbes, 2004; Malloy & Gambrell, 2006).

Labbo (2004) suggested the Kidz Page (Tarr, 2006) as an interactive way to use multimedia features to practice rhyming and poetry skills, which are important components of phonemic awareness and phonics. “Poetry is filled with elements of language that genuinely delight children – rhyme and sound, imagery, figurative language, rhythm, and emotional force.” (Labbo, 2004, p.311). Since the Kidz Page contains a section of poetry that is written by both children and adult contributors, students are able to use those poems as springboards to create their own poetry.

Labbo (2005a) suggested using the following websites to teach phonemic awareness and phonics: Starfall.com (Shutz, 2003), Magnetic Poetry (Allen, 2006), and Literacy Center.Net (2006). These websites were suggested because they will give students practice with phonemic awareness and phonics through interactive electronic books (online) in which students are able to click on each word, hear it read aloud, and hear the sounds stretched out, unscramble favorite nursery rhymes, and encounter multiple alphabet games.

The above mentioned websites are both appropriate and effective for several reasons. Starfall.com (Shutz, 2003) follows Vygotsky’s work as it both provides the necessary scaffolding process and provides an opportunity for children to master tasks independently. It also follows the Piagetian theory in that it allows children to build their own knowledge through exploration and discovery. In this interactive children’s book, students learn about the letter y being a vowel. The necessary scaffolding is done when
the students click on the word and each letter in the word is read (phonemic awareness) while simultaneously being highlighted so the students can read with the computer (phonics). They can also click on a picture of a camera and take a Polaroid picture of the characters on each page, as well as click on the characters themselves and watch as the characters act out their part on the page (exploration and discovery).

At Magnetic Poetry (Allen, 2006) students are able to unscramble favorite nursery rhymes and then write their own rhymes (phonics). This helps students learn both onsets (beginning parts of words – “s” and /s/) and rimes (ending parts of words – “ack” and /ack/). Magnetic Poetry provides an opportunity for both experimentation and scaffolding because students are able to use the computer to practice their rhyming skills by moving from manipulation of known words in a familiar nursery rhyme to creating their own nursery rhymes.

At Literacy Center.Net (2006) students encounter multiple alphabet games to build / reinforce phonics skills through letter recognition. Each game has multiple levels that are interactive, which allows students to build knowledge through exploration and discovery, and increase in difficulty from one level to the next, which provides scaffolding.

**Fluency and Technology**

Fluency is the ability to decode text automatically, accurately, and effortlessly which allows the reallocation of retention and prosody (Wolf & Katzir-Cohen, 2001; Kuhn & Stahl, 2003; NRP, 2000). Labbo (2004, 2005a), Lever-Davis and Pearman (2005), and Shamir and Korat (2006) give educators suggestions on how to incorporate
CD-Rom Storybooks. CD-Rom storybooks have been found to successfully improve sight word recognition (Shamir & Korat, 2006). Increasing sight word recognition helps fluency because students do not have to waste time decoding words, rather they can read them automatically. Because CD-Rom storybooks are often interactive programs, the reading environment is individualized. Students are provided necessary scaffolding and are able to build their own knowledge through exploration and discovery as they can choose when and where they need assistance. This also eliminates the issue of time needed to decode an unfamiliar word and maintains the flow of reading. For example, when students come to an unfamiliar word or phrase, they are able to click on it, hear the computer read it aloud, and continue reading (Lefever-Davis & Pearman, 2005).

The Internet. Labbo (2004, 2005a) maintained that poetry is a wonderful way to build motivation and to encourage fluency skills. She suggests using technology because many programs and the Internet include features that allow the poetry to be read aloud and expressively by professional voice actors. This necessary scaffolding models accurate fluency for students. Labbo (2004) suggested Kristine George.com (O'Connell George, 2004) to allow the students the opportunity to listen to the author read her own poetry. Labbo (2005a) suggested the Favorite Poem Project (Pinsky, 2000) to provide the students an opportunity to watch videos of 50 famous people reading poetry. While these
poems are geared toward older students, they do provide younger students scaffolding through demonstrations of what fluent reading should both look like and sound like.

**Vocabulary and Technology**

Vocabulary is the knowledge of words and their meanings (Nash & Snowling, 2006; Goldstein & Laufer, 2004). “Traditionally, vocabulary instruction has been conducted by having children look words up in dictionaries and memorize the definitions, under the assumption that, having learned the definition, they have learned the word” (Stahl, 2003, p. 16). However, vocabulary is more than just “learning” a word. Just because students learn the definition of a word, it doesn’t mean they understand what the word is or how to use it and use it appropriately. This is where technology can help by providing both necessary scaffolding and hands-on experimentations in which students are builders of their own knowledge through exploration and discovery.

**CD-Rom Storybooks and Software.** As students read CD-Rom storybooks, their vocabulary is enhanced when the characters from the story are involved in animated scenes using the words from the text (Lefever-Davis & Pearman, 2005). This enhances vocabulary as the printed words become both visual and put into context. CD-Rom storybooks especially help to enhance the vocabulary of struggling readers as they have support from the beginning. Struggling readers increase their self-confidence as readers when they are provided with scaffolding opportunities and hands-on experiences in which they are able to click on unfamiliar words, hear the word, listen to its definition, and see it used in context (Labbo, 2005a).
Software such as *I Spy: School Days* (2000, Scholastic) as cited in Labbo (2005a) can help to enhance vocabulary as well. When using this software, students are able to look for and discuss objects related to occupations, thus enhancing their vocabulary through exploration and discovery.

*The Internet.* When using the Internet, students are introduced to new vocabulary such as Web browser navigation and terminology (Forbes, 2004). In using the Web browser, students are provided a hands-on opportunity to use the new terminology and navigation skills in context.

In addition to using the Web browser, students may go to PBS’s *Between the Lions* website and have hands-on experiences. When they go to a game called *Word Play* students are able to click on words and watch them come to life. For example, if a student were to click on the word *pop* it would actually begin to move around and pop (Wepner & Cotter, 2002). This provides context for new vocabulary words.

*Comprehension and Technology*

As previously stated, the NRP definition of comprehension is the ability to understand and gain meaning from what has been read. Hickman, et al. (2004) expanded on this definition by listing comprehension skills as including, but not limited to, the ability to use words authentically in context (vocabulary); the ability to determine both important and unimportant details in a story; the ability to respond to text; and the ability to have conversations in relation to texts. In this sense, technology is an effective aid as it can be used again and again as many times as desired to build both prior knowledge and
vocabulary. Labbo (2005a) and Wepner and Cotter (2002) suggested that whether using computer programs or the Internet, the combination of graphics and sound provides necessary scaffolding by making the screen come to life, thereby providing context to enhance comprehension. Graphics and sound can even take the place of words to convey the message. When students do not have to use mental energy to decode words or struggle with vocabulary, they are able to spend more time and energy to process meaning for comprehension (Lefever-Davis & Pearman, 2005). For example, by clicking on the unfamiliar word, the struggling reader is able to reduce the decoding process and maintain the meaning of the story (Pearman & Lefever-Davis, 2006; Bauserman, Cassady, & Stroud, 2005).

Electronic/CD-Rom storybooks. Electronic/CD-Rom storybooks are text narration that are both expressive and interactive (Shamir & Korat, 2006), allowing students opportunities to build their own knowledge through exploration and discovery, and are similar to traditional storybooks in that they use narrative text with the traditional characters, plot, and setting to tell a story. Read-alouds also help students with the concept of story which is an important comprehension skill. Graphics are used as necessary scaffolding to enhance and communicate the text (Wepner & Cotter, 2002).

Because Shamir and Korat (2006) believe that electronic/CD-Rom storybooks have become a growing trend and should be researched for their quality and benefits, they conducted a literature review to find out more about it. According to their research, story comprehension and retelling were found to be higher when using electronic storybooks (e-books) versus using traditional storybooks.
Lefever-Davis and Pearman (2005) add that comprehension is further enhanced by scaffolding such as animations and music that signal events in a story. These elements can stimulate predictions or alert the reader/viewer to important ideas and events. For example, as cited in Lefever-Davis and Pearman (2005) when using the electronic version of *The Three Little Pigs* (The Learning Company, 1996) foreboding music, animated pigs screaming and an animated wolf yelling, signal that something is about to happen. Lefever-Davis and Pearman (2005) found that the “pairing of graphics and audio not only enhances the context but also helps set the mood the author is trying to establish” (p. 447).

The Internet. Another way to provide scaffolding that enhances comprehension through graphics and audio is to use Internet websites. Wepner and Cotter (2002) found that graphics serve as think-alouds because students are able to directly see the meaning which facilitates comprehension. Labbo (2004) suggested *Mama Lisa’s House of Nursery Rhyme* (Yannucci, 2006) for a way to add some fun to the equation. For example, if the nursery rhyme of *Fuzzy Wuzzy* is clicked on, “a bald-headed bear is found looking in a mirror and applying a hair-loss remedy” (p. 310).

Overall Benefits of Technology and Reading

Electronic storybooks are similar to traditional storybooks in that they use narrative text with the traditional characters, plot, and setting to tell a story. Graphics are used as scaffolding to enhance and communicate the text (Wepner & Cotter, 2002, p. 6). The Internet is also beneficial because it allows students to access the current classroom
content from the computer lab, classroom, public library, or home (Forbes, 2004, p. 153). Essentially it gives students constant and convenient access to school content area materials from many places both in and out of the classroom. In addition, the interactivity of both electronic storybooks and the Internet allows children to build their own knowledge through exploration and discovery.

Effective teachers are those who integrate computers and other technology into the literacy curriculum by linking them to things they already do – classroom practices with which they are comfortable and in which they find value (Labbo, 2005b). For example, one thing that is quite common in the elementary classroom is the morning message. The morning message “creates occasions for important reading and writing skills ranging from basic print concepts, to composing, to comprehension, to phonics. Thus children have the occasion to recognize or practice directionality, letter names, words, sentences, capitalization, oral language, vocabulary, and so on” (Labbo, 2005b, p. 783). Computer technology can be used to project the morning message electronically through the use of video projector or digital whiteboard. According to Solvie (2004), when using the Internet along with the digital whiteboard, teachers are able to use video and audio clips to develop background knowledge and provide information on authors, characters, and settings, as well as appropriate background information on places and artifacts not found within their community.

A summary chart of the above section may be found in Appendix One: Ways of using technology to teach the five essential elements of No Child Left Behind.
• When using computer technology, educators should provide a variety of levels to reduce student frustration and increase teacher awareness of materials that students will be accessing (Forbes, 2004).

• Graphics and other multimedia found within educational software and on the internet should be congruent with the graphics and other multimedia found within electronic storybooks so as not to distract from the learning (Shamir & Korat, 2006). If it is “intrinsic to the text being simultaneously heard and seen it helps the child identify the words with the concepts or items being shown” (Alabi, 2005, p. 5th).

• Computer activities that are well-designed, “motivate children to learn more about literacy by drawing their attention to the big ideas, new vocabulary, thematic connections, and innovations on text” (Labbo, 2005, p. 288).

• Websites that primarily contain audio and visual (or video) content are appropriate for younger learners (Forbes, 2004; Solvie, 2004).

Software Guidelines

Shamir and Korat (2006) have some criteria to look for when looking to purchase an e-book (a.k.a. CD-ROM storybook). They suggest looking for the following:

1) Age Appropriateness in terms of literacy skills found within the software.

2) Child Control – the software should encourage active participation by the child, rather than the child merely responding to computer generated activities.

3) Clear Instructions – it is essential that the software incorporate verbal directions.
4) Independence – the software should provide the scaffolding necessary to help children explore situations and objects for which they lack prerequisite skills or physical or cognitive abilities.

5) Process Orientation – the activities should be congruent with the story content; also look to see if the e-book includes a separate game mode.


Internet Guidelines

Internet use is one that can have wonderful benefits, but also should be cautioned. “Just as we teach students to question the author when reading print, students need to be taught to evaluate the information they find on the internet” (Malloy & Gambrell, 2006, p. 483). Internet sites that appear to be appropriate are not necessarily developmentally appropriate. They can cause more difficulties for primary-grade readers than developmentally appropriate software that has been developed to support literacy. When looking for appropriate internet sites, the teacher needs to look for those with both multimedia tools and resources that can be used to “enhance and extend children’s learning about new literacies” (Labbo, 2006, p. 811) and as a scaffolding process which enables students to be builders of their own knowledge through exploration and discovery.

This chapter shows how to apply modern and up to date strategies and techniques to the five essential elements of reading as required by the NCLB Act. Children are learning to use computer technology as early as three years of age (Haugland, 2000). So
by using computer technology in the classroom, students are using skills they already have to gain new knowledge.

Limitations

This paper reviewed a limited number of CD-Rom Storybooks and Internet sites related to the teaching of the five essential elements of reading instruction as cited by the NRP. The purpose of the review was to demonstrate the possibilities of using technology to assist in the teaching of reading instruction. Many more courseware products and Internet sites related to this topic exist, but reviewing them all is beyond the scope and purpose of this paper.

Another limitation of this paper is that it is based only on the author’s reviews and perspectives. Other forms of research, including interviews of practicing educators, might provide additional perspectives.

Recommendations

For future researchers, it would be beneficial to conduct a professional literature review on reading software other than CD-Rom Storybooks.

Conclusion

The report of the National Reading Panel (NRP) of 2000, upon which the No Child Left Behind Act (NCLBA) is based, tells us that computer technology is not an instructional method in itself, but that it should be examined. Therefore, this review of professional literature examined the use of computer technology as applied to the development of the five essential elements of NCLBA (phonemic awareness, phonics, fluency, vocabulary, and comprehension). The review also found that whether using
Electronic / CD-Rom Storybooks or the Internet, educators are able to apply both Vygotsky’s work and Piaget’s theory to each of the five essential elements of the NCLBA. When they do so, the combination of modern technology and sound learning theory makes it likely that children’s literacy learning will be enhanced.
References


Integrating Literacy and Technology in the Curriculum. (2002). *International Reading Association*. [Brochure]. Newark, DE: IRA.


Appendix One: Ways of Using Technology to Teach to the Five Essential Elements of *No Child Left Behind*

<table>
<thead>
<tr>
<th>Five Essential Elements</th>
<th>Definitions</th>
<th>General Explicit Teaching Ideas</th>
<th>General Implicit Teaching Ideas</th>
<th>Software Recommendations</th>
<th>Internet / Website Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phonemic Awareness</td>
<td>The ability to hear, identify, and manipulate sounds in the spoken language.</td>
<td>Graphic Organizer Kidsiration</td>
<td>Center Time CD-Rom storybooks / Electronic Books</td>
<td>CD-Rom storybooks / electronic books</td>
<td><a href="http://www.iKeepBookmarks.com">www.iKeepBookmarks.com</a></td>
</tr>
<tr>
<td>Phonics</td>
<td>The relationship between the letters of the written language and the sounds of the spoken language.</td>
<td>Letter Recognition Web-based bookmarking</td>
<td>Indep. Silent Rdg. CD-Rom storybooks / Electronic Books</td>
<td>Kidspiration</td>
<td><a href="http://www.starfall.com">www.starfall.com</a> (Various interactive reading activities that are aligned with NCLB)</td>
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<tr>
<td>Fluency</td>
<td>The capacity to read text accurately and quickly.</td>
<td>Morning Message Digital White Board PowerPoint</td>
<td></td>
<td></td>
<td><a href="http://www.mamalisa.com/">www.mamalisa.com/</a> house/index.html (Mama Lisa's House of Nursery Rhymes)</td>
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<tr>
<td>Vocabulary</td>
<td>The words students must know to communicate effectively.</td>
<td></td>
<td></td>
<td></td>
<td><a href="http://www.mothergoose.com">www.mothergoose.com</a> (Various Mother Goose Activities)</td>
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<tr>
<td>Comprehension</td>
<td>The ability to understand and gain meaning from what has been read.</td>
<td></td>
<td></td>
<td></td>
<td><a href="http://www.kristinegeorge.com">www.kristinegeorge.com</a> (poetry books by Kristine O'Connel George)</td>
</tr>
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</table>

**References:**