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The Effects of Using an Electronic Talking Book on the Emergent Literacy Skills of Preschool Children

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The Effects of Using an Electronic Talking Book on the Emergent Literacy Skills of Preschool Children

by

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Dedication

To John Wright: you continue to inspire my intellectual endeavors everyday!

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The Effects of Using an Electronic Talking Book on the Emergent Literacy Skills of Preschool Children

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This study examined whether an electronic talking book aided the emergent literacy skills of preschool children. One hundred thirty-seven 4-year-old children were assigned to one of three conditions: (a) book only condition, (b) machine with no instruction condition, (c) machine with instruction condition. Parents and children in the book only condition were given two books without a talking book machine and instructed to read either of the books at least three times per week for a five-week period. Parents and children in the machine with no instruction condition were given the machine in the box with no explicit instructions on how to use the machine. They were also given the same two books to use with the machine as the book only condition. They were instructed to use the machine at least three times per week for a five-week period. Parents and children in the machine with instruction condition were given the machine and the same two books. They were instructed on how to use the machine, and given some tips on how to play additional reading games. They, too, were instructed to use the machine at least three times per week for a five-week period. Emergent literacy skills were assessed before the intervention and following the intervention period. There was no evidence to suggest that either being read the books or using the machine had any differing effects on the emergent literacy skills of children overall. There was some evidence to suggest that having the electronic talking book interferes in child's ability to recall important story information.

Differing effects were found for children of different skill levels as well as the amount of time children used the books overall, with parents and alone across conditions. The talking book benefited low performing children in compound-word blending and high performing children in the phonological awareness task of initially sound fluency. In addition, children who used the talking book for more minutes alone had gains on measures of concepts of print, speech to print matching, alliteration, and the TERA-3 alphabet subtest, than those who used it for fewer minutes alone. The same relationship was not found for using the books alone. These results are discussed in terms of how these findings relate to past research in other mediums, how they relate to children's trajectories of literacy learning, and how the findings can be used to inform toy manufacturers to create the best toy possible to maximize children's learning of emergent literacy skills.

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INTRODUCTION

Children learn from a variety of contexts and experiences including their families, childcare, schools, extracurricular activities, peers and siblings, and electronic media. Critics of electronic media place blame on them for children's negative behaviors such as violence and aggression, as well as for passivity, obesity, and lack of reading. But if media can have negative effects on children, they can also have positive effects, including teaching school-readiness skills (Anderson, Huston, Schmitt, Linebarger, & Wright, 2001), and preliteracy and literacy skills (Neuman, 1995).

Research suggests children can learn literacy skills from television programs (Rice, 1983; Rice, 1984, Rice & Woodsmall, 1988). However, little is known about how interactive technologies, such as computers and interactive toys can aid children's learning (Lee & Huston, 2003). While some of the findings can be borrowed from television, there exist differences between television and other interactive technologies. Computer games and interactive toy products offer a unique combination of a visual medium with the written text. However, little is known about their short-term or long-term effects on the cognitive development or literacy of children. The nature of interactivity itself has led to claims that it can be more beneficial to children's cognitive development than a more passive medium like television because the child is an active, engaged participant in the interaction. Little is also known about how children and their parents actually use these products in their homes.

The goal of this project is to examine the effectiveness of a technology-based approach to reading instruction using an electronic talking book. This toy is a machine in which a book and cartridge are inserted. Once activated, the machine reads and plays literacy games with children. The key research questions that this project will address are:

1. Can an interactive talking book teach emergent literacy skills found in the books themselves?
2. Can an interactive talking book teach skills that transfer to general literacy knowledge as evidenced in standardized literacy tests?
3. Does an interactive talking book benefit children differently at differing skill levels?
4. Is there a difference in learning from an interactive talking book if the child is using the product alone versus with a parent or another adult?

The foundations of emergent literacy are acquired early and occur on a developmental continuum before formal schooling (Whitehurst & Lonigan, 1998). The first section of this paper will describe the early literacy skills that are necessary for the development of reading and reading comprehension, specifically oral language and print decoding skills. The vast literature on literacy acquisition is beyond the scope of this paper. The aim is to summarize key literacy skills learned by children early in life so that they can be directly applied to how electronic media can teach these skills. The next section will specifically consider the properties of television, computers, and other electronic toys that can support literacy learning. The features unique to each medium as well as the content within each medium will be explored as they relate to the comprehension of narrative as well as specific oral language and code-related skills. Finally, the literature on parental scaffolding of traditional print and other media will be presented.

The goal of reviewing the diverse set of literature is to begin understand how children learn literacy skills, how they can be learned from all media, and how parents play a role in helping children to gain literacy skills. New technology such as electronic talking books have properties that resemble paper storybooks, as well as computer software, however little is known about how they can have an impact on children learning from them. In order to understand the impact these talking books may have on children, one has to draw on the diverse literature of other media in order to make inferences about this new technology.

How Preschoolers Learn Literacy Skills

Reading can be defined as gaining meaning from print, using knowledge of the written alphabet and oral language skills such as vocabulary and grammar, in order to achieve understanding (National Research Council, 1998). The emergent literacy approach to reading instruction views reading as a skill that begins before the formal school years. It posits that literacy acquisition occurs on a developmental continuum and that certain preliteracy skills as well as knowledge of print conventions are developmental precursors to conventional forms of reading and writing (Whitehurst & Lonigan, 1998). This perspective approaches the acquisition of reading as a series of milestones that occur early in life and progress, with no differentiation between pre-reading and reading (Lonigan, Burgess & Anthony, 2000, Whitehurst & Lonigan, 1998).

The tasks of emergent literacy include learning oral language skills such as knowledge about words and vocabulary, knowledge about grammatical rules and word orders, and story telling and retelling capabilities (Storch & Whitehurst, 2002). Emergent literacy also involves code-related skills such as knowledge about the conventions of print (reading left to right and top to bottom), knowledge of graphemes or letters, grapheme-phoneme correspondence (the idea that a letter represents a particular sound), and phonological awareness (e.g., hat begins with the /h/ sound) (National Research Council, 1998; Storch & Whitehurst, 2002; Whitehurst & Lonigan, 1998) (see Table 1). Learning these component skills may indirectly help children to conceptualize reading so that comprehension is attained (Whitehurst & Lonigan, 1998). Emergent literacy skills may also interact with formal and informal learning opportunities such as children's language environments, experiences with storybooks and other forms of print, and electronic media to advance children's acquisition of conventional literacy (Whitehurst & Lonigan, 1998).

Oral Language Skills

Vocabulary

Learning language includes learning the meaning of words. In the first year of life, children begin to understand word meanings, even before they are able to speak (National Research Council, 1998). Between the ages of 1 ½ and 6, children learn an average of 14,000 words, which translates to approximately nine new words per day (Lemish & Rice, 1988). Studies have shown that the better vocabularies children have, the better they are able to comprehend stories (Davis, 1968; Kameenui, Carnine & Freschi, 1982). Vocabulary knowledge early in the preschool years predicts later emergent literacy skills such as phonological sensitivity and letter knowledge (Lonigan, Burgess, & Anthony, 2000). When children understand the meaning of the print, they are better able to understand the overall meaning of the story, and this skill is stable and predictive of children's decoding skills in the early school years.

Grammar

Children learn grammatical conventions at a rapid pace. Children under two years of age start combining words to make simple sentences with a syntactic structure, and they begin to appreciate the grammatical meaning of sentences. For example, they come to understand that "Elmo is throwing a ball to Zoe" is different from "Zoe is throwing a ball to Elmo" (see National Research Council, 1998, for review). Understanding of these grammatical conventions aids in their oral language abilities, but vocabulary knowledge, rather than these syntactic abilities, is more predictive of young children's reading abilities. Syntactic abilities seem to become more important as children learn to read for meaning rather than when they are learning to decode single words (Whitehurst & Lonigan, 1998).

Emergent Reading

Early experiences with print are important precursors to literacy skills (Christian, Morrison & Bryant, 1998; Smith & Dixon, 2001). Children who have the opportunity to experience print-rich environments are better readers upon entering school (Millard, Taylor, & Watson, 2000; Scarborough, Dobrich, & Hager, 1991), and being read to at home is related to a child's later reading achievement (Neuman, 1996).

Around the ages of three and four, children begin to recite their favorite books as though they are reading. Most will attend to the pictures and to labeled words while a few will begin to attend to the main body of print (National Research Council, 1998). Pretending to read and reading environmental text (e.g. a McDonald's sign, a stop sign) are emergent reading skills that begin to develop even before a child can read words (Whitehurst & Lonigan, 1998). In a cross-sectional study of 2- to 4-year olds and a longitudinal study of 4- to 6-year-olds, Sulzby (1985) found a developmental progression in how the children "read" storybooks. Children initially treat individual pages of the book as discrete units. As they get older and more experienced with text, their "reading" progresses to building a story across multiple pages of the book. Children initially use oral-discourse speech (speech used to have a conversation) to retell the story, and the pictures are the basis for their story. As they reach the end of kindergarten, children begin to use written-discourse speech (intonation that sounds like reading and words that are more common to written, rather than oral discourse) to describe the pictures and build the story.

Code-Related Skills

Conventions of Print

Without being able to read, children can understand conventions of a book as reading top-to-bottom and left-to-right on a page (in English), the difference between the book being upside-down or right side up, differentiation between pictures and print on a page, and the meaning of punctuation and spacing between words (Clay, 1979). Clay's Concepts about Print (1979) is a test developed to measure print knowledge. Tunmer, Herriman & Nesdale (1988) found that scores on this measure at the beginning of first grade predicted reading comprehension and decoding ability at the end of second grade.

Knowledge of Graphemes

Letter identification in preschool is the strongest predictor of short- and long-term reading ability (National Research Council, 1998; Stevenson & Neuman, 1986; Whitehurst & Lonigan, 1998). A letter-naming task administered prior to kindergarten predicted reading achievement in high school (Stevenson & Neuman, 1986), but interventions to teach letter names have not been effective in producing large effects on reading acquisition (Adams, 1990 as cited in Whitehurst & Lonigan, 1998). Letter knowledge may indicate a higher-level knowledge and familiarity with print, whereas teaching the letters may provide surface knowledge about the letter name.

Phoneme-Grapheme Correspondence

Knowing the links between the letters and their sounds is an important skill for the development of reading. Children need to know the sounds of individual letters and, as they get older be able to blend the sounds of multiple letters. This ability has been termed phonological recoding and can be assessed by a pseudoword reading task (reading nonsense words by blending the sounds of the letters together) (Vandervelden & Siegel, 1995; Whitehurst & Lonigan, 1998). Children who have achieved phonological recoding skills have higher levels of reading achievement (Tunmer et al., 1988; Vandervelden & Siegel, 1995).

Phonological and Phonemic Awareness

Within the first five years of life, learning literacy is a progression from learning language to phonological awareness. Phonological awareness is the understanding that sounds of speech are distinct from their meaning. Children come to understand that words and the objects they represent are separate and distinct. For example, the word caterpillar is a long word but a shorter object than snake, which is a longer object but a shorter word (National Research Council, 1998).

Children also gain phonemic awareness, which is the understanding that words are divided into separate sounds or phonemes. For example, the word stamp can be divided at the syllable level: /stamp/, at the onset and rime level within the syllable: /st/ and /a/, and /mp/, or into individual phonemes /s/ /t/ /a/ /m/ /p/. Other components of phonemic awareness are rhyming and alliteration. Bryant, MacLean, Bradley & Crossland (1990) found rhyming and alliteration skills to be developmental precursors to phoneme detection, which played a role in learning to read. The ability to rhyme was directly related to reading ability (Bryant et. al., 1990). Rhyme may contribute to reading by associating common spelling patterns and sounds in the words that rhyme.

A higher-level of phonemic awareness is the knowledge that every word can be broken into its component phonemes. For example, *hat* and *nut* end with the same sound and *cat* and *crayon* begin with the same sound, while removing the */mon/* from *monkey* leaves *key* (called elision). In a meta-analysis examining the relation of phonological awareness to reading abilities, Bus & van Ijzendoorn (1999) analyzed 36 studies (N = 3,092) of phonological training programs and 34 studies (N = 2,751) testing the effects of phonological awareness on reading abilities. They reported that phonological training improves children's phonological awareness (d = .73) as well as their reading skills (d = .70). In addition, they found that preschoolers, rather than children in kindergarten or grade school, benefited most from phonological training in teaching them to learn to read. Phonological awareness in preschool is an important predictor of reading abilities later.

Inherent in the emergent literacy approach to literacy acquisition is the notion that children learn a variety of literacy skills through exposure to a variety of contexts and experiences. One of those contexts is electronic media.

Learning Literacy Skills from Electronic Media

Electronic media are prolific. Ninety-eight percent of households with children 2-17 years old have a television in their home, and 70% of households with children have a computer (Woodard & Gridina, 2000). Although some would argue that the pervasiveness of these media lead to negative effects on children, electronic media can also be powerful teachers that reach large numbers of diverse children relatively quickly. If content is appropriately designed and cognitively stimulating, electronic media can enrich the learning environments of children.

In order to examine what is learned from electronic media, one has to observe the unique attributes of each medium. The form of the medium can be distinguished from the content that is delivered. Form has been defined as "the vehicle in which the message is presented" (Huston & Wright, 1989, p. 106) whereas the content is the message itself.

The electronic media forms that will be examined are television, computers, and electronic talking books. The distinctions among these media are more often form-driven while the similarities are more often content-driven (Fisch, 2003; Neuman, 1995). Early critics of television were concerned that the medium itself induced laziness and passivity (Huston & Wright, 1994). Computers, on the other hand, have been perceived as interactive and engaging (Lee & Huston, 2003). What formal features of media lead to learning best from them? What specific content of media has aided in learning literacy skills? Specifically, can children learn literacy skills from media, and if so, how?

Television

Very young children (birth to six) watch approximately one hour of television per day (Kaiser Family Foundation, 2003). Many critics of television assert that children become zombies in front of the "boob tube" (Winn, 1985). Many believe that television elicits passive, rather than active, cognitive processing (McLuhan, 1967; Gotz, 1975, Healy, 1990). But years of research on television have shown that children process it actively (Anderson, Lorch, Field, & Sanders, 1981; Anderson, Huston, Schmidt, Linebarger, & Wright, 2001; Huston & Wright, 1997; Lorch, Anderson, & Levin, 1979). They attend selectively to the portions of the program that are comprehensible to them, ignoring incomprehensible content (Anderson, Lorch, Field & Sanders, 1981; Bryant & Anderson, 1983).

When television was first introduced, there was public concern that children's time with print and reading abilities would be negatively affected by this new medium. This displacement hypothesis will be discussed as it relates to the reading time and reading abilities of children. Next, specific formal features of television will be introduced as they relate to promoting learning in general, and literacy skills, in particular. Finally, specific content of programs on television are discussed in relation to the acquisition of key literacy skills. Television's messages are available in almost any home. If children are ready to receive them and the content is appropriately designed, children can learn narrative comprehension, code-related skills (i.e., concepts of print, letter naming, phonemic awareness), and oral language (i.e., vocabulary) skills from this medium.

The Displacement Hypothesis

When television was introduced, many critics were concerned that time previously devoted to reading would now be devoted to watching television. But, research suggests that this displacement hypothesis is too simplistic. In studies that examined the introduction of television into a community, the most affected activities were functionally similar to TV, such as listening to the radio and attending movies (Huston & Wright, 1997; Huston, Wright, Marquis & Green, 1999; Neuman, 1995). There is some evidence that comic book reading decreased with the introduction of television (Beentjes & van der Voort, 1988; Huston & Wright, 1997), but other types of reading seemed not to change. One needs to look beyond the medium itself to content within the medium. Huston and colleagues (1999) found that time spent viewing child informative programs had no association with increases or decreases in reading time. They and others (Beentjes & van der Voort, 1988) did, on the other hand, find that there was a negative relationship between time spent viewing cartoons and general audience programs, and time spent reading, especially for preschool children.

Critics of television were also concerned that children's reading abilities would be negatively affected by television. Corteen & Williams (1986; as cited in Huston & Wright, 1997) found weak evidence for a negative effect on early reading skills for young children after the introduction of television in a small town in British Columbia. But when the amount of time spent watching television was taken into account, a different picture arose. Based on reading assessment measures from eight states and an attitudinal television measure, children who watched a moderate amount of television (up to 2 hours per day) had slightly higher reading achievement scores (vocabulary, comprehension & study skills) than those who reported watching less (Neuman, 1988). Children who watched more than 4 hours of television per day, on the other hand, had diminished reading achievement scores (Neuman, 1988). A similar result was found in a metanalysis of 23 studies assessing the impact of television viewing with achievement. Children who watched up to 10 hours per week showed slightly higher achievement scores than those who watched more, but beyond 10 hours per week, achievement scores diminished (Williams, Haertel, Haertel, & Walberg, 1982). The causal direction remains unclear, however. Do those children who watch a lot of television have less time to devote to reading and, therefore perform poorly on reading achievement tests, or do those children who have a problem reading seek out television as an alternative activity.

Neuman (1995) proposed that print, television, and other media have a synergistic relationship. Rather than competing with one another, interest in one may facilitate interest in another. For example, viewing a television program on dinosaurs may lead a child to read books about dinosaurs, play interactive games with dinosaurs, or search the Internet for dinosaurs. In addition to this complementarity, it is possible that "television might enliven and even enhance literacy" (Neuman, 1995, p.84).

Formal Features of Television

The formal features of television allow for learning its messages. The combination of visual and auditory characteristics (Huston & Wright, 1983, 1997), along with repetitive formats (Crawley, Anderson, Wilder, Williams & Santomero, 1999), simplified dialogue (Lemish & Rice, 1986), perceptually salient cues such as rapid action, visual special effects, and sound effects (Calvert, Huston, Watkins, & Wright, 1982), and comprehensible narrative (Anderson et al., 1981; Lorch, Anderson, & Levin, 1979) help children attend to and learn from a televised narrative. In addition to these medium characteristics, there are also content characteristics that help children learn narrative comprehension and more specific print decoding and oral language skills from television.

Learning Narrative Comprehension from Television

While comprehensibility drives attention to television, comprehension of a narrative is also a component of emergent literacy. Because much of children's television conveys stories, it may be one means by which children learn story structures. There is an extensive literature showing how children acquire narrative comprehension via television; the level of comprehension is affected by the child's perceptions and capabilities as well as by the program itself (Fisch, 2000).

Viewer perceptions and capabilities. Many factors contribute to learning from educational television, including how much the working memory is devoted to comprehending the narrative as well as the embedded educational content within that narrative (Fisch, 2000). Decreasing working memory demands increases comprehension of educational content on television by making it easier to process the information.

Comprehension of a narrative is affected by prior knowledge of the topic (Huston & Wright, 1989), the amount of invested mental effort (AIME) (Beentjes & van der Voort, 1993; Salomon, 1984), knowledge of story schemas, or the general structure of the stories (Medowcroft & Reeves, 1989), and knowledge of television conventions, such as cuts, pans, zooms, and fades (Huston & Wright, 1983).

Story characteristics. Just as viewer characteristics affect comprehension of a televised narrative, properties of the story can contribute as well. These include the complexity of the narrative (Anderson et al., 1981; Huston & Wright, 1989; Lorch et al., 1979), the explicit or implicit nature of the narrative (Beijing, Danling & Hong, 1995), and central content markers such as previews (Fisch, 2000; Neuman, Burden, Holden, 1990; Calvert, Huston & Wright, 1987) and salient formal features (e.g., rapid and moderate character action, music, sound effects, vocalizations, visual special effects, zooms, and pans) (Calvert, Huston, Watkins & Wright, 1982).

A model combining viewer and story characteristics. Rice, Huston & Wright (1982) developed a model for explaining how interest and attention interact in order for children to learn from television. The *Traveling Lens Model for Learning from Television* is an inverted U shaped curve. Interest and attention are greatest when the stimulus is “moderately novel, of intermediate complexity, integratable, somewhat regular, partially ordered and recognizable” (Huston & Wright, 1989, p. 117). Attention is low either when the material is familiar, simple, and too easy, (the left hand abscissa) or when the content is incomprehensible because of its complexity or novelty (right hand abscissa). As children age and have increased viewing experience, they move toward more cognitively challenging stimuli; hence the stimuli that are initially incomprehensible “gradually move toward and through the child’s focal lens of maximum interest, and then lose attention as they are habituated and become old hat” (Huston & Wright, 1989, p. 118). The inverted U moves through space and what was once incomprehensible, becomes comprehensible as a child develops. This model incorporates viewer characteristics such as the age and prior experience with story characteristics such as the complexity of the narrative.

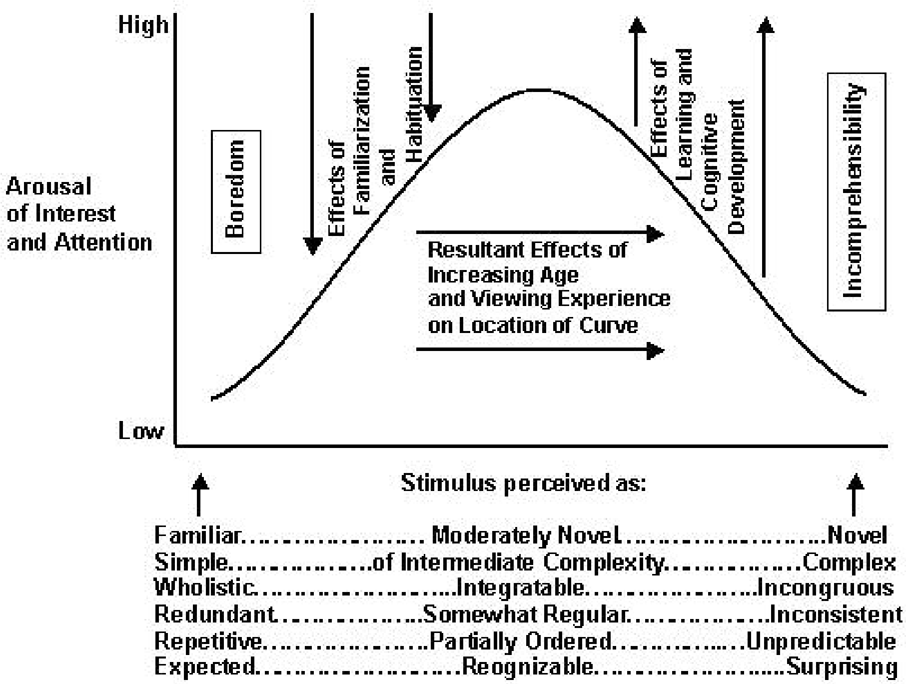

Figure 1. Traveling lens model. Rice, M.L., Huston, A.C. & Wright, J.C. (1982). The forms and codes of television: Effects on children's attention, comprehension, and social behavior. In D. Pearl, L. Bouthilet, and J. Lazar (Eds.), *Television and behavior: Ten years of scientific progress and implications for the 80s (p.32).* Washington, DC: U.S. Government Printing Office. In the public domain.

Summary. Comprehension of a televised story is affected by viewer characteristics such as the child's amount of invested mental effort, prior knowledge of the topic, knowledge of story schemes, and general short-term memory. Comprehension is also affected by story characteristics such as the complexity of the narrative, the degree of explicit and implicit information, and understanding how to determine central story content. All these characteristics are not static: they are constantly a "traveling lens" that moves and shifts as children either gain more knowledge of the viewing experience and/or develop. While narrative comprehension is one aspect of emergent literacy that can be learned from television, code-related and oral language skills are additional components of emergent literacy that television can teach.

Learning Code-Related and Oral Language Skills

Code-related skills. Recall that code-related skills are those that help children to decode printed material. They include such things as knowledge of print conventions, letter names, and letter-sound correspondence. Television can teach some of these skills. *Sesame Street* is one of the most popular, and commonly studied children's educational television programs. Early summative evaluations of *Sesame Street* (Ball & Bogatz, 1970; Bogatz & Ball, 1971) compared two groups of 3- to 5-year-old children on key academic skills: one group was encouraged by their parents to watch *Sesame Street* and the other was not informed about the program. Children who viewed *Sesame Street* improved more than those who did not on measures of academic skills including recognizing letters (both alone and in words), naming letters, and reading words.

In a nationally representative sample of parents surveyed via telephone about their child's school readiness and television viewing (Zill, 2001), four-year-old children who watched *Sesame Street* at least once a week were more likely than their peers who did not watch to be able to retell a story, recognize the letters of the alphabet, and write rather than scribble. These results were stronger for children of lower incomes than those of middle incomes. Children who watched *Sesame Street* before kindergarten were more likely to be able to read on their own by the time they reached first or second grade, even after controlling for age, parent education, family income levels, primary language spoken in the home, birth order of child, number of family members, mother work status, and whether the child ever attended a center-based preschool program. *Sesame Street* viewers were set on a positive trajectory for learning.

The Early Window Study (Wright & Huston, 1995; Wright, Huston, Murphy et al., 2001; Wright, Huston, Scantlin, & Kotler, 2001) was a 3-year assessment of the relations of children's television viewing to their academic skills and school readiness. Several 24-hour time-use diaries were collected for two cohorts of children (ages 2-5 and 4-7 years) over the three years. There was a strong, positive relationship between viewing child-audience, informative programs in general, and *Sesame Street* in particular, to time spent reading or being read to (Wright & Huston, 1995). Path analyses revealed that children who were frequent viewers of educational programs when they were 2 and 3 years old performed better on tests measuring reading skills such as recognition of icons, letters, and words, and a general test of school readiness skills as assessed by the Bracken Basic Concepts School Readiness Scale than more infrequent viewers (Wright, Huston, Murphy et al., 2001). This finding also held up when analyzing *Sesame Street,* in particular. *Sesame* Street viewing at age 2 predicted reading and school readiness skills at age 3 and the more frequent early viewers continued to have an advantage more than infrequent viewers at age 5 (Wright, Huston, Scantlin et al., 2001).

The effect of viewing cartoons and general-audience programming was opposite to that of viewing informative programming (Wright & Huston, 1995; Wright, Huston, Scantlin et al., 2001). Children who were frequent viewers of cartoons at ages 2 and 3 had lower scores on a letter-word subtest than infrequent viewers   Heavy viewers of general-audience programming at ages 4 and 5 performed more poorly on letter skills tests at age 5 than did infrequent viewers. These findings suggest that the content is more important that the medium itself.

Viewing child-informative programs in general, and *Sesame Street,* in particular seems to have lasting effects on children. In a longitudinal study assessing the relations of preschool children's television use to adolescent outcomes, educational television viewing in general and *Sesame Street* viewing in particular at age 5 predicted book use as a teen and, for boys, school achievement (Anderson, Huston, Schmitt, Linebarger & Wright, 2001).

In an assessment of *Between the Lions*, an educational television program designed to teach literacy skills, kindergarten children who were assigned to view 17 half-hour episodes outperformed their peers who did not view by almost 4 to 1 on measures of specific program content, including phonemic awareness, letter-sound correspondence, and concepts of print (Linebarger, 2000, 2004). In addition, the kindergarten children were able to transfer the knowledge they acquired to more general literacy measures. The viewers of *Between the Lions* had higher mean scores and higher rates of growth on phonemic awareness, letter-sound correspondence, and letter identification than those who did not watch.

Oral-language skills. Televised educational stories use a number of auditory and visual techniques that enhance language learning. Much of the dialogue has a concrete visual referent which alerts children to what is being said and enables children to make the connection between the word and its referent (Rice, 1983). The dialogue is also similar to the ways that adults talk to young children, with simplified sentence structure, emphasis on the present, and basic yes/no or who questions (Rice & Haight, 1986). Children are able to observe new words being used in context. Target words in children's educational television programs are repeated approximately 5 times in a 6-7 minute period (Rice & Haight, 1986). Lemish & Rice (1986) observed that when children viewed a television program, they repeated chunks of language, an important strategy for learning how language is put together.

In an experimental study, 3- and 5- year old children viewed a video with either difficult or simple words in the narration (e.g., gramophone vs. record player) (Rice & Woodsmall, 1988). Children learned the novel object, action, and attribute words from viewing the video. The new word was learned without any special introduction or exaggerated reference to it.

In longitudinal studies of children's television viewing (Rice, Huston, Truglio & Wright, 1990; Wright & Huston, 1995; Wright, Huston, Murphy et al., 2001; Wright, Huston, Scantlin et al., 2001), children's vocabulary was positively associated with informative viewing. *Sesame Street* viewing at age 3 predicted vocabulary development two years later, independent of family size, parent education, child gender and parental attitudes about television (Rice et al., 1990). In The Early Window Study (Wright & Huston, 1995; Wright, Huston, Murphy et al., 2001; Wright, Huston, Scantlin et al., 2001) educational television viewing was a positive predictor of vocabulary gains for preschool children.

Summary. Television can be a powerful teacher with positive lasting effects on children. Television as a medium can be repetitious (Crawley et al., 1999; Rice & Haight, 1986), and allows verbal and visual reference to words, which enhances language learning (Rice & Haight, 1986; Rice & Woodsmall, 1988). Appropriately designed content, such as *Sesame Street* and *Between the Lions,* can teach code-related and oral language skills. The newer electronic media may have even more potential to teach literacy skills. The next section considers these media.

Other Electronic Media

In the last decade there has been an explosion of electronic technologies that purport to have educational intent, but there is very little systematic research to either legitimize or dispute such claims. They range from electronic talking books to videogame systems; electronic components are now the norm rather than a novelty.

In this section, I discuss the informal uses of these technologies for young children, rather than their use in instructional settings. There is a large literature about computer-aided instruction (CAI) in school environments that is beyond the scope of this paper. The goal here is to explore if and how computer games and interactive toys can be used to promote literacy skills in informal settings that are comparable to use in children's homes.

The characteristic that sets these technologies apart from television is "interactivity." While the nature of interactivity is ill defined, it is assumed to contribute to learning because the user has control. Some have defined interactivity as multidirectional communication (McMillan, 2002; Rafaeli, 1988). Others have noted that, although the levels of interactivity may vary across media, the idea is to facilitate interactions that are similar to interpersonal communication (Kiousis, 2002). There is little consensus as to whether interactivity is a descriptive property of a medium or a perception of those participating in the communication (Kiousis, 2002). Jensen (1998) believes it to be the former and defines interactivity as "a measure of media's potential ability to let the user exert an influence on the content and/or form of the mediated communication" (p. 201).

Besides interactivity, what additional characteristics of these technologies aid in children's learning? Are there formal features of these media that promote learning best from them? What literacy skills can children learn from using technologies such as computer games, and interactive toys such as talking books?

Computers and Computer Games

Formal features of computers that promote learning. The graphics, animation, sound, music, and other audio and visual effects are analogous to television's perceptually salient formal features (Lee & Huston, 2003). It seems likely that their effects on attention and comprehension are similar to those that occur with television, but tests of this notion are not available. Calvert (1994) conducted an experiment to assess the effects of a perceptually salient feature (action) and verbal labeling in a computer-presented story on children's production and recall of content. She found that kindergarten children produced and recalled object names better when the objects were presented with an accompanying action than when they were in a still frame. There were no differences for second-graders. This finding supports what Huston & Wright (1982) found with television: that younger children rely on perceptually salient features to process information and older children process the information without the need for salient cues. Calvert (1994) also found that labeling the objects helped kindergartners, but not second-graders, to process the information. These findings suggest that children use formal features on computers and television similarly to process information.

Computers have features that make them unique as well. Two of these are versatility and customizability (Meyer & Rose, 1998). They can be used like a storybook, a DVD, an audio CD player, a video game, a telephone, a musical instrument, an artist's palate, or an animation station. They can also be customized to suit users' abilities, such as language and cultural background, as well as their prior exposure to literacy. Users control the computer more than they do television. Most stories in a computerized format will not progress without user input. Depending on the nature of the software and hardware – navigating through the story may or may not demand knowledge of reading or a higher level of fine motor skills than does televised or printed material.

Games. Games can be delivered on computers on external CD ROM disks or via the Internet, but if the child has high-speed connections that minimize the frustrations with downloading time, the experiences of playing a game on the Internet or a CD ROM version are similar. Unlike television programs, some computer games have no narrative content (e.g., solitaire, Tetris). These games can teach spatial and iconic skills (Lee &

Huston, 2003), but not literacy skills. For this reason, this review will focus only on story-based games.

A limited number of empirical studies examine the effects of CD-ROM or other story-based games on children's literacy acquisition. The few that are available are cross media comparisons that examine how this medium compares to such other media as storybooks and televised stories. Most have been compared on how they affect children's levels of comprehension and recall, while a few have been compared on how well oral language and print decoding skills can be learned during the interaction.

Comprehension and recall. In a study assessing first-grade children's story recall, children were assigned to one of three groups (Derley, 1995). The first group viewed a video version of the book, where occasional pans and zooms of the pages were included for interest. The second group viewed a "read only´ version of the story on the computer, where text and illustrations appeared on the screen, the text was read aloud, and phrases were highlighted as they were read. The final group had a fully interactive version of the story in which a narrator read the story, and the child could click on individual words, characters, icons, or objects. Children in the passive computer condition had the highest recall of the story followed by the interactive condition, and then the video condition. The author hypothesized that the addition of the clickable items in the fully interactive version distracted children from the central content of the story.

In a study comparing a CD ROM with printed versions of the same story, Matthew (1996) found that third-grade children who read the CD ROM version scored significantly higher on retelling the story than children who read the printed version.

There were no significant differences between the groups on responses to open-ended questions about the story.

Ricci & Beal (2002) examined how different presentations of a story related to story recall. Six- and 7-year-old children were in one of four groups: narration only (analogous to radio), audiovisual presentation (analogous to television), fully interactive CD ROM version, and passive CD ROM version. The authors found no significant differences between the groups on a free recall measure, but the audio-only group performed less well than any of the other groups on a questionnaire assessing story knowledge.

These investigations suggest that story recall and story comprehension are affected by the ways in which the narrative is presented and by the ways in which recall and comprehension are measured. As future research continues to explore narrative comprehension via computer, both need to be taken into account.

Oral language and print decoding skills. de Jong & Bus (2002) compared Dutch kindergarten children in one of four conditions: (a) reading, in which a storybook was read by an adult, (b) a computer condition, in which the child was restricted to clicking on icons but had no access to games, (c) an unrestricted computer group in which children could listen to the story as well as play additional games and click on icons, and (d) a control group that did not read the book. After six 15-minute sessions, children in the fully interactive condition had heard the story all the way through less frequently than did any other group. These children got caught up in interacting with the games and progressed more slowly through the story. Children in the reading condition scored higher than those children in the unrestricted computer condition and the control condition on a test of reading words with icons (no effects were found on a similar test of reading words with no icons). Children in the reading condition and the restricted computer condition also improved more from their pre- to post-test on the word reading task. Children in all groups who had letter-sound knowledge prior to the start of the study improved in their word recognition more than those who did not. The authors surmise that children use their letter-sound knowledge to help them read the word that is paired with its icon. There were no condition effects on letter knowledge, rhyming, name writing or word writing.

In a study of younger children (ages 3- to 6) with reading difficulties, a computerized animated CD ROM was presented to one group while another was not exposed to the software (Chera & Wood, 2003). After ten 10-minute interactions with the software over the course of 4 weeks, the intervention group showed improved phonological awareness and awareness of letter sounds and word onsets in comparison to the control. Their scores on reading words did not significantly differ from one another.

Summary. CD ROMs have the potential to be effective learning tools. Children can comprehend and recall stories in a CD ROM format as well as gain a general knowledge of literacy skills. When incidental features of the interactive storybooks, such as games and "clickables" are closely tied to the narrative they aid children's comprehension of the story. Perceptually salient features (i.e., character action) also help young children to process the information presented. If we borrow what we've learned from television research, repetition, simplified dialogue, and clear verbal to visual referents will also enhance the literacy skills learned from computers.

Electronic Talking Books

Electronic talking books offer a combination of a visual medium with written text. The distinction between these electronic talking books and those presented on computer CD ROMs is the absence of moving images from the electronic version. Another important distinction is that the electronic talking books have an accompanying physical paper book that is inserted into a small computer device. It is possible that, because of the addition of the physical book, children perceive this medium to be more similar to printed books in comparison to screen media such as television and computers.

Nothing is known about the short-term or long-term effects of these interactive talking books on the cognitive development or literacy of children. Manufacturers claim that they can be more beneficial to children's cognitive development than television because the child is an active, engaged participant in the interaction. None of these claims have been tested in a naturalistic setting. LeapFrog Inc., the parent company of LeapPad, does undertake internal research to develop and then evaluate programs that they implement in schools using their products (LeapFrog Schoolhouse, 2004). But there are no peer reviewed empirical studies examining how the everyday consumer uses these products at home. Nothing is known about the product's effects on the literacy learning of children. This study is the first to test the effects of this medium on learning in general, and literacy in particular.

Parental and Media Scaffolding

Because most children between the ages of birth and six cannot read themselves, it is necessary for a parent, or more capable other, to read to them. While preschool children can flip though books on their own, most are not able to get the true meaning of what they are "reading" unless an older person is part of the experience. Parents' roles go well beyond being narrators; they talk with children about the story content, adjust the pace and repetition of content to the child's level of interest and understanding, and provide positive attentive interactions with the child. By being a participant in the activity, adults provide young children with opportunities to extend learning that could not take place without them—a process known as *scaffolding*. Not only has scaffolding been shown to enhance performance, but it also provides children with an understanding that someone cares enough to spend time with them.

The original idea of scaffolding related to person-to-person relationships, but the concept has grown to include machine-to-person as well (Luckin, 2001). Scaffolding's natural emphasis on interaction has made it such that it has become the foundation for software development, particularly interactive media (Luckin, 2001; Revelle, Medoff & Strommen, 2001).

Vygotsky proposed that learning occurs best in the *zone of proximal development (ZPD).* He defined this zone as:

> … the distance between the actual development level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers (Vygotsky, 1978, p. 86).

Scaffolding can help children go to a level of potential learning. With the help of a "more capable other," (be it a person or a machine) children go beyond what would be cognitively possible on their own. Most of the scaffolding research is on parents and so the question becomes, not *how much* the parent is there, but *what* the parent is doing when there.

Parental Scaffolding of Print

Whitehurst and colleagues have created a program of shared reading, called dialogic reading (Whitehurst & Lonigan, 1998). The child is an active participant in the reading experience, rather than a passive listener. The adult questions the child on the pictures and story, increasing the sophistication of questions as the child develops. For example, typical questions for a 2- and 3-year-old would include questions about the pictures and what the characters are doing. Four- and 5-year-olds would be asked about the narrative and asked to relate the pictures to their lives. The aim is to teach the child to become the storyteller.

In a 5-year longitudinal study of 4- and 5-year olds, parental involvement in reading was assessed (Senechal & LeFevre, 2002). Parents reported children's general exposure to storybooks as well as how frequently they taught their children about reading and printed words. These measures were uncorrelated but had lasting effects on the children. Informal experiences with print (i.e. storybook reading) were associated with the child's receptive language skills, and more formal experiences with print (i.e. teaching about reading and letters) were associated with the development of such early literacy skills as alphabet knowledge and decoding. Time spent reading to children was less important to their language development than *how* the parent actually read to their children (Whitehurst et al., 1988). It seems that quality rather than quantity of book reading is important for a child to learn language skills. Parents' teaching about reading and letters was associated with their children's letter recognition and decoding skills (Senechal & LeFevre, 2002). If parents can learn (a) effective shared-reading skills, and (b) effective teaching skills, their children will be on a positive trajectory to learn language and code-related skills necessary to be good readers.

In experimental studies (Whitehurst et al, 1988; see also Arnold, Lonigan, Whitehurst, & Epstein, 1994; Lonigan & Whitehurst, 1998; Valdez-Menchaca & Whitehurst, 1992) parents and/or teachers were trained in dialogic reading. They were taught to "ask why questions, follow answers with questions, repeat what the child says, help the child as needed, praise and encourage, shadow the child's interests, and have fun" (Arnold et al., 1994, p. 238). They were also trained to ask open-ended questions and to elaborate on what the child said. In the first of these studies (Whitehurst et al, 1988), parents who were trained had children with enhanced language development, on the order of 6 months to 8.5 months greater then the control group. The control group was read to the same amount of time as the experimental group, but the parents received no additional instruction as to *how* to read to their children. The dialogic reading training was effective for high-risk children in day care (Valdez-Menchaca & Whitehurst, 1992), low-income children (Lonigan & Whitehurst, 1998), and regardless of how the training was administered – via direct contact or videotaped training (Arnold et al., 1994; Lonigan & Whitehurst, 1998).

Parental Scaffolding of Media Presentations

When parents coview a children's television program, they can help children navigate the television medium so its messages can be comprehended. Sometimes termed instructive mediation, coviewing has been defined as an active effort by parents to help children gain meaning from television (Desmond et al., 1985). Media messages come through the airwaves and children can watch them without parental supervision or support. When preschool children view children's educational programs, they usually do so without an adult present. Rice, Huston, Truglio & Wright (1990) found that 74% (for 3-5 years old) and 82% (for children 5-7 years old) of child informative viewing took place without a parent in the room. Most coviewing with parents occurs as children get older and come to enjoy similar general audience programs as their parents (Huston & Wright, 1997).

Lemish & Rice (1986) observed parents and infants during coviewing of *Sesame Street*. Parents exhibited similar behaviors when interacting with this television program to those typically exhibited when parents and children interact around joint book reading. Behaviors included labeling objects, questioning about the content, repeating dialogue, and relating the subject matter to the child's personal experience.

In an experimental study, a group of Israeli mothers were encouraged to view *Sesame Street* with their children while another group was not encouraged to view (Salomon, 1977). Children who coviewed the program with their mother *and* were from lower socioeconomic backgrounds had the most significant gains in learning from *Sesame Street*. Specifically, children who coviewed improved in their matching of numbers, matching of pictures, relational concepts and classification skills more than did children who did not coview.

In an observational study of parent-child reading of an online storybook, Fisch, Shulman, Akerman & Levin (2002) found that the online story elicited similar behaviors to joint storybook reading: labeling, relating the story to one's own life, predicting, and explaining what is happening. These behaviors are related to later literacy skills (Whitehurst, 1998).

Media Scaffolding

Media presentations can scaffold the child's understanding of experiences. For example, hints and guides presented on television or on the computer can help children gain the understanding needed to arrive at a correct answer. When designing computer software for children, much of the literature refers to zone of proximal development as a foundation for collaboration between user and software (Chang, 2001; Luckin, 2001).

Interactive toy scaffolding. Luckin, Connolly, Plowman & Airey (2003) evaluated an interactive plush toy in helping children navigate a CD ROM computer game. When children had difficulty, the toy reminded them that they could push the ear for help. If the toy was not present during the game, a computerized icon of the toy's face and shoulders popped up in the corner of the screen and help could be garnered by clicking on the face.

In observing children interacting with this plush toy, Luckin et al. (2003) found that less help was elicited from the onscreen icon than from the toy. But children seemed to ignore the tips and hints given by both interfaces. They also seemed annoyed at the toy's attempts to praise or flatter the child. But, once children became proficient with the technology, and the help that the toy or software gave was appropriate, children sought out and used the information from the toy to help them with the game. It seems, though, that until children feel proficient and confident with the technology, they are apprehensive to seek help from the very technology they do not feel comfortable with. Parents or capable others need to be there first.

Game scaffolding. When designing educational software for Sesame Workshop, a hint structure is incorporated to scaffold the child through the experience and help them succeed with the problem (Revelle, Strommen, & Medoff, 2001). Each time an error is made, more information is revealed to the child to help them to solve the problem. For example, if they are asked to find a rectangle and they make an error, the first hint may be, "A rectangle has four sides." If an error is still made a second hint may be, "The rectangle is in the shape of a door." These hint structures are designed by conducting formative research with children (Revelle, Strommen, & Medoff, 2001).

Summary. In reading storybooks as well as using electronic media, parental scaffolding enhances the learning experiences of children. In addition, media themselves can provide scaffolding. It is possible, then, that parental scaffolding during a media-scaffolded experience can provide an enhanced learning environment.

Proposed Study

The following proposed study is the first of its kind to assess if, and how, an electronic talking book can aid in the emergent literacy of children. As the review of literature suggests, there is a lack of empirical studies assessing if new interactive technologies have effects on the cognitive development of children. We do know that good electronic media support learning from them. Different media platforms have the ability to focus a child's attention if the material presented is within the comprehensibility of the child. And the content of different media presentations also has been shown to teach oral language and print decoding skills (Ball & Bogatz, 1971; Bogatz & Ball, 1972, Huston & Wright, 1995; Linebarger, 2001, 2004; Rice, Huston, Truglio, & Wright, 1990; Wright, Huston, Scantlin et al., 2001).

Media's interactivity can also be an effective learning tool, especially if the ancillary content is directly tied to the overall message of the story (Derley, 1995; Matthew, 1996; Ricci & Beal, 2002). Therefore, it is possible that an electronic talking book may be the most optimal medium for learning literacy skills because it combines the auditory and visual characteristics of television and computers, the interactive characteristics of computers, *and* it has the addition of a tangible storybook.

We also know from the literature that learning is enhanced when parents scaffold the experience of print or media. But we do not yet know whether a media-scaffolded experience can replace the role of an adult. Can the properties of the talking book actually be a parent-substitute or does additional learning take place when the parent scaffolds a media-scaffolded experience?

The purpose of this study is to test the influence of an electronic talking book, on the emergent literacy skills of young children. Can children who use this electronic book learn book-specific conventions of print, alphabet, phoneme-grapheme correspondence, and phonemic awareness more that those who use a storybook without the electronic component? Can these skills be transferred to general literacy knowledge? How do children's overall reading skills interact with learning from an electronic talking book? Can the properties of the electronic talking book replace an adult reading to a child?

METHOD

Participants

Participants were 139 children (mean age = 56 months, 73 boys, 66 girls) and their parents recruited through their schools in the Austin and surrounding areas. In addition, a snowball sample was accepted. Children were included in the study if their family income was above $35,000 per year (based on who would typically buy a literacy toy product), if their birthday fell between March 1, 1999 and September 1, 2000, and if they did not own the specific electronic talking book used in this study.

Two hundred, ninety-three families were interested in participating in the study. Of them, 42 (14%) did not qualify due to the income, birthdate, or talking book requirements. Of the 203 that qualified to participate, 53 (26%) dropped before any testing commenced. Complete data was obtained for 147 participants for all measures completed in the child's center (TERA-3 and all progress monitoring measures). Due to scheduling difficulties, eight children were not posttested in their homes, therefore they are missing data on all the *book specific measures* and the *time-use diaries*. In follow-up analyses with and without the missing cases, the coefficients and amount of variance explained was nearly identical. In addition, there was no reason to expect that the cases were missing due to their reading abilities. For these reasons, all analyses were conducted on the sample that had complete data on all outcome variables (n = 139).

Eighty-one percent of the children were European American, 4% were Hispanic, 3% were Black, and 10% were from other backgrounds. On average, parent's reported 16 years of education, and the median family income was $97,500 (see Table 2).

Apparatus

An electronic talking book was used for children in the experimental conditions. This talking book has a plastic casing in which a paper book and cartridge are inserted. When children point to parts of the book the computer is activated to talk; when children turn a page, the machine recognizes the new page. There are different buttons on top of each page which allows children to use the storybook in different ways: children hear the story read aloud when in the *story mode*, in the*words mode* when children point to individual words and pictures they are identified and given additional information such the letter a word begins. The *phonics mode* allows children to hear how words are sounded out using the phonetics that makes it up. The *spelling mode* identifies the graphemes that make up the word that is pointed to. The *find mode* asks children to search for different things on the page. The *surprise mode* plays a variety of games with children such as asking her to touch the animal that makes a particular sound. The *count mode* asks children to find things on the page in multiples, and the*music mode* plays music when children point to a picture or word.

Design

A 3 (books only condition, machine with no instruction condition, and machine with instruction condition) by 3 (pretest, midtest, posttest) design with repeated measures on literacy outcomes was used. All children were randomly assigned to one of the three conditions: children in the*books only condition* were given two books but no talking book machine; children in the *machine with no instruction* condition were given the same two books and the talking book machine, but no instruction on how to use the machine; children in the *machine with instruction* condition were also given the same two books and the talking book machine, and the parents were given a tutorial on how to use the machine along with some games to play to extend the literacy learning possible from the machine. The two books were *The Story of Clifford* and *Elmo's Noisy Day*. Each was targeted for the "beginner reader" ages 3- to 5-years-old.

Measures

The measurements in this study included *demographic information*, *time-use diaries*, and *direct assessment* of key emergent literacy skills (i.e., concepts of print, phonemic awareness, rhyming, alliteration, comprehension) (see Table 1). To better evaluate how the electronic talking book affected the key emergent literacy skills, a three-tiered approach was used: *book specific code skills* measured specific words found in the books, *progress monitoring* measured the transfer of that content to performance on tests measuring growth in emergent literacy, and *summative measures* tracked the normative growth using a standardized test of early reading ability.

Demographic Information

Information was collected from the parent regarding the child's sex, race, birthdate; the parent's race, years of education, and employment status; and total family income.

Time-Use Diaries

Parents were asked to record the date, time, book choice, and with whom they read the books provided for this study or played with the electronic talking book. There was also a column for the parent to record any additional comments about the context of use or clarifying statements (i.e., they *read the Elmo book on the couch in the living room*). These diaries were analyzed to assess how many minutes each child read each of the two books or played with the talking book and with whom they were with.

Book Specific Code Skill Measures

Direct learning of key literacy skills from each of the books was assessed by 5 researcher-developed *book-specific* measures (*concepts of print, sight words, picture to print matching, speech to print matching, word reading, and blending)* administered prior to the intervention and at the completion of the intervention. *Story knowledge* and *story recall* comprehension measures assessing the main ideas of both books were also administered at the completion of the intervention.

Concepts of print. Concepts of print was adapted from Clay's (1972) Concepts of Print and assessed the conventions of print using a two-page spread from each of the two books. Children were asked questions such as where to begin and end reading, to identify two identical words on a page, to identify specific words, to find rhyming words, to find a word that starts with the /L/ sound, to find a word that ends with the /T/ sound, to identify and explain what a period means, to point along while researcher read, to identify where to read next by line as well as page jump, and to read any words they could on the two pages. The score on this subtest was the total number the child answered correctly out of a possible forty-two.

Sight words. This measured the child's ability to recognize common short words that occur frequently all stories, including the *Story of Clifford* and *Elmo's Noisy Day*. Five words were on one ring and five were on another and they were flipped through one at a time. Children were asked to read each word as best as they could. The tested words were: *the, of, and, to, a, in, is, you, that, it.* The score on this subtest was the total number the child answered correctly out of the possible ten.

Picture to print matching. This measured the child's ability to match a picture with its corresponding word. Ten pictures were taken directly from the two books and each was laminated to create a picture card. Then the corresponding word that labeled that picture was also laminated onto a separate card. Care was taken to select an equal number of pictures from each book. The researcher laid out the first five picture cards with the corresponding five word cards in random order. Children were first asked to label each picture. If they incorrectly labeled the picture, the researcher told them, "It could be that, but for today we will call it a frog," or whatever the picture was. Then after labeling all the pictures they were asked to find the word that matched that picture.

As they went along, they were allowed to correct themselves if they found they had made an error in a prior match. After the children matched the first five pictures with the corresponding words, the next set of five was laid out and the same procedure was repeated. The score on this measure was the number correct out of a possible ten.

Speech to print matching. This measured children's phonemic awareness and ability to discriminate initial sounds, final sounds, vowels, and blends. Children were shown a card with three words on it and asked to point to the word that was said. The choices increased in difficulty: (a) no initial sounds were repeated (i.e., *rain, cloud, sun*), (b) the end sounds were repeated (i.e., *head, bed, said*), (c) the vowel and end sounds were repeated (i.e., *float, goat, boat*), (d) some initial sounds were repeated (i.e., *bird, hat, baseball*), (e) all initial sounds were repeated (i.e., *drop, drum, dress*), and (f) initial and end sounds were repeated (i.e., *fan, fin, fun* and *back, black, bark*). The score on this measure was the total correct out of a possible ten.

Word Reading. In word reading children were asked to read aloud consonant-vowel-consent words. There were ten words all together (*cup, dog, big, map, red, car, set, box, run, tall)*. Words were selected equally from both books. There were two rings of five words each and children were shown one word at a time and asked to read the word as best as they could. This task was split up five-at-a-time so as to minimize fatigue. The score on this subtest was the total correct out of a possible ten.

Blending. Blending measured children's linguistic awareness of compound words. They were asked to put segments of sounds together to form words, as well as to eliminate segments of sounds to form other words (called elision). Children were shown a page with four pictures. The researcher labeled each picture, and then asked the child to find the word that was made up of the two words the researcher said (i.e., find what you get when you put *out* and *side* together find *out* [pause] *side* or find *monkey* without the *mon).* The score on this test was the number correct out of a possible eleven.

Comprehension. The comprehension measure asked children the main ideas of each of the two stories. The first question for each story was an open-ended recall question which asked children to tell everything they remembered about the stories (story recall). Each correct aspect of the story the child remembered was totaled based on the number of correct story elements they recalled. A total story recall score was computed by summing the recall of the Elmo story and the recall of the Clifford story. Story recall provides children with the opportunity to discuss all aspects of the text (Matthew, 1996). The rest of the questions were cued recall and asked children pointed questions about portions of the text (story knowledge). They were coded based on the level of detail that they answered correctly. Children were given a 0 if they incorrectly responded to the question or if they didn't answer the question, a 1 if they correctly mentioned one element of the question correctly, but not with much detail, and a 2 if they answered the question in the most thorough way possible. A story knowledge comprehension score was the sum of all the scores of each of the questions. Two independent coders scored each question. Cohen's Kappa was computed in order to take into account chance agreement and a value of .86 was obtained. For any disagreements, a consensus was reached by discussion.

Progress Monitoring Measures

In order to assess the progress that the electronic talking book may have on children's literacy skills, individual growth and development indicators were used. These measures are designed for repeated measurements of young children's early literacy skills. We used three subtests from the Dynamic Indicators of Basic Early Literacy Skills (DIBELS) assessment tool: Initial sound fluency, letter naming, and phonemic segmentation (found at http://dibels.uoregon.edu) and two subtests from Get it, Got it, Go!: Alliteration and rhyming (found at http://ggg.umn.edu). These measures were administered three times: prior to the intervention, two weeks after the start of the intervention, and after the completion of the intervention. All five subtests are individually administered and timed and are meant to monitor the development of pre-reading and early reading skills.

Initial sound fluency. This is a measure of phonological awareness that assesses a child's ability to recognize and produce the initial sound in an orally presented word. The researcher presents four pictures to the child, names each picture, and then asks the child to identify (i.e., point to or say) the picture that begins with the sound produced orally by the researcher. For example, "This is a tomato, bear, plate, and doughnut. Which picture begins with /b/?" and the child points to the correct picture. The child is also asked to orally produce the beginning sound for an orally presented word that matches one of the given pictures. For example, "What sound does plate begin with?" The amount of time taken to identify/produce the correct sound is calculated and converted to a score that is the number of initial sounds correct in a minute. This measure takes about three minutes to administer and has over 20 alternate forms (Kaminski & Good, 2003). According to Elliott, Lee, and Tollefson (2001) the test-retest reliability coefficient for this measure was found to be .74 and the predictive validity with the Woodcock Johnson total reading cluster for the middle of first grade was found to be .36 (Good, Kaminski, Shinn, Bratten, Shinn, Laimon, Smith & Flindt, 2004).

Letter naming fluency. This is a measure of the knowledge of the alphabetic principle. Children are presented with a page of upper- and lower-case letters arranged in a random order and are asked to name as many letters as they can. They are told if they do not know a letter the researcher will tell its name to them. Children are allowed one minute to produce as many letter names as they can, and the score is the number of letters named correctly in 1 minute (Kaminski & Good, 2003). The test-retest reliability coefficient for letter naming fluency was found to be .90 (Elliott, Lee, & Tollefson, 2001) and the predictive validity with the Woodcock Johnson total reading cluster by the end of first grade was found to be .64 (Good et al., 2004).

Phonemic segmentation. This measure assesses children's ability to segment three- and four-phoneme words into their individual phonemes fluently. This measure has been found to be a good predictor of later reading achievement (Kaminski & Good, 1996). The researcher orally presents words of three to four phonemes and the child needs to produce verbally the individual phonemes for each word. For example, the researcher says, "sat," and the child would say "/s/ /a/ /t/" to receive three possible points for the word. After the student responds, the researcher presents the next word, and the number of correct phonemes produced in 1 minute determines the final score. This measure has over 20 alternate forms (Kaminski & Good, 2003). The test-retest reliability for this measure was found to be .85 (Elliott, Lee, & Tollefson, 2001) and the predictive validity with the Woodcock Johnson total reading cluster for the end of first grade was found to be .68 (Good et al., 2004).

Rhyming. Rhyming is a measure of a child's phonological awareness and early literacy development. Children are presented with a series of cards. Each card shows four pictures: at the top is a picture depicting the stimulus word (e.g., bees) and under the stimulus picture is a row of three other pictures (e.g., house, pants, cheese) with one correct and two incorrect responses. For each card the examiner points to and says the name of each picture and tells the child to, "Point to the picture that sounds the same as the top picture." After demonstration (two standard cards) and practice items (four randomly selected cards), the researcher shows a random selection of cards for 2 minutes. A child's score is the number of correctly identified rhymes in 2 minutes. Test-retest reliability was found to range from .83 to .89 and was positively correlated (ranging from r = .44 to .64) with other measures of expressive vocabulary, concepts of print and phonological awareness (Missall & McConnell, 2004). In addition, concurrent validity was established with the DIBELS letter naming fluency ($\underline{r}$ = .48 to .59) and initial sound fluency ($\underline{r}$ = .44 to .68; Missall & McConnell, 2004).

Alliteration. This is also a measure of a child's phonological awareness and early literacy development. The same procedure as the rhyming measure is followed. Children are shown cards depicting four pictures: at the top is the stimulus word (e.g., cake) and under the stimulus picture is a row of three other pictures (e.g., cat, sink, bear) with one correct and two incorrect responses. The child is told to, "Look at the pictures and find the ones that start with the same sound." For each card the examiner names all the pictures for the child. After demonstration (two standard cards) and practice items (four randomly selected cards), the examiner shows a random selection of cards for two minutes. The child's score is the number correct in two minutes. The test-retest reliability ranged from .46 to .80 and was positively correlated with other standardized measures of phonological awareness and literacy development ranging from $\underline{r}$ = .34 to .79 (Missall & McConnell, 2004). Concurrent validity ranged from moderate to high with DIBELS letter naming fluency ($\underline{r}$ = .39 to .71; Missall & McConnell, 2004).

Summative Measures

The Test of Early Reading Ability – 3rd addition (TERA-3) was used as a test measuring early developing reading skills. This standardized measure has three subtests: Alphabet (measuring knowledge of the alphabet and its uses), Conventions (measuring knowledge of the conventions of print), and Meaning (measuring the construction of meaning from print). Within the alphabet subtest questions included naming upper and lowercase letters, naming initial letters in a word, identifying particular words, and identifying sounds in particular words. Within the conventions subtest questions included identifying the correct direction of a book, identifying where to begin and end reading, identifying the author of a story, and understanding the meaning of punctuation. Within the meaning subtest questions included recognizing environmental text, identifying words with a rebus, identifying everyday objects such as a letter or a menu, and identifying a word that does not belong among a list of other words. This test was administered prior to the intervention and after the completion of the intervention. Standard scores are provided for each subtest and an overall reading quotient is computed using all three-subtest scores.

According to the examiner's manual (Reid, Hresko, & Hammill, 2001) the TERA-3 had high internal reliability with Cronbach's alphas ranging from .80 to .97 and the test-retest correlations ranging from .92 to .97. The TERA 3 also had criterion-related validity with the *Stanford Achievement Test Series, Ninth Edition* (r = .36 to r = .74) as well as the *Woodcock Reading Master Test – Revised – Normative Update* (r = .40 to r = .67).

Procedure

Preschool centers in the Austin and surrounding areas were contacted about participating in this study. If they agreed, a brief one-page description of the study was given to all parents of potentially qualifying children in pre-kindergarten classrooms. A screener questionnaire was attached to this letter, which asked questions about the child's birthdate, family ownership of talking books, and their yearly family income category. Parents who were interested in participating in the study returned the questionnaire to the child's teacher. The initial data-collection period was spring of 2004 so in order to obtain 4-year-old children for this study, their birthdate had to fall between March 1, 1999 and February 29, 2000. We extended the study into the summer and fall of 2004 so the birthdate qualification was also extended to include children whose birthdate fell between March 1, 1999 and September 1, 2000. Since we were only recruiting through preschools, no child had entered kindergarten yet.

In order to qualify for the study, the child's birthdate needed to fall within the range specified for the data-collection period, the yearly family income had to be above $35,000, and they could not own the specific talking book being used for the study. All children who met these qualifications were included in the study once parental consent was received. Once we received consent, children were pretested in their schools on the standardized test of reading ability (TERA-3), and all the progress monitoring measures described above (see Table 3 for study design). In addition, a different researcher contacted each parent so that a home visit could be scheduled. The goal was that the home visit be no more than one week past the center visit. On average, the number of days between the first center visit and the first home visit was 6 days. At the home, children were pretested on the researcher-developed book specific measures described above. At the same time, the parent filled out the parent demographic questionnaire. After the pretest and the parent questionnaire were both completed, the parent was videotaped reading the two intervention books (*The Story of Clifford* and *Elmo's Noisy Day*) to their child. Testing was done in both centers and homes because, during pilot testing we found running through all the measures at one time was too time consuming and children were not able to stay focused all the way through to the end.

Prior to the center visit, each child had been randomly assigned to one of two experimental conditions, or a control condition. The randomization was checked periodically using the child's TERA-3 scores to assure that the groups did not differ on reading ability. The intervention occurred at the first home visit and changed depending upon which group the child was assigned. After all pretesting was complete, parents with children in the *books only condition* were told to read either of the two books at least three times per week for a four-week period. It was explained that more time was acceptable, but the minimum that they should read the books was twelve times. The researcher gave them a time diary and explained both how to use it and the importance of recording each experience with the books. They were also told that someone would call them weekly to check in to make sure there were no problems or issues, and at the end of this four-week period, the researcher would be back to collect the diaries and to do some additional "reading games" with the child.

Parents with children in the *machine with no instruction condition* were given the talking book in the box and were told to use it however they would if they just bought it from the store. No explicit instructions were given to them on its use. They were told, though, that their child should use the machine at least three times per week over the course of four weeks (more time was acceptable too), and that either book could be put into the machine. The researcher gave them a time diary and explained both how to use it and the importance of recording each experience with the machine or books. They were told that the researcher would call them once per week to ascertain if they were having any problems or concerns and at the end of the four-week period, the researcher would be back to collect their time diary and play some additional "reading games" with the child.

Parents with children in the *machine with instruction condition* were given a talking book. The researcher removed it from the box and explained each mode of the machine to the parent and some tips on how to play reading games with their child using the talking book. Parents were also alerted to the instruction booklet that came with the machine for additional games they could play. They were told that they should use the talking book with their child at least three times per week over a four-week period. More time was acceptable but the minimum should be twelve times. Either of the two books could be used with the machine, but the parent was asked to record each experience in the time diary. They were also told that their child could use the books without the machine or the machine without the books. The researcher explained the time diaries and the importance of recording each experience with the machine or the books. Parents were told that someone would call them weekly to check in to make sure there were no problems or issues and at the end of the four-week period, the researcher would be back to collect the time diaries and to play additional "reading games" with the child.

Approximately two weeks after the initial home visit (and three weeks after the first center visit) children were midtested in their centers again on all five subtests of the progress measures (*M* = 16 days and *M* = 23 days respectively). Two weeks later (*M* = 14 days), they were postested on the five subtests of the progress measures as well as the TERA-3 summative reading measure. After this final center visit, the final home visit was scheduled (*M* = 7 days from the post center visit). At the final home visit, time diaries were collected and children were videotaped in their intervention condition. *Books only* children were videotaped being read to by their parent, the children in the *machine with no instruction* condition were videotaped however they most often played with the taking book and children in the *machine with instruction* condition were videotaped using the talking book with their parent. The book used was counterbalanced: half were videotaped reading or playing with the Clifford book and half with the Elmo book. After videotaping, all pretest measures were administered again. In addition to the researcher-developed measures of reading ability, children were also asked some basic comprehension questions about the two books as well as some appeal questions about their experience with the intervention.

Analytical Approach

In order to examine how playing with an electronic talking book and reading storybooks affected the emergent literacy skills of preschool children regression analyses were conducted. For the main effects, age and pretest score were entered in the model as controls and the conditions were dummy coded so that each talking book condition (machine with no instruction and machine with instruction) was compared to the book only condition. The dependent variables included the *book specific code-skill* measures (an overall composite score was calculated that comprised each of the subtests: concepts of print, sight words, picture to print matching, speech to print matching, word reading, and blending), *progress monitoring* measures (initial sound fluency, letter naming fluency, phonemic segmentation, rhyming, and alliteration), and *summative evaluation* measures (the TERA-3 reading quotient was calculated from a composite of the three subtests: alphabet, conventions, and meaning).

In order to assess whether initial skills or time-use changed the main effects interactions of condition with pretest score were entered as a final step. The interaction terms were based on multiplying the centered deviation scores (where their means are zero) of the predictors together. This procedure helps to minimize the mulitcollinearity that would be introduced into the regression equation and helps to better estimate the regression coefficients (Aiken & West, 1991). Standardized regression coefficients are reported.

The minutes variables (total, time with parent and time alone) were transformed using a square root transformation in order to achieve normality. The *total minutes reading or playing* variable and the *minutes playing or reading with a parent* achieved normality after the transformation. (The Kolmogorov-Smirnov test for each was not significant so we would conclude that the distribution is not significantly different from a normal distribution.) The *minutes reading or playing alone*, however, did not achieve normality with any transformation, but the skewness and kurtosis statistics were improved using a square root +1 transformation therefore all analyses were performed with this transformed variable (pre-transformation: skewness = 2.23, kurtosis = 6.88; post-transformation: skewness = .77, kurtosis = .22).

RESULTS

Descriptive Analyses

One hundred, thirty-nine participants were included in all analyses. There were 47 children in the *book only* condition, 48 in the *machine with no instruction* condition and 44 in the *machine with instruction* condition. No group differed on any of the demographic variables (see Table 2), or the outcome variables (see Table 4 and Table 5) while the intervention itself did differ across groups (see Table 2). Children in the *no instruction* condition used the talking book machine significantly more overall than children in the *book only* condition read the books and significantly more alone than either of the other two groups (see Table 2).

Correlations of the emergent literacy outcome measures revealed positive relationships among all pretest literacy measures (see Table 6), and these relationships remained consistent across conditions. Examination of all pretest emergent literacy outcome measures also reveled that age was the only demographic variable that consistently correlated with any of the outcome measures (see Table 7). It is not associated with the TERA-3 scores. It is, however, positively associated with Initial Sound Fluency, Letter Naming, Phonemic Segmentation and all subtests of the Book Specific Code Skill measures. The total number of minutes reading or playing with a talking book does not approach a significant relationship with most of the pretest literacy measures, but the pattern looks like a negative association. The same holds true for the total number of minutes reading or playing with a parent or the total number of minutes reading or playing alone. All the time variables are also negatively associated with age (although not significantly).

Main Effects Analyses

Does having the electronic talking book over the course of the5-week intervention aid in children learning specific emergent literacy skills more than just having a printed book?

Multiple regression analyses were performed to assess the effect of the treatment on scores for each emergent literacy measure. The child's age and pretest scores were entered as controls. The means and standard deviations are presented in Tables 4 and 5. The results of the regression analyses revealed that for all dependent measures, the strongest predictor of posttest scores were the corresponding pretest score, while condition never predicted any of the emergent literacy outcomes (*book specific overall*: $\Delta R^2 = .004$ F (2, 134) = .70, *n.s.*; *initial sound fluency:* $\Delta R^2 = .010$ F (2, 132) = .37, *n.s.*; *rhyming:* $\Delta R^2 = .007$ F (2, 134) = 1.13, *n.s.*; *letter naming:* $\Delta R^2 = .005$ F (2, 134) = 1.58, *n.s.*; *alliteration:* $\Delta R^2 = .000$ F (2, 134) = .00, *n.s.*; *phonemic segmentation:* $\Delta R^2 = .000$ F (2, 134) = .05, *n.s.*; *TERA-3 Reading Quotient:* $\Delta R^2 = .002$ F (2, 134) = .36, *n.s.*). Overall, having an electronic talking book was no different from having a printed book on any emergent literacy outcome measured.

Multiple regression analyses were conducted to assess the relationship between the treatment and the two comprehension dependent variables: story knowledge and story recall. Age was entered as a control. Means and standard deviations are reported on Table 8. There were no main effects between groups on story knowledge, $\Delta R^2 = .013$ F (2, 131) = .88, *n.s.*. Regardless of what condition a child was in, they did not differ on story knowledge. There was a main effect between groups on story recall, $\Delta R^2 = .044$ F (2, 131) = 302, $p < .06$, such that children who were in the book only group performed significantly better on story recall than children in the machine with instruction group (b = -.23, $p < .01$).

Interaction of Initial Skills and Treatment

Does the electronic talking book have differing influence on children's emergent literacy skills depending on their initial skill-level?

Multiple regression analyses were performed to assess the interaction of pretest score and condition on each emergent literacy outcome variable. As seen in Tables 9, 10, and 11, pretest score accounted for the majority of the emergent literacy skill variability in all cases, while condition never predicted the outcomes.

On the book specific measures, there was significant improvement in model fit when interactions with initial skills were included. Children with low initial skills improved more in the machine conditions, especially the machine with instruction than in the book condition (see Table 9). The analyses of the component scores showed negative coefficients for the interaction on each of the six components with a significant interaction on the *Blending* score (see Figure 2) and trends on concepts of print and sight words (see Table 9). Children with low initial skills also gained more on blending in the machine no instruction group than in the book-only group (see Table 9 and Figure 2). Specifically, adding the interaction of initial score X conditions for the book specific composite measure increased the variance explained, $\Delta R^2 = .019$ $F(2, 132) = 3.93$, $p < .05$ (see Table 9 and Figure 3) as did adding the interaction of initial score X condition for blending, $\Delta R^2 = .095$ $F(2, 132) = 8.33$, $p < .001$ (see Figure 2).

The pattern for the progress measures of emergent literacy skills was reversed; children with higher initial skills tended to improve in the machine conditions more than those with lower initial skills. A significant interaction was found for *Initial Sound Fluency* score X condition, $\Delta R^2 = .032$, $F(2,130) = 3.23$, $p < .05$ (see Table 10), such that children who performed higher on their pretest performed higher on their posttest if they were in the machine with instruction condition (see Figure 4). The talking book machine benefited children's initial sound fluency skills if they performed higher on the skill at the start of the intervention. The summative measures produced no clear pattern of effects and no significant improvement in model fit with the addition of the interactions (see Table 11).

Interaction of Reading Risk Status and Treatment

Does the electronic talking book have differing influence on children's emergent literacy skills as a function of their reading risk status?

A multiple regression analysis was performed to assess the relations of risk status and condition to each emergent literacy skill outcome. Prior research has found that children's reading risk status moderated the effects of a reading intervention using the television program, *Between the Lions* (Linebarger et al., 2004) and so we wanted to assess whether that same relationship was also found using an electronic talking book. Using the criteria established and statistically validated by the creators of the DIBELS (Good, Simmons, & Kame'enui, 2001), each child was assigned to one of three groups based on their *Initial Sound Fluency* score: *At risk* for reading difficulty = ISF < 4 correct initial sounds; *some risk* for reading difficulty = $4 \leq$ ISF < 8; *low risk* for reading difficulty = ISF ≥ 8.

Overall, children in the*at risk* group and the *some risk* group performed at lower levels than those in the *low risk* group on all emergent literacy outcomes. Specifically, the risk status step improved model fit for *picture to print matching*, $\Delta R^2 = .035$, $F(2,132) = 4.26$, $p < .05$; *speech to print matching*, $\Delta R^2 = .053$, $F(2,132) = 5.30$, $p < .01$; *word reading*, $\Delta R^2 = .027$, $F(2,132) = 5.91$, $p < .01$; *initial sound fluency*, $\Delta R^2 = .046$, $F(2,132) = 4.79$, $p < .01$; *alliteration*, $\Delta R^2 = .051$, $F(2,132) = 7.78$, $p < .001$; *phonemic* *segmentation*, $\Delta R^2 = .058$, $F(2,132) = 8.39$, $p < .001$. There were no interactions between condition and risk status.

Interaction of Time and Treatment

Does the amount of overall time, time with a parent, or time alone spent using the electronic talking book or reading the storybooks change the main effects?

A series of multiple regression analyses were conducted to predict each emergent literacy outcome variable from the amount of time children had used the electronic book or the storybook. Time diaries were used to calculate the amount of total time each participant played with the machine or read the storybooks. The total time was also divided into the amount of time that the parent played or read with the participant, and the amount of time the child played or read alone. Two participants did not turn in time diaries so all analyses are conducted on a sample size of 137. For all analyses, the child's pretest score and condition were controlled.

Main effects of time for book specific code skills. For the book specific code skills measures, the total time and time with parent tended to be positively related to total skills, largely because children who spent more time had higher gains on the concepts of print subtest (Tables 12 and 13). The total amount of time ($\Delta R^2 = .048$, $F(1,131) = 14.08$, $p < .001$) or the amount of time with a parent ($\Delta R^2 = .022$, $F(1,131) = 6.18$, $p < .05$) playing with the electronic talking book or reading the storybooks positively predicted the *concepts of print* posttest score, regardless of condition, (see Tables 12 and 13). There was a borderline tendency for time alone to be associated with gains on concepts of print as well; $\Delta R^2 = .014$, $F(1,131) = 3.83$, $p < .055$ (Table 14). After controlling for age, pretest score, and condition, playing or reading more significantly contributed to children's knowledge of concepts of print.

Main effects of time for the progress measures. For the progress measures, there is no consistent pattern for the main effects of total time (see Table 15) while the main effect of time with a parent is consistently negative (Table 16) and the main effects of time alone is slightly, but not significantly positive (see Tables 17). Only letter naming, ($\Delta R^2 = .006$, F (1,131) = 3.59, $p < .06$) and phonemic segmentation, ($\Delta R^2 = .011$, F (1,131) = 2.99, $p < .10$) marginally improved model fit for the amount of time spent playing or reading with a parent. Time spent playing or reading with a parent was negatively related to the gains in children's letter naming scores and phonemic segmentation scores (see Table 16).

Main effects of time for the summative measures. For the summative measures, there is a tendency for negative relations of time to gains; the difference is significant for the meaning subtest, $\Delta R^2 = .043$, F (1,131) = 7.25, $p < .01$ (see Table 18). There is a more consistent negative relation of time with parent to the TERA subtests; the difference is also significant for the meaning subtest, $\Delta R^2 = .034$, F (1,131) = 5.56, $p < .05$ (see Table 19), and some tendency in the same direction for time alone, $\Delta R^2 = .019$, F (1,131) = 3.09, $p < .10$ (see Table 20). Time spent playing or reading overall, with a parent or alone was negatively related to scores on the gains on the TERA-3 meaning subtest, regardless of the child's condition.

Interactions of time and condition for book specific code skill measures. Interactions of conditions with time (total, parent, and alone) were entered as the final step of the regressions. Again, these interaction terms were calculated using centered predictor variables.

For the book specific skills, there was no consistent pattern for the interactions of treatments with total time playing or reading. The same was true for the interactions of time with parent and treatment (see Tables 12 & 13). Only the interaction step in the *Word Reading* analysis marginally improved the model fit for total time, $\Delta R^2 = .014$, $F(2, 129) = 2.86$, $p <.10$; (see Table 12). In order to examine the direction of the interaction, I conducted separate follow-up regressions for each experimental group predicting word reading from the total time spent reading or playing. Because the original interaction was only marginally significant none of the follow-up betas reached significance. However, they showed that there were negative relationships between time and word reading for the book only group (b = -.07) and the no instruction group (b = -.07), but a positive relationship or the instruction group (b = .17). Children's time playing in the instruction condition was associated with higher gains on word reading than was the amount of time they spent reading in the book condition. In other words, using the talking book more with instructions on how to use it contributed to a child's word reading scores while just reading the books more or using the machine with no instruction more did not.

The interactions of condition with alone minutes were consistently positive across all book specific code-skill measures. The interaction step in the Concepts of Print analyses marginally improved model fit, $\Delta R^2 = .021$, $F(2,129) = 3.00$, $p < .055$; (see Table 14). Follow-up regressions revealed that there was a negative relationship between time alone and the concepts of print score for the book only group (b = -.11, *n.s.*) but a positive relationship of time alone and concepts of print score for the machine with no instruction group (b = .23, $p < .05$) and the machine with instruction group (b = .21, $p < .10$). Children who used the machine (in the instruction group or the no instruction group) for more minutes alone had higher gains in Concepts of Print scores than those who used it for fewer minutes alone. Children who read the books alone did not show that same association. While the interaction step in the Speech to Print Matching analysis did not improve overall model fit, there were significant or nearly significant coefficients for both interactions (see Table 14). Follow-up regressions revealed that there was a negative relationship between time alone and the speech to print matching score for the book only group (b = -.20, $p < .10$) and positive relationships between time alone and the speech to print matching score for the machine with no instruction (b = .12, *n.s.*) and the machine with instruction group (b = .10, *n.s.*). Children who used the machine for more minutes alone had higher gains on the Speech to Print Matching measure in comparison than those who used it for fewer minutes alone. This same relation was not found for the children who read the books alone.

Interactions of time and condition for progress measures. The interaction step for the total time and parent time analyses did not significantly contribute to model fit for any of the progress measures (see Tables 15 & 16). The pattern was consistently positive for interactions of alone minutes with condition and significantly contributed to model fit for the Alliteration measure, $\Delta R^2 = .034$, $F(2,129) = 4.80$, $p < .01$. Follow-up regressions revealed negative relationships between time alone and alliteration for children in the book only condition (b = -.30, $p < .01$) and the machine with instruction condition (b = -.03, *n.s.*) and a positive relationship between time alone and alliteration for children in the machine with no instruction condition (b = .10, *n.s.*). Children who used the machine for more minutes alone had higher gains on Alliteration than those who used the machine for fewer minutes alone (see Table 17). Children who read the books alone did not show this same pattern.

Interactions of time and condition for summative measures. The interaction step for total time and parent time by condition, although consistently positive, did not significantly contribute to model fit for any of the summative measures (see Table 18 & 19). The interaction step of alone minutes by condition significantly contributed to model fit for the alphabet subtest, $\Delta R^2 = .016$, $F(2,129) = 3.17$, $p < .05$ (see Table 20). Follow-up regressions revealed a negative relationship between time alone and scores on the alphabet subtest for children in the book only condition (b = -.10, *n.s.*) and positive relationships between time alone and scores on the alphabet subtest for children in the machine with no instruction condition (b = .01, *n.s.*) and in the machine with instruction condition (b = .21, $p < .05$). Children in the instruction group who used the machine for more minutes alone had higher scores on the alphabet subtest than those who used the machine for fewer minutes alone. The same relationship was not found for children who read the books for more minutes alone or who used the machine for more minutes alone but did not have instruction.

DISCUSSION

This study was an experimental test designed to assess how emergent literacy skills of preschool children are affected by using an electronic talking book in comparison to ready storybooks in their everyday home environments. Gains in three levels of literacy skills were assessed: *book specific code-skills* measured specific words and concepts found directly in the books, *progress monitoring* measured the transfer of that content to performance on tests measuring growth in emergent literacy, and *summative measures* assessed normative growth using a standardized test of early reading ability. Two important findings emerged. First, using the talking book contributed to gains in basic or lower-level skills for children whose initial performance on that skill was low. Gains in more complex literacy skills were greater for children whose initial performance was high. Second, children who used the talking book for more minutes alone performed better on certain emergent literacy skills than those who used the talking book for fewer minutes alone, but that same pattern was not evident for reading storybooks alone. The findings are discussed in terms of why some skills were affected by the machine while others were not, what this means for the emergent literacy learning of young children, and the potential value of the electronic talking book for the literacy learning of young children.

Main Effects Analyses

Does having the electronic talking book over the course of the 5-week intervention aid in children learning specific emergent literacy skills more than just having a printed book?

The goal of this study was to evaluate the effects of storybook reading and using an electronic talking book to the emergent literacy skills of preschool children. Over the course of a 5-week period, parents and children were either given 2 storybooks without a machine (*book only* condition) or given the same 2 storybooks in addition to an electronic talking book machine. One machine group was not instructed on how to use the machine (*machine with no instruction* condition), while the other was given instructions on the machine's use along with some examples of reading games to play (*machine with instruction* condition). Children were pretested on all literacy measures prior to the intervention and then again following the intervention. Recall, three levels of literacy skills were assessed: those hypothesized most likely to be affected by the intervention were skills directly taken from the books themselves (*book specific code-skills)*, followed by skills that measured short-term growth in emergent literacy (*progress monitoring measures),* and finally, skills that measured normative growth in literacy using a standardized test of early reading ability (*summative measures)*.

There were no main effects for any of the literacy skills measured at any levels. Regardless of what condition a child was assigned, each improved over time on all *book-specific, progress monitoring*, and *summative* measures. The time frame for this intervention was 5 weeks, a fairly short amount of time to affect change, especially since the intervention was not likely to be much different from other literacy activities these children encountered in their already rich literacy environments. The findings suggest that reading storybooks or using an electronic talking book aids children's knowledge of oral language and code-related literacy skills. It is also possible that these children are learning these skills in their everyday lives, including preschools. All children had some form of intervention, be it reading storybooks or playing with an electronic talking book. The next step of this study will be to assess if the literacy growth occurred independently of any of the treatments over a five-week period by adding one more non-intervention group that neither read the books nor played with the electronic talking book.

In addition to measuring oral language and code-related literacy skills, we assessed children's comprehension and recall of the stories presented in the two books that were provided in all treatments. Story comprehension is an important literacy skill that is related to children's decoding ability, vocabulary ability, and metacognitive skills (see National Research Council, 1998 for review). We found that comprehension differed across the groups for the story recall measure, while story knowledge did not differ. Story recall was an open-ended question that asked children to recount everything they remembered about the stories while story knowledge was a cued recall measure that asked children specific questions about the stories. Perhaps the cued questions focused children in all conditions to the important story information, while the interactive nature of the machine was distracting to open-ended story recall questions.

While not significant, the direction of effects is consistent for both story recall and story knowledge: children in the book only condition had the highest scores, followed by children in the machine with no instruction condition, and finally children in the machine with instruction condition   This finding suggests that when children are focused on the oral-language and code-related skills on which the machine concentrates, it may be at the expense of recalling important story elements.   Perhaps young children have trouble processing two dimensions and so they focus on what the medium - or in the case of the machine with instruction group, their parents - are highlighting.

Past research has found differences when central story elements were separated from incidental story elements. Derley (1995) compared children in a video condition, a passive computer condition, and an interactive computer condition. While children in the passive computer condition recalled more central story elements than either of the other two conditions, children in the interactive condition recalled the most incidental story elements. Our study did not differentiate central from incidental story elements. Follow-up analyses of this study should assess whether children in the talking book conditions recalled fewer central story elements, but perhaps more of the incidental elements of the story. In addition, comparison studies of electronic talking books need to be undertaken to determine if they act more like a storybook, more like a video, more like a passive computer program, or more like an interactive computer program. It is possible that it has the best elements of each medium – a tangible storybook, the ability to interact with the machine, while not being overly distracted by animation. Only future research will confirm this assumption.

The different modes of the talking book are specifically designed to emphasize code-related skills. For example, in the word mode, when a child points to a word it is verbalized and sometimes the initial grapheme is identified; in the phonics mode, when a child points to a word it is sounded out; and in the spelling mode, when a child points to a word each grapheme in that word is verbalized. If the talking book incorporated story comprehension as an additional mode, it might help children to recall important story information better. In addition, future parent guides might include comprehension recall games to focus children on the story elements as well as the emergent literacy code-related skills.

Interaction of Initial Skills and Treatment

Does the electronic talking book have differing influence on children's emergent literacy skills depending on their initial skill-level?

While the machine helped the low-performing children with the blending task (*book-specific code-skill*), the machine helped the high-performing children in initial sound fluency (*progress monitoring measure).* The blending skill is an early phonological awareness task of compound words that requires putting together different segments of words as well as eliminating segments of words (e.g., what do you get when you put out and side together – find the picture out – pause – side). Initial sound fluency is also a phonological awareness task but one that is more difficult. It asks children to recognize and produce the initial sound in an orally presented word (e.g., this is a tomato, cub, plate, and doughnut. Which one begins with /d/? What sound does plate begin with?) The findings suggest that a well-designed electronic talking book has the potential to teach different literacy skills to children of varying skill levels. The machine benefits children with lower skills if the task is easier, while it benefits children with higher skills if the task is more difficult. The skill itself has to be in the child's zone of proximal development in order for it to be relevant to the child (Vygotsky, 1978).

The blending task was an auditory skill that asked children to put together segments of words. This skill was relatively easy for children based on the distribution of scores (see Table 4). The machine was able to aid the children who scored low because this task is in their zone of proximal development. For those who scored high on this skill initially, a ceiling effect could be acting such that children already had the blending knowledge so neither reading the books, nor using the machine had any effects on their skills. The machine was able to scaffold the learning experience for children who are ready to learn this skill.

Initial sound fluency was a more challenging phonological awareness task. In addition, the words that the children encountered were not directly taken from the books. Children had to transfer knowledge learned in the books to a different context. For those reasons, the task was more difficult for the children in the study and is demonstrated by the distribution of scores (see Table 5). The higher-performing children were more ready to learn this skill than were the lower-performing children, therefore the machine was able to scaffold the learning for those ready to learn this skill.

Bus & van Ijzendoorn (1999) reported that phonological training programs such as phonetic training and phonetics with letter training were important for preschoolers reading abilities even more than for kindergartners. Early training is important and has developmental implications for later reading abilities. Phonological awareness in preschool is an important predictor of reading abilities later and if the talking book can aid in these skills, especially for those who really need the help, this can have lasting effects on their later reading abilities and can set children on a positive trajectory for learning. In addition, a more economically disadvantaged population is more at risk for ready difficulties so the machine could potentially have even more benefits to them.

Interaction of Time and Condition

Does the amount of overall time, time with a parent, or time alone spent using the electronic talking book or reading the storybooks change the main effects?

Time-use overall differed among the groups, and most of this difference was accounted for by the amount of time children spent using the talking book or the storybooks by themselves. Children in the machine with no instruction group used the talking book for significantly more time than children in the book only group read the books. Parents spent approximately equal amounts of time with children in both electronic book conditions, but children in the machine with no instruction group spent significantly more time using the talking book by themselves than did either of the other two groups.

The interaction between the parent and the child in the two talking book conditions did not differ in quantity of time, but perhaps the nature of the interaction itself differed. It is possible that parents who were instructed felt the need to supervise the talking book experience whenever their children used it. It is also possible that when the parents were instructed, interactions with their children were more didactic and controlling. Parent interactions may either encourage or impede using the talking book alone. This is consistent with the literature of parent-child interactions surrounding book reading. The interactions between parents and children during reading are a strong predictor of the type of reader children become (Baker, Makler, Sonnenschein & Sprpell, 2001) and positive interactions can create a motivation to learn literacy and enjoy reading (de Jong & Leseman, 2001). If the children had positive experiences with the talking book, they may have felt more empowered to use it on their own, whereas if the experience was more controlled by their parents, they may not have felt that same desire. Future analyses of the videotapes in this study will be able to confirm this hypothesis.

Children in the book only condition read for the fewest number of minutes. This could be because the books, themselves, may not have appealed to children. While designed for the beginning reader, the stories were very simple and were character-driven. It is possible that children did not enjoy the content in the absence of the talking book machine, which provides additional story elements. When they did read, however, it was most often with their parent, and least often alone. This is not surprising considering that most of these children were pre-readers, who have not yet mastered reading. Looking at the pictures in a storybook may not have kept the children's interest for long periods of time. In addition, the script that most parents and children have around storybook reading involves shared reading, especially at younger ages.

The negative correlations of time with pretest scores suggest that both the books themselves and the talking book appealed to children with lower skills. It is the children that are lower on skills initially that were reading more and playing more with the talking book. Perhaps the content of the books appealed to those children lower in skills whereas those with higher skills became bored with the content more quickly. It is not necessarily that those children higher in skills mastered all the emergent literacy concepts, rather that the content did not entice them enough to stay with the experience.

Main Effects of Time-Use on Learning

Book Specific Code-Skills. For the majority of the book specific measures, the more time a child spent reading or playing, the more they gained on the emergent literacy posttests. This relationship was significant for concepts of print which measured the conventions of the printed word such as the direction that one reads, the meaning of punctuation, differentiation between pictures an print on a page etc. and so it is reasonable to expect that the more time a child reads, the better they perform on this task. Regardless of whether children were read the storybooks or used the electronic talking book, children who spent more time reading or playing (overall, with their parent, or alone), the better their concepts of print score.

While this sample was socioeconomically advantaged, prior research has found that children from lower socioeconomic backgrounds are at a disadvantage in learning concepts of print because they are less often read to, have fewer printed materials in their environments, and interact less around reading materials than children from more advantaged homes (Smith & Dixon, 1995). Our study found that even with children from advantaged homes, the more a child used printed materials (either printed or electronic), the better they did on a concept of print task.

In an intervention where lower-income families had access to printed materials, children improved in their concepts of print over the course of 12 weeks. Concepts of print knowledge is related to later reading comprehension and decoding ability (Tunmer, Herriman & Nesdale, 1988), and the current study findings suggest that talking books and printed books may help children from all backgrounds to gain these skills. While an electronic talking book is an expensive toy, it is a relatively inexpensive media device, particularly for use in early education programs. Head Start programs may be willing to include some in the classrooms if they understand the benefits it can have for children of all backgrounds.

Progress monitoring measures. Overall, there were few associations of time with the progress monitoring measures, but those that did occur were opposite in direction to the findings for book specific skills. In particular, the amount of time that children spent with a parent reading or playing was negatively associated with gains in such skills as letter naming and phonemic segmentation. Given that children with lower skills spent more time reading or playing with the talking book, it is possible that these findings are reflecting the initial skill difference. Children who need more help with the tasks would, more often, have their parent be a part of the experience because of the help they need. This finding is one that needs replication.

Summative measures. The pattern of association between time and the summative measures was similar to that of the progress measures. There was a negative relationship found between the amount of time (overall, with a parent, and alone) children read the books or played with the talking book machine and their scores on the TERA-3 meaning subtest. Even after controlling for children's initial scores, ages, and conditions, children who read or played for more minutes had lower scores on the TERA-3 meaning subtest than children who read or played for fewer minutes. The TERA-3 meaning subtest is composed of recognizing the meaning of signs, logos, and words in print. It is possible that this negative association is also reflecting the initial skill difference found with time. Those children with lower skills were playing for more minutes than those children with higher skills.

Interactions of Time-Use and Condition on Learning

Given the large differences in time children spent in the three conditions, one might expect time, especially time alone, to predict gains better in the machine with no instruction condition if children were able to learn from the electronic talking book without adult help. On the other hand, if parent involvement is critical to learning from either the book alone or from the electronic talking book, one might expect that time with parent would predict learning. We found that the amount of time children spent reading storybooks or playing with the electronic talking book with their parents were similar across all three conditions and the relations of this time to learning were similar as well. Children learned at about the same rate from each medium when they used it with a parent. The time children spent using the electronic talking book alone, and its effects on literacy learning is most noteworthy. Children used the talking book alone in addition to, not instead of, using it with their parents in the machine with no instruction group compared to the machine with instruction group. Time alone did not displace time with parents.

Subsequently, children learned a range of emergent literacy skills from using the electronic talking book alone, without a parent. It is not surprising that children in the book only condition did not read alone very often. Because the amount of time reading alone was so small we would not expect this time to affect the child's literacy skills. However, it seems that the electronic talking book was able to engage children in literacy activities that promoted learning on their own. These skills encompassed every level of learning: book-specific code-skills, progress monitoring, and summative measures.

Book-specific code skill interactions. The more time children used the talking book alone, the more they gained on all book-specific emergent literacy measures. Specifically, using the talking book alone contributed significantly to a child's concepts of print and speech to print matching. Children who used the talking book for more minutes alone had higher scores on concepts of print and speech to print matching, than those who used it for fewer minutes alone. As mentioned earlier, concepts of print was a measure of print knowledge and speech to print matching was a phonological awareness task that assessed the ability to discriminate initial sounds, final sounds, vowels, and blends. A well-designed learning toy, such as the one used in this study, had the ability to teach these important code-related literacy skills that affect reading.

Progress monitoring interactions. The more time children used the talking book alone, the more they gained on all progress monitoring measures. Specifically, using the talking book, without instruction, for more minutes alone significantly contributed to a child's alliteration score. The alliteration task asked children to select two pictures that start with the same sound. Perhaps this auditory skill was ready to be learned by children and the talking book enhanced their knowledge by giving them practice with it. The find mode asked children, among other things, to find pictures that started with particular sounds.

Summative interactions. The more time children used the talking book alone, the more they gained on alphabet subtest of the TERA-3. According to Reid, Hresko, & Hammill (2001) children who do well on this test are good at phonics, decoding, and phoneme-grapheme awareness. Perhaps the instruction given to children was able to focus them on the alphabet games in the talking book, even when the parent was not part of the interaction. It is also possible, that if the parent was part of the interaction, the time was focused on more difficult tasks, therefore not affecting the alphabet task in particular. Alphabet knowledge is usually taught by parents and caregivers, or in preschool (Reid, Hresko, & Hammill, 2001) and so children are ready to learn this task at the age of our sample. It seems if given the proper initial guidance, children use the talking book to explore on their own and gain this skill with more alone usage.

Contributions of this Study

This study was the first of its kind to experimentally test claims made in the toy industry that an electronic talking book can aid children's literacy skills. While the proliferation of media continues, research tends to trail behind. This study can be used as a starting point to understand how these types of products are used in the everyday lives of children and their families and what qualities of talking books can help children to learn emergent literacy skills. The study produced some modest evidence that children can learn from electronic talking books. As Neuman (1991) has argued, print and electronic media should no longer be seen as competitors for literacy; rather they exist in a synergistic relationship that can enhance and expand learning. One does not have to see reading as an either – or situation (either being read to by a parent or reading with an electronic talking book), but one with choices and benefits. The benefits of reading to a child have been well documented (see National Research Council, 1998 for review), and it is now time to document how other tools can also aid in children's literacy learning. This study is the first step to do that for a new technology.

Although there was some evidence that children learned from electronic books, the effects were scattered and those that occurred were of small magnitude. It is important to note that the intervention in this study was naturalistic in that no explicit curriculum was taught and no one was enforcing the guidelines set about. Parents and their children were simply asked to read storybooks or to use an electronic talking book in their homes as though they had bought them from the store. Care was taken to encourage parents and children to play and read at least the minimum amount of time by weekly check-in phone calls and use of the time diaries. Aside from that, though, no other enforcement of the intervention was given. Therefore, the effects that were found are truly meaningful given that (a) no curriculum was taught, (b) the sample was economically homogeneous, and (c) the time of the intervention was relatively short (5 weeks).

The findings suggest that electronic talking books can be a complement to storybook reading, and that they offer some additional benefits for emergent literacy skills. Parents as well as educators need to be aware of these benefits so that children are given the opportunity to learn from this tool. It can become one of the many tools in the arsenal of learning literacy.

Limitations of the Study and Future Directions

Children in this sample lived in environments that were rich in literacy opportunities. The sample was relatively homogeneous and affluent. Most children attended childcare centers that taught some literacy skills. Parents reported owning an average of 128 children's books, and children read or were read to an average of 309 minutes per week. Ninety-eight percent of parents also reported that they began reading to their child before the age of one. The intervention asked parents and children to use an electronic talking book over the course of a five-week period, a fairly short amount of time to effect change, especially since the intervention was not likely to be much different from other literacy activities these children may encounter due to their already rich literacy environment.

Future research needs to explore if and how a less advantaged sample would benefit from a talking book. It is possible that the benefits would be even greater because as was shown in this study, the talking book does help children with low skill levels to learn some components of basic literacy. Economically disadvantaged children are at risk for reading difficulty (Lonigan et al., 1999; National Research Council, 1998; Smith & Dixon, 1995; White, Graves & Slater, 1990), and perhaps a learning tool such as the talking book would truly benefit children who do not have such a full arsenal of learning toys at their disposal.

Reading storybooks and/or playing with the electronic talking book with their parents did not yield any benefit to the emergent literacy skills of this sample of children, however this study did not assess the quality of the reading/playing experience. As prior research has demonstrated for language development, how parents read to children is more important than the time spent reading to children (Whitehurst et al., 1988). The videotapes of parent-child interactions need to be explored to assess if the quality of parental involvement in reading/playing, rather than just the quantity of reading/playing produces different effects on children's skills. From our study, there is some evidence to suggest that instructing parents on how to use the talking book to teach literacy skills actually aided in children learning those skills, even if the parent was not directly part of the interaction. The children whose parents were instructed used the machine for less time than those who were not instructed, but were still able to gain some literacy skills. Perhaps they are more efficient at using the machine and do not have to expend mental effort understanding the machine itself.

Conclusions

Talking books appeared to help children learn the skills in their zone of proximal development. It aided low-performing children in acquiring some basic skills, and it was helpful to high-performing children in acquiring some more complex skills. It is reasonable to expect that this learning tool is going to be beneficial to those children who find it enjoyable, as well as those who are in the zone of proximal development to find it moderately challenging, but engaging nonetheless.

Children used the electronic book by themselves, but the time they spent alone with the toy did not displace the time they used the toy or the storybooks with their parents. Using the talking book alone contributed to children's emergent literacy skills at all transfer levels (skills taught in the books themselves, progress monitoring skills, and summative skills). This finding suggests that the talking book can be a valuable adjunct to the time an adult spends reading to a child. Reading storybooks to a child is a worthwhile endeavor and one that has been shown to have lasting effects on children's reading skills (Neuman, 1996), but children are much more likely to get engaged in using an electronic book by themselves than to look at books alone. At early, pre-reading ages, if one has the choice to read alone or use an electronic talking book alone, the latter is a better option. While I would not say that a talking book is a true parent substitute, it certainly can be valuable to a child learning skills – even if the parent is not there.

Overall, these findings indicate that preschool children with limited reading skills can reap considerable benefits from using a talking book on their own, without the immediate involvement of a parent. For children of pre-reading age, there appears to be considerably more benefit from using the talking book than from looking at a book by themselves. If they cannot read the book, they may be looking at pictures and making up a story – or remembering a story already told to them. Based on the findings of this study, if a parent has the choice to let their child read alone or use the talking book alone, the latter seems to be more beneficial to learning skills.

Table 1

Emergent Literacy Skills and the Outcome Variables that Measure Them

Emergent Literacy Skill		Book Specific Measure	Progress Measure	Summative Measure
Oral Language Skills	Vocabulary	_______	_______	Meaning subtest
	Emergent Reading	_______	_______	Meaning subtest
	Grammar	_______	_______	_______
Code-Related Skills	Conventions of Print	Concepts of Print		Conventions subtest
	Knowledge of Graphemes	_______	Letter naming fluency	Alphabet subtest
	Phoneme-Grapheme Correspondence	Sight words Word reading	_______	Alphabet subtest
	Phonological and Phonemic Awareness	Picture to Print Matching Speech to Print Matching Blending	Initial sound fluency Rhyming Alliteration Phonemic Segmentation	_______

Table 2

Characteristics of Sample

	Whole Sample (n = 139)		Book Only (n = 47)		No Instruction (n = 48)		Instruction (n = 44)	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Total family income*	$111,023	72,479	$116,757	77,126	$103,984	41,483	$113,405	93,671
Parent's years of education**	16.03	2.89	15.79	2.78	15.95	3.55	16.42	2.09
Total minutes reading/playing	263.75	176.57	213.53[a]	126.76	336.52[a]	233.27	241.32	124.61
Total minutes reading/playing with parent	131.52	107.50	157.51	118.49	116.09	107.63	119.89	90.96
Total minutes reading/playing alone	87.99	117.46	19.28[ab]	30.92	155.72[ac]	160.94	90.59[bc]	73.71
Child age in months	55.91	4.02	55.40	3.72	56.46	4.08	55.86	4.26
Child gender (0 = male, 1 = female)	.47	.50	.49	.51	.46	.50	.48	.51
Child ethnicity (0 = non White, 1 = White)	.82	.39	.85	.36	.85	.36	.74	.44

Note. [abc] Matching superscript within rows denote values that are significantly different at $p < .05$.
* The whole sample n = 118, book only n = 37, no instruction n = 43 & instruction n = 38 due to missing information.
** The whole sample n = 121, book only n = 43, no instruction n = 42 & instruction n = 36 due to missing information.

Table 3

Study Design

	Time Period						
	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7
Measures Collected	Pretest Center: Progress Measures Summative Measures	Pretest Home: Book Specific Code-Skills		Midtest Center: Progress Measures		Posttest Center: Progress Measures Summative Measures	Posttest Home: Book Specific Code-Skills
		Treatment →					
		Time Diaries →					

Note. Mean number of days between Pretest Center and Pretest Home (Week 1 & Week 2) = 6 days
Mean number of days between Pretest Home and Midtest Center (Week 2 & Week 4) = 16 days
Mean number of days between Midtest Center and Posttest Center (Week 4 & Week 6) = 14 days
Mean number of days between Posttest Center and Posttest Home (Week 6 & Week 7) = 7 days
Mean number of days between Pretest Center and Posttest Home (Week 1 & Week 7) = 44 days

Table 4

Descriptives of Summative and Book Specific Code Skills Measures by Condition

Variable	Score Range	Book Only (n = 47)				No Instruction (n = 48)				Instruction (n = 44)			
		Pretest		Posttest		Pretest		Posttest		Pretest		Posttest	
		M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
TERA-3 Reading Quotient	72 - 147	105.19	11.58	107.19	12.94	105.15	12.80	106.23	13.07	105.68	13.89	108.14	12.51
TERA Alphabet Subtest	4 - 19	11.62	3.10	11.63	3.18	11.42	3.28	11.40	3.22	11.70	3.29	12.11	3.06
TERA Conventions Subtest	5 - 18	9.94	2.13	10.55	2.83	10.17	2.60	11.15	2.45	9.73	2.21	10.75	2.00
TERA Meaning Subtest	4 - 19	10.89	1.58	11.15	1.73	10.81	1.67	10.35	2.09	11.23	2.45	10.95	2.12
Book Specific Overall	4 - 87	23.45	13.25	28.09	17.28	22.85	11.07	28.94	14.58	21.05	13.99	27.50	16.74
Concepts of Print	0 - 40	4.83	3.91	8.53	7.81	5.08	3.75	9.08	6.09	4.43	5.82	8.70	8.65
Sight Words	0 - 10	1.47	2.51	1.28	2.57	1.08	1.74	1.27	2.17	1.05	2.15	1.30	2.40
Picture to Print Match	0 - 10	3.91	3.26	4.51	3.12	4.21	3.17	4.75	3.59	3.48	3.27	3.95	2.85
Speech to Print Match	0 - 10	4.53	2.19	4.45	2.26	4.48	2.25	4.52	2.07	4.05	2.19	4.27	2.43
Word Reading	0 - 10	1.09	2.34	1.62	2.75	0.67	1.68	1.35	2.34	0.75	1.86	1.32	2.25
Blending	0 - 11	7.62	2.62	7.70	2.39	7.31	1.60	7.98	1.94	7.30	2.15	7.88	2.05

Note. For all dependent variables, there was a main effect of time. All groups improved in all skills over the intervention period.

Table 5

Descriptives of Progress Monitoring Measures by Condition

		Book Only (n = 47)						No Instruction (n = 48)						Instruction (n = 44)					
		Pretest		Midtest		Posttest		Pretest		Midtest		Posttest		Pretest		Midtest		Posttest	
Variable	Score Range	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Initial Sound Fluency[a]	0.57 - 50	10.26	8.16	12.01	7.17	10.72	7.78	7.93	5.96	12.92	9.76	9.88	6.43	8.94	6.15	13.38	6.82	11.77	7.93
Rhyming	0 - 27	6.98	5.07	8.11	5.61	9.32	5.59	6.96	5.71	8.52	5.76	10.21	5.78	6.18	4.76	7.89	5.22	8.41	5.61
Letter Naming	0 - 66	14.87	12.73	17.61	14.51	19.02	13.01	18.79	13.48	20.40	15.83	20.54	16.16	18.52	14.19	19.84	13.49	22.09	15.64
Alliteration	0 - 28	3.89	4.73	4.59	4.06	5.32	5.34	4.52	4.24	4.67	5.44	6.02	5.30	3.41	3.24	4.48	4.36	4.95	4.88
Phonemic Segmentation	0 - 53	3.43	5.83	6.58	9.06	9.40	11.56	4.25	6.87	7.60	10.41	11.17	13.56	4.95	8.25	8.75	11.44	11.23	15.28

Note. [a] *n* = 136 due to inability to calculate accurate score for 2 participants.

Table 6. *Correlations of all Pretest scores with each other*

	Pre TERA-3 score	Pre TERA-3 Alphabet score	Pre TERA-3 Conventions score	Pre TERA-3 Meaning score	Pre Initial Sound Fluency	Pre Letter Naming Fluency score	Pre Rhyming score	Pre Alliteration score
Pre TERA-3 score								
Whole Sample								
Book Only	____							
No Instruction								
Instruction								
Pre TERA-3 Alphabet Subtest								
Whole Sample	.876***	____						
Book Only	.880***							
No Instruction	.902***							
Instruction	.852***							
Pre TERA-3 Conventions Subtest								
Whole Sample	.802***	.562***	____					
Book Only	.800***	.539***						
No Instruction	.811***	.600***						
Instruction	.818***	.557***						
Pre TERA-3 Meaning Subtest								
Whole Sample	.651***	.355***	.337***	____				
Book Only	.603***	.307*	.334*					
No Instruction	.553***	.337*	.193					
Instruction	.763***	.413**	.514***					
Pre Initial Sound Fluency score								
Whole Sample	.488***	.528***	.376***	.158#	____			
Book Only	.533***	.554***	.380**	.202				
No Instruction	.568***	.598***	.469***	.140				
Instruction	.399**	.448**	.321*	.149				

Table continues

Table 6. Continued

	Pre TERA-3 score	Pre TERA-3 Alphabet score	Pre TERA-3 Conventions score	Pre TERA-3 Meaning score	Pre Initial Sound Fluency	Pre Letter Naming Fluency score	Pre Rhyming score	Pre Alliteration score
Pre Letter Naming Fluency score								
Whole Sample	.654***	.710***	.485***	.249***	.400***	____		
Book Only	.628***	.756***	.436**	.075	.372*			
No Instruction	.683***	.715***	.561***	.172	.522***			
Instruction	.661***	.689***	.460**	.418**	.418**			
Pre Rhyming score								
Whole Sample	.284***	.253**	.242**	.165#	.207*	.294***	____	
Book Only	.345*	.301*	.330*	.149	.110	.334*		
No Instruction	.253#	.267#	.155	.140	.375**	.293*		
Instruction	.276#	.194	.268#	.236	.170	.283#		
Pre Alliteration score								
Whole Sample	.453***	.468***	.318***	.227**	.434***	.504***	.432***	____
Book Only	.402**	.370**	.349*	.182	.342*	.525***	.444**	
No Instruction	.388**	.466***	.185	.176	.438**	.494***	.529***	
Instruction	.662***	.670***	.492***	.404**	.688***	.546***	.251	
Pre Phonemic Segmentation score								
Whole Sample	.277***	.357***	.183*	.039	.443***	.343***	.112	.316***
Book Only	.311*	.366*	.317*	-.099	.369*	.320*	.240	.296*
No Instruction	.350*	.366*	.212	.219	.563***	.315*	.172	.258#
Instruction	.196	.353*	.073	-.018	.505***	.372*	-.033	.474***
Pre Book Specific Overall score								
Whole Sample	.609***	.675***	.461***	.201*	.526***	.720***	.248**	.445***
Book Only	.648***	.782***	.402**	.143	.459***	.673***	.224	.401**
No Instruction	.595***	.668***	.506***	.047	.702***	.315*	.172	.258#
Instruction	.643***	.572***	.531***	.458**	.468**	.800***	.251	.477***

Table continues

Table 6. Continued

	Pre TERA-3 score	Pre TERA-3 Alphabet score	Pre TERA-3 Conventions score	Pre TERA-3 Meaning score	Pre Initial Sound Fluency	Pre Letter Naming Fluency score	Pre Rhyming score	Pre Alliteration score
Pre Concepts of Print score								
Whole Sample	.636***	.640***	.476***	.322***	.510***	.656***	.259**	.432***
Book Only	.734***	.805***	.429**	.339*	.621***	.589***	.346*	.410**
No Instruction	.570***	.631***	.489***	.054	.534***	.658***	.355*	.486***
Instruction	.643***	.572***	.531***	.458**	.468**	.739***	.130	.477***
Pre Sight Words score								
Whole Sample	.527***	.589***	.388***	.181*	.404***	.610***	.185*	.416***
Book Only	.501***	.633***	.334*	.029	.255#	.605***	.219	.391**
No Instruction	.483***	.565***	.369**	.049	.700***	.658***	.355*	.486***
Instruction	.629***	.592***	.517***	.410**	.395**	.709***	.184	.448**
Pre Picture to Print Matching score								
Whole Sample	.487***	.622***	.304***	.101	.455***	.665***	.228**	.399***
Book Only	.432**	.655***	.159	-.027	.426**	.598***	.138	.348*
No Instruction	.579***	.657***	.401**	.168	.590***	.683***	.196	.430**
Instruction	.461**	.572***	.321*	.169	.407**	.740***	.359*	.429**
Pre Speech to Print Matching score								
Whole Sample	483***	.547***	.366***	.143#	.435***	.567***	.63#	.293***
Book Only	.68***	.688***	.376**	.250#	.375**	.574***	.164	.311*
No Instruction	.447***	.540***	.364*	.002	.467***	.601***	.002	.178
Instruction	.417**	.432**	.353**	.353**	.211	.515***	.572***	.361*
Pre Word Reading score								
Whole Sample	.496***	.549***	.367***	.179*	.413***	.532***	.083	.364***
Book Only	.554***	.666***	.354*	.120	.312*	.519***	.020	.102
No Instruction	.353*	.404**	.319*	-.008	.589***	.448***	.149	.491***
Instruction	.600***	.574***	.487***	.381*	.402**	.716***	.095	.415**
Pre Blending score								
Whole Sample	.057	.069	.167*	-.131	.127	.204*	.149#	.080
Book Only	.156	.161	.245#	-.094	.027	.261#	.081	.100
No Instruction	.100	.044	.289*	-.177	.341*	.225	.304*	.201
Instruction	-.074	-.020	-.022	-.145	.111	.172	.101	-.078

Table continues

Table 6. Continued

	Pre Phonemic Segmentation score	Pre Book Specific Overall score	Pre Concepts of Print score	Pre Sight Words score	Pre Picture to Print Matching score	Pre Speech to Print Matching score	Pre Word Reading score	Pre Blending score
Pre Letter Naming Fluency score								
Whole Sample								
Book Only								
No Instruction								
Instruction								
Pre Rhyming score								
Whole Sample								
Book Only								
No Instruction								
Instruction								
Pre Alliteration score								
Whole Sample								
Book Only								
No Instruction								
Instruction								
Pre Phonemic Segmentation score								
Whole Sample								
Book Only	——							
No Instruction								
Instruction								
Pre Book Specific Overall score	.383***							
Whole Sample	.287*							
Book Only	.471***	——						
No Instruction	.422**							
Instruction								

Table continues

Table 6. Continued.

	Pre Phonemic Segmentation score	Pre Book Specific Overall score	Pre Concepts of Print score	Pre Sight Words score	Pre Picture to Print Matching score	Pre Speech to Print Matching score	Pre Word Reading score	Pre Blending score
Pre Concepts of Print score								
Whole Sample	.396***	.878***						
Book Only	.392**	.810***	____					
No Instruction	.524***	.902***						
Instruction	.339*	.935***						
Pre Sight Words score								
Whole Sample	.204*	.829***	.633***					
Book Only	.140	.823***	.494***	____				
No Instruction	.248#	.802***	.581***					
Instruction	.270#	.870***	.833***					
Pre Picture to Print Matching								
score	.377***	.837***	.659***	.647***				
Whole Sample	.192	.865***	.639***	.668***	____			
Book Only	.467***	.870***	.775***	.635***				
No Instruction	.466***	.791***	.621***	.664***				
Instruction								
Pre Speech to Print Matching								
score	.321***	.785***	.611***	.605***	.646***			
Whole Sample	.383**	.853***	.684***	.661***	.718***	____		
Book Only	.284*	.757***	.593***	.632***	.597***			
No Instruction	.347*	.751***	.603***	.535***	.615***			
Instruction								
Pre Word Reading score								
Whole Sample	.224**	.825***	.641***	.843***	.625***	.574***		
Book Only	.102	.840***	.531***	.875***	.692***	.688***	____	
No Instruction	.240	.734**	.508***	.739***	.557***	.493***		
Instruction	.373*	.904***	.897***	.873***	.641***	.529***		
Pre Blending score								
Whole Sample	.134	.428***	.260**	.221**	.189*	.238**	.257**	
Book Only	.085	.522***	.288*	.305*	.320*	.318*	.286#	____
No Instruction	.184	.364*	.343*	.182	.096	.040	.245#	
Instruction	.178	.359*	.214	.103	.105	.308*	.205	

Note. #$p < .10$, *$p < .05$, **$p < .01$, ***$p < .001$

Table 7. *Correlations of all Pretest scores with demographic variables*

	Child Age	Total Family Income	Parent's years of education	Child Gender	Child Ethnicity	Total Number of minutes	Total Number of minutes with parent	Total Number of minutes alone
Pre TERA-3 score								
Whole Sample	.029	-.081	.062	.134	.162	-.031	-.056	.031
Book Only	.075	-.318	-.018	.036	.111	-.169	-.080	-.253#
No Instruction	.008	.096	-.020	.257	.256#	.089	-.092	.150
Instruction	.016	-.008	.397*	.098	.131	-.132	.011	-.084
Pre TERA-3 Alphabet Subtest								
Whole Sample	.074	-.023	.133	.068	.086	-.042	-.098	.024
Book Only	.294*	-.216	.154	-.003	.162	-.195	-.149	-.282#
No Instruction	.020	.044	.031	.114	.162	.101	-.090	.133
Instruction	-.053	.082	.354*	.087	-.029	-.158	-.052	-.036
Pre TERA-3 Conventions Subtest								
Whole Sample	.007	-.087	.013	.170*	.182*	-.011	-.054	.044
Book Only	-.169	-.273	-.111	.131	.044	-.057	.002	-.236
No Instruction	.085	-.001	-.001	.249#	.256#	.053	-.093	.125
Instruction	.053	.007	.321	.119	.205	-.196	-.073	-.100
Pre TERA-3 Meaning Subtest								
Whole Sample	-.038	-.121	-.049	.097	.137	.003	.072	.011
Book Only	-.096	-.348*	-.198	-.042	.010	-.097	.032	.010
No Instruction	-.121	.238	-.134	.307*	.203	.062	.010	.102
Instruction	.061	-.151	.226	.042	.198	.054	.182	-.072
Pre Initial Sound Fluency score								
Whole Sample	.196*	.126	.184*	-.065	.013	-.193*	-.153#	-.126
Book Only	.132	.006	.208	-.198	.091	-.232	-.172	-.267#
No Instruction	.337*	-.010	.295#	-.003	.070	-.206	-.217	-.120
Instruction	.212	.323#	-.015	.040	-.129	-.054	-.156	.081

Table continues

Table 7. Continued

	Child Age	Total Family Income	Parent's years of education	Child Gender	Child Ethnicity	Total Number of minutes	Total Number of minutes with parent	Total Number of minutes alone
Pre Letter Naming Fluency score								
Whole Sample	.257**	-.043	.034	.098	-.046	-.079	-.205*	.096
Book Only	.228	-.185	.045	.159	-.062	-.152	-.097	-.226
No Instruction	.234	-.048	-.004	-.039	-.016	-.102	-.282#	.040
Instruction	.278#	.077	.084	.195	-.168	-.140	-.186	.157
Pre Rhyming score								
Whole Sample	.150#	-.061	.209*	.043	-.051	-.071	-.050	-.084
Book Only	.166	-.039	.067	.055	.094	-.060	-.074	.072
No Instruction	.132	.120	.310	-.023	-.101	-.211	-.124	-.240
Instruction	.162	-.188	.275	.118	-.067	.174	.075	.144
Pre Alliteration score								
Whole Sample	.050	-.040	.099	.038	.000	.067	.016	.099
Book Only	.062	-.249	.016	-.096	.099	.085	.141	-.035
No Instruction	.103	-.104	.150	.075	.178	.040	-.073	.111
Instruction	-.062	.272#	.238	.204	-.122	-.042	-.065	.082
Pre Phonemic Segmentation score								
Whole Sample	.257**	.387***	.101	.042	-.002	-.081	-.110	.020
Book Only	.156	-.103	.164	-.116	.020	-.166	-.066	-.136
No Instruction	.286*	.326*	.088	.065	.093	-.061	-.155	.018
Instruction	.297#	.723***	.048	.145	-.065	-.121	-.078	-.028
Pre Book Specific Overall score								
Whole Sample	.407***	.052	.036	.000	.065	-.046	-.077	.003
Book Only	.454**	-.014	.018	.025	.133	.052	.046	-.211
No Instruction	.503***	-.116	.027	-.114	.129	-.078	-.221	.011
Instruction	.307*	.174	.154	.073	-.059	-.139	-.132	.009

Table continues

Table 7. Continued

	Child Age	Total Family Income	Parent's years of education	Child Gender	Child Ethnicity	Total Number of minutes	Total Number of minutes with parent	Total Number of minutes alone
Pre Concepts of Print score								
Whole Sample	.378***	.057	.055	-.020	.132	-.113	-.142#	-.020
Book Only	.466***	-.033	.084	-.078	.213	-.135	-.097	-.177
No Instruction	.405**	.021	-.004	-.066	.169	-.103	-.190	-.067
Instruction	.307*	.174	.154	.073	-.059	-.139	-.132	.009
Pre Sight Words score								
Whole Sample	.243**	-.111	.061	-.036	.002	-.015	.001	-.012
Book Only	.269#	-.156	.109	.055	.031	.100	.111	-.275#
No Instruction	.358*	-.253	.047	-.069	.089	.003	-.131	.098
Instruction	.161	-.027	.078	-.128	-.105	-.122	-.098	.073
Pre Picture to Print Matching score								
Whole Sample	.363***	.112	-.009	-.027	.004	.033	-.019	.023
Book Only	.383**	.187	.123	.026	.082	.078	.018	-.181
No Instruction	.394**	-.050	-.115	-.101	.084	-.019	-.032	-.025
Instruction	.311*	.167	.045	-.000	-.163	-.006	-.018	.133
Pre Speech to Print Matching score								
Whole Sample	.339***	-.037	-.065	.028	-.028	-.022	-.083	.049
Book Only	.403**	-.141	-.036	.133	.063	-.073	-.022	-.200
No Instruction	.548***	-.364*	-.120	-.217	-.009	-.051	-.300*	.078
Instruction	.066	.221	.052	.190	-.063	.039	.074	.161
Pre Word Reading score								
Whole Sample	.290***	-.019	.150	-.001	.076	-.038	-.001	-.060
Book Only	.283#	-.234	.012	.093	.119	.149	.152	-.246
No Instruction	.349*	-.101	.237	-.067	.166	.038	-.035	.086
Instruction	.299*	.183	.201	-.068	-.045	-.351*	-.297	-.142
Pre Blending score								
Whole Sample	.211*	.179#	.012	.094	.061	-.005	-.056	.074
Book Only	.275#	.176	-.241	-.036	-.169	.199	.134	.001
No Instruction	.203	.146	.287#	.030	.082	-.213	-.418**	-.016
Instruction	.185	.204	.106	.316*	-.074	.088	-.098	.342*

Note. # $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$

Table 8

Comprehension Scores by Condition

	Story Recall		Story Knowledge	
Condition	M	SD	M	SD
Book Only	3.50[a]	2.14	13.13	5.32
Machine with no instruction	3.28	2.55	12.37	5.76
Machine with instruction	2.37[a]	2.14	11.67	5.94

Notes. $n = 135$

[a] Matching superscript within columns denote significant differences at $p<.055$.

Actual range for story recall is 0 – 12. Actual range for story knowledge is 1 – 23; possible range is 0 – 25.

Table 9

Summary of Hierarchical Regression Model Predicting Emergent Literacy Skills: Book Specific Measures

	Book Specific Overall	Concepts of Print	Sight Words	Picture to Print Matching	Speech to Print Matching	Word Reading	Blending
Step 1: Control Characteristics							
Age	-.09	- .08	.01	-.001	.11	.05	-.02
Pretest score	.84***	.73***	.78***	.66***	.49***	.80***	.39***
R^2 change	.66***	.50***	.61***	.43***	.29***	.67***	.15***
Step 2: Condition Variables							
No instruction group	.06	.03	.07	.01	.01	.03	.10
Instruction group	.06	.05	.08	-.04	.01	.00	.09
R^2 change	.00	.00	.01	.00	.00	.00	.01
Step 3: Interactions							
No instruction X Pretest	-.002	-.07	.02	-.04	-.07	.04	-.18*
Instruction X Pretest	-.14*	-.16#	-.11#	-.06	-.06	-.04	-.32***
R^2 change	.02*	.01	.01	.00	.00	.00	.10***
Adjusted R^2	.67	.49	.61	.41	.26	.66	.21

Note. $n = 139$
#$p < .10$, *$p < .05$, **$p < .01$, ***$p < .001$

Table 10

Summary of Hierarchical Regression Model Predicting Emergent Literacy Skills: Progress Measures

	Initial Sound Fluency[a]	Rhyming	Letter Naming	Alliteration	Phonemic Segmentation
Step 1: Control Characteristics					
Age	.04	.08	.04	.15*	.11#
Pretest score	.55***	.76***	.87***	.69***	.66***
R^2 change	.31***	.60***	.78***	.50***	.49***
Step 2: Condition Variables					
No instruction group	.03	.07	-.08	-.004	.01
Instruction group	.11	-.03	-.02	-.01	-.01
R^2 change	.01	.01	.01	.00	.00
Step 3: Interactions					
No instruction X Pretest	.14#	-.04	.09#	.11	.09
Instruction X Pretest	.19*	-.02	.03	.09	.02
R^2 change	.03*	.00	.01	.01	.01
Adjusted R^2	.33	.59	.78	.49	.47

Note. n = 139
[a] n = 137
#$p < .10$, *$p < .05$, **$p < .01$, ***$p < .001$

Table 11

Summary of Hierarchical Regression Model Predicting Emergent Literacy Skills: Summative Measures

	TERA-3 Reading Quotient	TERA 3 Alphabet subtest	TERA-3 Conventions subtest	TERA-3 Meaning subtest
Step 1: Control Characteristics				
Age	- .02	-.04	.06	-.08
Pretest score	.77***	.81***	.52***	.37***
R^2 change	.59***	.65***	.27***	.15***
Step 2: Condition Variables				
No instruction group	-.03	-.01	.09	-.17
Instruction group	.02	.06	.06	-.07#
R^2 change	.00	.00	.01	.02
Step 3: Interactions				
No instruction X Pretest	-.02	-.05	.02	.15
Instruction X Pretest	-.10	-.09	-.01	.03
R^2 change	.01	.01	.00	.02
Adjusted R^2	.58	.65	.25	.15

Note. $n = 139$
#$p < .10$, *$p < .05$, **$p < .01$, ***$p < .001$

Table 12

Summary of Hierarchical Regression Model with Total Time Interactions of Condition: Book Specific Measures

	Book Specific Overall	Concepts of Print	Sight Words	Picture to Print Matching	Speech to Print Matching	Word Reading	Blending
Step 1: Control Characteristics							
Age	-.09	-.08	.02	.00	.11	.05	-.02
Pretest score	.84***	.74***	.77***	.66***	.49***	.80***	.39***
R^2 change	.66***	.50***	.61***	.43***	.29***	.67***	.15***
Step 2: Condition Variables							
No instruction group	.06	.02	.07	.02	.01	.03	.10
Instruction group	.06	.05	.08	-.04	.01	.00	.09
R^2 change	.00	.00	.01	.00	.00	.00	.01
Step 3: Total Time							
Total time playing/reading	.10#	.23***	.03	-.04	.00	-.01	.10
R^2 change	.01	.05***	.00	.00	.00	.00	.01
Step 4: Interactions							
No instruction X Total time	.02	-.08	-.06	-.01	.13	.02	.19#
Instruction X Total time	.05	-.01	.02	-.03	.10	.14*	.09
R^2 change	.00	.01	.01	.00	.01	.04#	.02
Adjusted R^2	.65	.53	.60	.41	.26	.67	.14

Note. $n = 137$ due to 2 missing time diaries
#$p < .10$, *$p < .05$, **$p < .01$, ***$p < .001$

Table 13

Hierarchical Regression Model with Interactions of Parent Time with Condition: Book Specific Measures

	Book Specific Overall	Concepts of Print	Sight Words	Picture to Print Matching	Speech to Print Matching	Word Reading	Blending
Step 1: Control Characteristics							
Age	-.09	-.08	.11	.00	.11	.05	-.02
Pretest score	.84***	.74***	.77***	.66***	.49***	.80***	.39***
R^2 change	.66***	.50***	.61***	.43***	.29***	.67***	.15***
Step 2: Condition Variables							
No instruction group	.06	.02	.07	.02	.01	.03	.10
Instruction group	.06	.05	.08	-.04	.01	.00	.09
R^2 change	.00	.00	.01	.00	.00	.00	.01
Step 3: Parent Time							
Parent time playing/reading	.09#	.16*	.04	-.02	-.05	.02	.08
R^2 change	.01	.02*	.00	.00	.00	.00	.01
Step 4: Interactions							
No instruction X Parent time	-.003	-.09	-.02	-.08	.13	-.03	.15#
Instruction X Parent time	-.01	-.05	-.002	-.06	.00	.09#	.06
R^2 change	.00	.01	.00	.01	.02	.01#	.02
Adjusted R^2	.65	.51	.59	.41	.27	.67	.14

Note. $n = 137$ due to 2 missing time diaries

#$p < .10$, *$p < .05$, **$p < .01$, ***$p < .001$

Table 14

Hierarchical Regression Model with Interactions of Alone Time with Condition: Book Specific Measures

	Book Specific Overall	Concepts of Print	Sight Words	Picture to Print Matching	Speech to Print Matching	Word Reading	Blending
Step 1: Control Characteristics							
Age	-.09	-.08	.02	.00	.11	.05	-.02
Pretest score	.84***	.74***	.77***	.66***	.49***	.80***	.39***
R^2 change	.67***	.50***	.61***	.43***	.29***	.67***	.15***
Step 2: Condition Variables							
No instruction group	.06	.02	.07	.02	.01	.03	.10
Instruction group	.06	.05	.08	-.04	.01	.00	.09
R^2 change	.00	.00	.01	.00	.00	.00	.01
Step 3: Alone Time							
Alone time playing/reading	.07	.14#	.04	.00	.05	.01	.02
R^2 change	.00	.01#	.00	.00	.00	.00	.00
Step 4: Interactions							
No instruction X Alone time	.17#	.21*	.04	.14	.27*	.09	.19
Instruction X Alone time	.13	.24*	.07	.04	.23#	.13	.06
R^2 change	.01	.02#	.00	.01	.02	.01	.02
Adjusted R^2	.65	.51	.59	.41	.28	.66	.13

Note. $n = 137$ due to 2 missing time diaries

#$p < .10$, *$p < .05$, **$p < .01$, ***$p < .001$

Table 15

Summary of Hierarchical Regression Model with Total Time Interactions of Condition: Progress Measures

	Initial Sound Fluency[a]	Rhyming	Letter Naming	Alliteration	Phonemic Segmentation
Step 1: Control Characteristics					
Age	.04	.08	.04	.15*	.11#
Pretest score	.55***	.76**	.87***	.69***	.66***
R^2 change	.32***	.61***	.78***	.51***	.49***
Step 2: Condition Variables					
No instruction group	.03	.07	-.07	-.01	.02
Instruction group	.11	-.02	-.02	-.01	-.01
R^2 change	.01	.01	.00	.00	.00
Step 3: Total Time					
Total time playing/reading	.00	.03	-.03	.01	-.003
R^2 change	.00	.00	.00	.00	.00
Step 4: Interactions					
No instruction X Total time	.02	-.04	.06	.06	.04
Instruction X Total time	.01	.01	.08#	.05	-.08
R^2 change	.00	.00	.01	.00	.01
Adjusted R^2	.29	.60	.78	.48	.47

Note. $n = 137$ due to 2 missing time diaries
[a] $n = 135$
#$p < .10$, *$p < .05$, **$p < .01$, ***$p < .001$

Table 16

Hierarchical Regression Model with Interactions of Parent Time with Condition: Progress Measures

	Initial Sound Fluency[a]	Rhyming	Letter Naming	Alliteration	Phonemic Segmentation
Step 1: Control Characteristics					
Age	.04	.08	.04	.15*	.11#
Pretest score	.55***	.76***	.87***	.69***	.66***
R^2 change	.32***	.61***	.78***	.51***	.49***
Step 2: Condition Variables					
No instruction group	.03	.07	-.07	-.01	.02
Instruction group	.11	-.02	-.02	-.01	-.01
R^2 change	.01	.01	.00	.00	.00
Step 3: Parent Time					
Parent time playing/reading	-.01	-.05	-.08#	-.01	-.11#
R^2 change	.00	.00	.01#	.00	.01#
Step 4: Interactions					
No instruction X Parent time	-.02	-.05	-.004	-.01	.04
Instruction X Parent time	-.05	.02	.07	.00	-.09
R^2 change	.00	.00	.00	.00	.01
Adjusted R^2	.29	.60	.79	.48	.49

Note. $n = 137$

[a] $n = 135$

#$p < .10$, *$p < .05$, **$p < .01$, ***$p < .001$

Table 17

Hierarchical Regression Model with Interactions of Alone Time with Condition: Progress Measures

	Initial Sound Fluency[a]	Rhyming	Letter Naming	Alliteration	Phonemic Segmentation
Step 1: Control Characteristics					
Age	.04	.08	.04	.15*	.11#
Pretest score	.55***	.76***	.87***	.69***	.66***
R^2 change	.32***	.61***	.78***	.51***	.49***
Step 2: Condition Variables					
No instruction group	.03	.07	-.07	-.01	.02
Instruction group	.11	-.02	-.02	-.01	-.01
R^2 change	.01	.01	.00	.00	.00
Step 3: Alone Time					
Alone time playing/reading	.06	.04	.04	-.01	.01
R^2 change	.00	.00	.00	.00	.00
Step 4: Interactions					
No instruction X Alone time	.14	.07	.09	.33**	.13
Instruction X Alone time	.11	.05	.08	.22*	.08
R^2 change	.01	.00	.00	.03*	.01
Adjusted R^2	.30	.60	.78	.51	.47

Note. $n = 137$

[a] $n = 135$

# $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$

Table 18

Summary of Hierarchical Regression Model with Total Time Interactions of Condition: Summative Measures

	TERA-3 Reading Quotient	TERA-3 Alphabet subtest	TERA-3 Conventions subtest	TERA-3 Meaning subtest
Step 1: Control Characteristics				
Age	- .01	-.04	.06	-.08
Pretest score	.77***	.81***	.52***	.37***
R^2 change	.59***	.65***	.28***	.15***
Step 2: Condition Variables				
No instruction group	-.02	-.01	.10	-.17
Instruction group	.02	.06	.06	-.07
R^2 change	.00	.00	.01	.02
Step 3: Total Time				
Total time playing/reading	-.08	.02	-.05	-.22**
R^2 change	.01	.00	.00	.04**
Step 4: Interactions				
No instruction X Total time	.02	.02	.04	.04
Instruction X Total time	.07	.12#	.01	.02
R^2 change	.00	.01	.00	.00
Adjusted R^2	.58	.65	.25	.17

n = 137 due to 2 missing time diaries

#$p < .10$, *$p < .05$, **$p < .01$, ***$p < .001$

Table 19

Hierarchical Regression Model with Interactions of Parent Time with Condition: Summative Measures

	TERA-3 Reading Quotient	TERA-3 Alphabet subtest	TERA-3 Conventions subtest	TERA-3 Meaning subtest
Step 1: Control Characteristics				
Age	- .01	-.04	.06	-.08
Pretest score	.77***	.81***	.52***	.37***
R^2 change	.59***	.65***	.28***	.15***
Step 2: Condition Variables				
No instruction group	-.02	-.01	.10	-.17#
Instruction group	.02	.06	.06	-.07
R^2 change	.00	.00	.01	.02
Step 3: Parent Time				
Parent time playing/reading	-.11#	-.01	-.10	-.19*
R^2 change	.01#	.00	.01	.03*
Step 4: Interactions				
No instruction X Parent time	.04	-.01	.02	.12
Instruction X Parent time	.04	.05	.05	-.02
R^2 change	.00	.00	.00	.02
Adjusted R^2	.58	.64	.26	.18

Note. $n = 137$ due to 2 missing time diaries

#$p < .10$, *$p < .05$, **$p < .01$, ***$p < .001$

Table 20

Hierarchical Regression Model with Interactions of Alone Time with Condition: Summative Measures

	TERA-3 Reading Quotient	TERA-3 Alphabet subtest	TERA-3 Convention s subtest	TERA-3 Meaning subtest
Step 1: Control Characteristics				
Age	- .01	-.04	.06	-.08
Pretest score	.77***	.81***	.52***	.37***
R^2 change	.59***	.65***	.28***	.15***
Step 2: Condition Variables				
No instruction group	-.02	-.01	.10	-.17
Instruction group	.02	.06	.06	-.07
R^2 change	.00	.00	.01	.02
Step 3: Alone Time				
Alone time playing/reading	-.04	.03	.01	-.17#
R^2 change	.00	.00	.00	.02#
Step 4: Interactions				
No instruction X Alone time	-.01	.11	-.08	-.04
Instruction X Alone time	.13	.20*	-.03	.08
R^2 change	.01	.02*	.00	.01
Adjusted R^2	.59	.66	.25	.16

Note. $n = 137$ due to 2 missing time diaries

#$p < .10$, *$p < .05$, **$p < .01$, ***$p < .001$

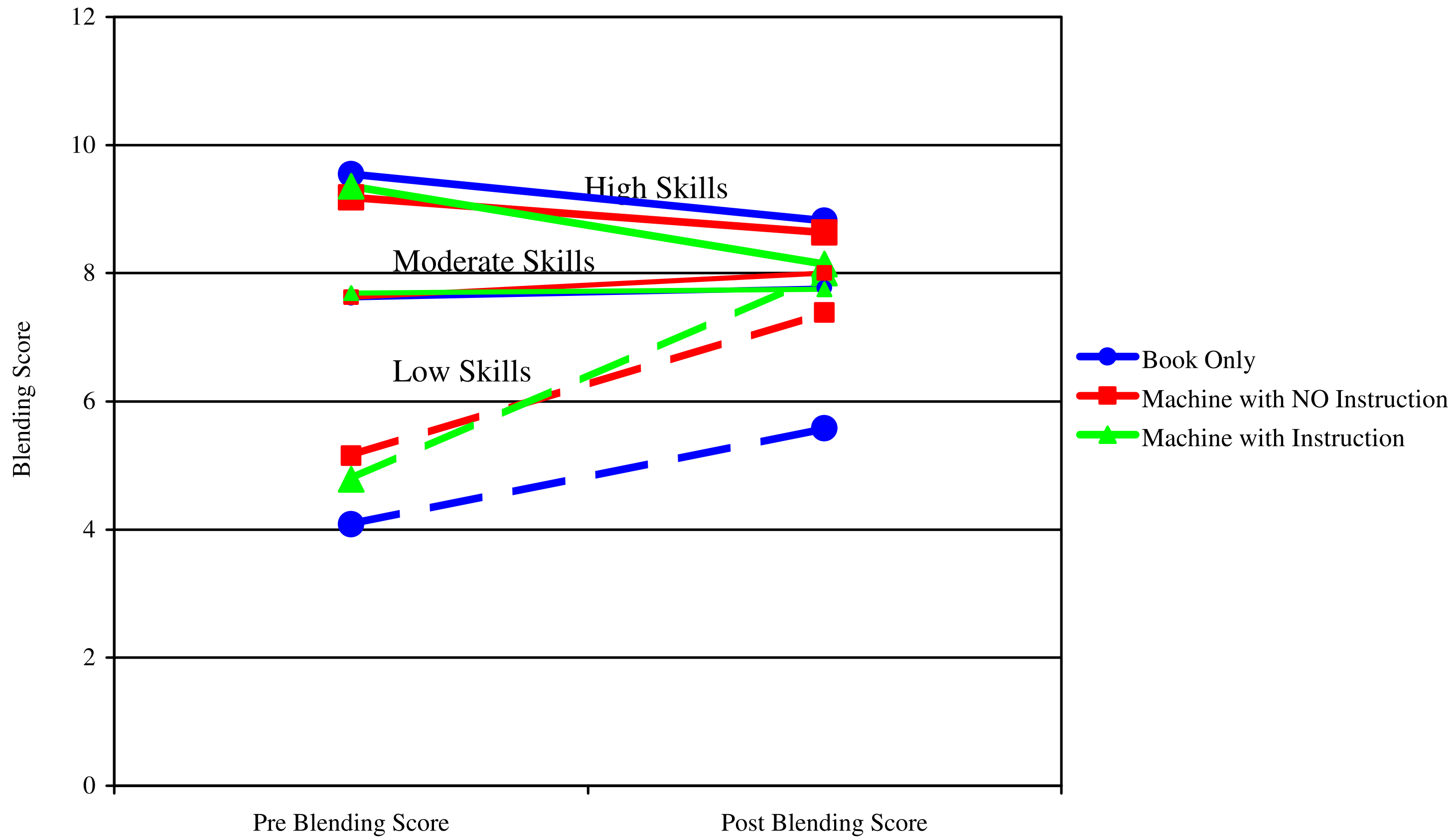

Figure 2. Follow-up interaction of blending score and condition. The *High Skills* group are children who score in the top 33% on blending at pretest. The *Moderate Skills* group are those that score in the middle 47%. The *Low Skills* group are children who score in the lowest 28% on blending at pretest.

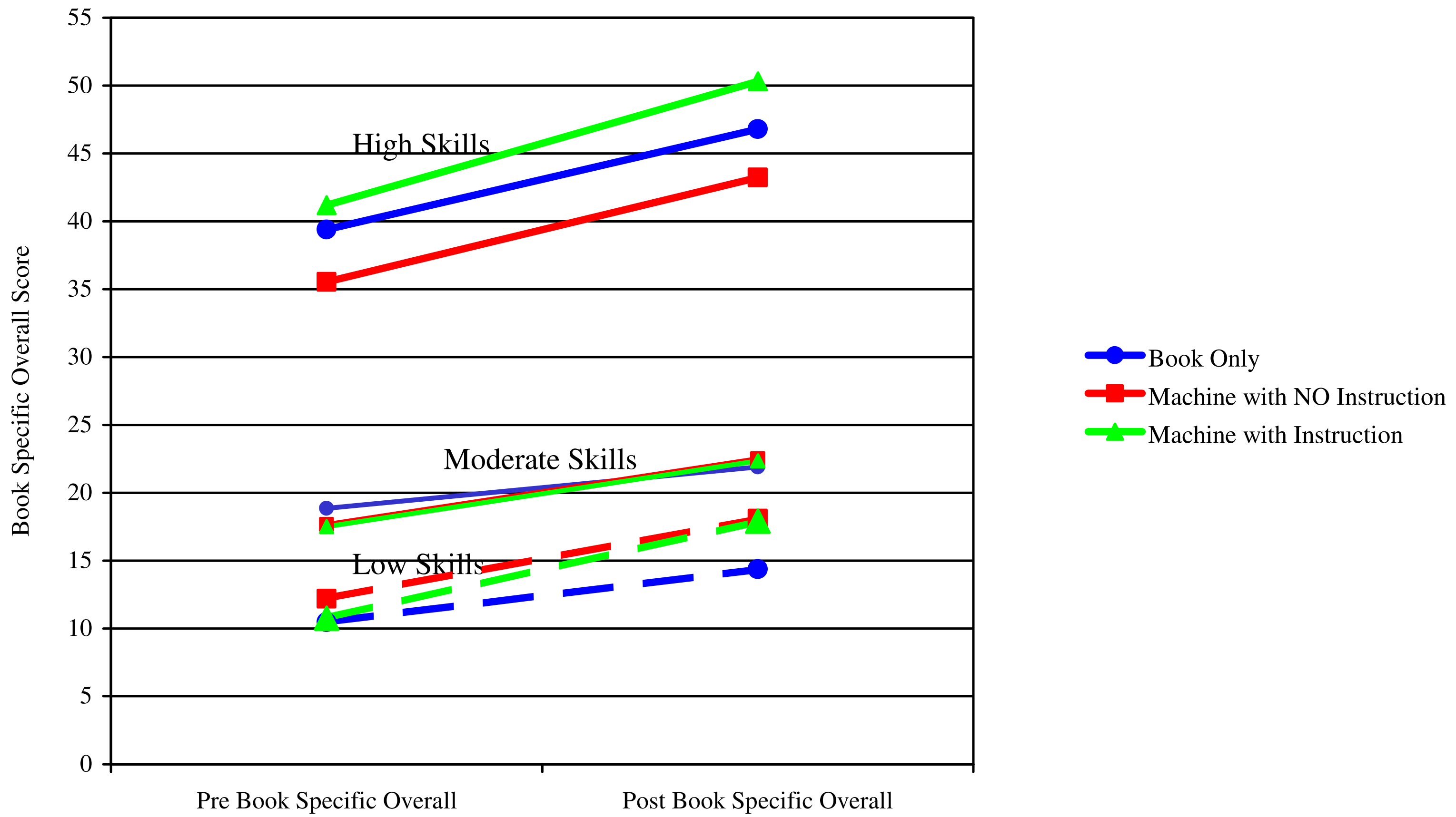

Figure 3. Follow-up interaction of book specific code-skills overall by condition. The *High Skills* group are children who score is the top 25% on the overall composite of book specific code skills at pretest and the *Moderate Skills* group are children who score in the middle 50%, and *Low Skills* group are children who score in the bottom 25%.

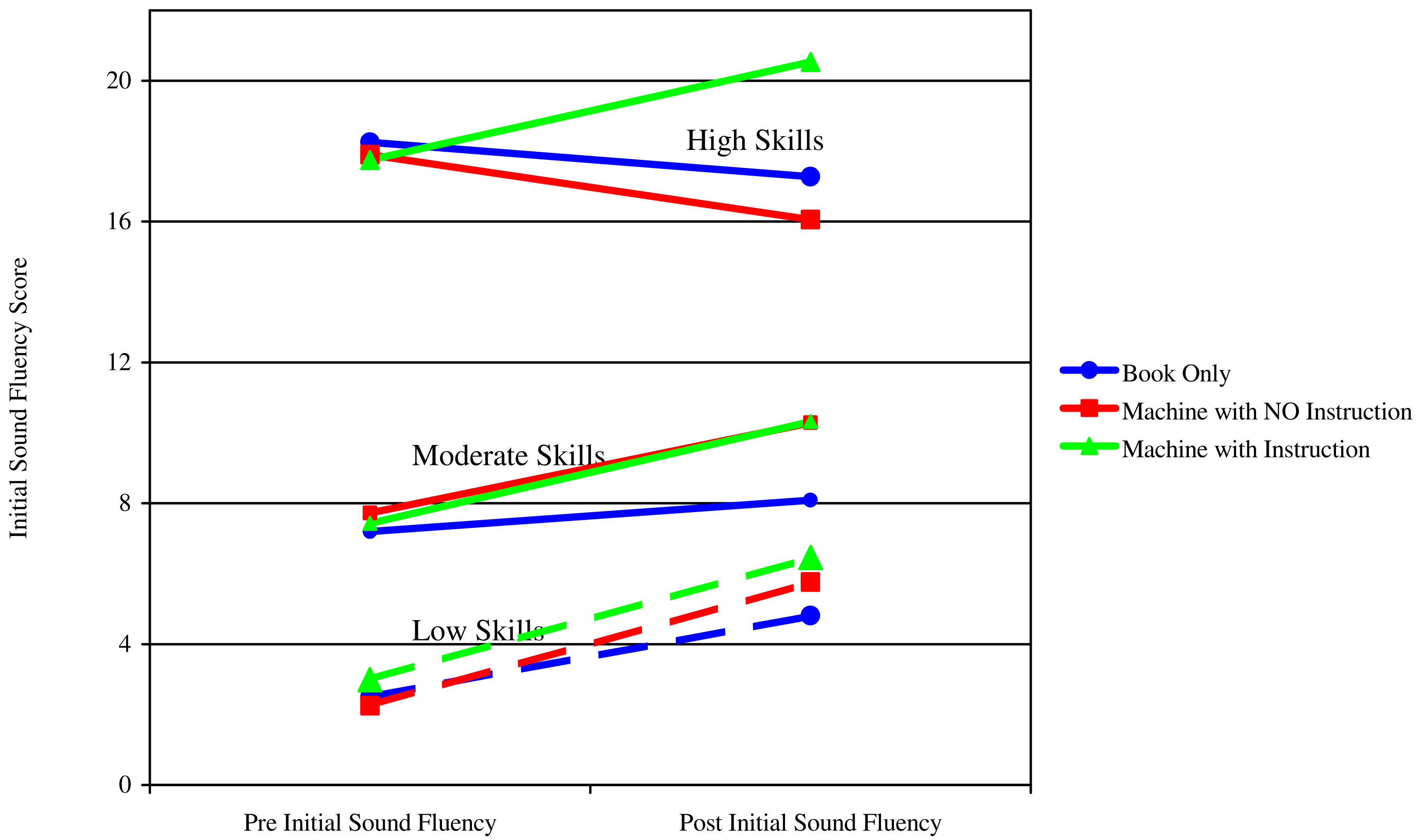

Figure 4. Follow-up interaction of initial sound fluency score and condition. The *High Skills* group are those children who score in the top 25% on initial sound fluency at pretest. The *Moderate Skills* group are those that score in the middle 50%. The *Low Skills* group are those children who score in the bottom 25% on initial sound fluency at pretest.

APPENDIX A

Pre and Post Book Specific Measures

SCRIPT: Introduction experience. Try to have some brief general conversation with the child before testing to help them feel comfortable interacting with you. For example, *ask them what they did today.* Explain *We are going to play some letter and reading games today.*

Directions: Examiners read the capitalized words, using appropriate lists. All items are worth one point, except for Item 1B (reading words from copy of book) which can be worth up to 22 points from the story and 4 points for incidental words depending on how many words the child can read. Follow the order of subtests and encourage child with statements like "*You're doing a good job. You're working hard on this. Keep going. It's okay if you don't know all the answers (or you can't read all the words). We just want to see which things are easy and which things are hard."* Do not give specific feedback that indicates if the child's response is correct or incorrect. If a child does not respond within 3 seconds, repeat the directions. If they do not respond within 2 more seconds, score a zero & move on to the next question.

CLIFFORD SPREAD

1**. Concepts of Print:** (Show child Clifford spread that begins, "Something special happened", and ask the following questions). THIS PAGE IS A COPY OF 2 PAGES FROM A BOOK. I AM GOING TO ASK YOU SOME QUESTIONS ABOUT THESE PAGES AND I WANT YOU TO ANSWER THEM AS BEST AS YOU CAN.

A. SHOW ME WHERE TO BEGIN READING THE STORY. _____

B. Point to the entire spread and say PLEASE READ WHATEVER YOU CAN ON THESE PAGES. (If child reads all of the words in the story, write 22 in the blank, score question C and D with a 1, and skip to question E. If child reads all 4 incidental words, score 4 in incidental blank, then continue to question C). If child reads words here and there, count the number of words child could read, and write that number in the blank. If child cannot read, score zero, and go to next item. _____/22 (story) _______/4 (incidental)

C. Read the first line of the text aloud and stop (run finger along words). WHERE DO I GO NOW? _____ (when Emily…) If incorrect response, redirect ACTUALLY WE CONTINUE HERE and finish reading first sentence.

APPENDIX A Continued

D. NOW IT IS YOUR TURN. PLEASE POINT TO EACH WORD AS I READ IT. (Point to the first word on last line, "the", and read entire spread, somewhat slowly but with normal rhythm. If student's word-by-word finger-pointing **matches** your reading for the last line on page one, score 1. _____

   If they transition & also follow along the second page score 1______

E. Point to the entire second page and say POINT TO THE FIRST WORD IN THE STORY ON THIS PAGE. _____

F. Point to the entire second page and say POINT TO THE LAST WORD IN THE STORY ON THIS PAGE. _____

G. Point to the entire second page and say PLEASE POINT TO TWO WORDS THAT ARE THE SAME ON THIS PAGE _____ (score 1 if they point to **night or bigger**) If they only point to one word say WHERE IS THE WORD THAT MATCHES THAT ONE.

H. Point to the entire spread and say ANYWHERE ON THESE PAGES FIND THE WORD "RED". _____

I. Point to the entire spread and say ANYWHERE ON THESE PAGES FIND THE WORD "STAR". _____

Please note any of the child's responses to the illustration and/or the text.

ELMO SPREAD

(Show child spread from Elmo book with text and ask the following questions). HERE ARE TWO OTHER PAGES COPIED FROM A BOOK. I AM GOING TO ASK YOU SOME QUESTIONS ABOUT THESE PAGES FROM THE BOOK AND I WANT YOU TO ANSWER THEM AS BEST AS YOU CAN.

J. Point to entire spread and say FIND THE WORD "BIG". _____

K. Point to entire spread and say CAN YOU POINT TO A WORD ANYWHERE ON THESE PAGES THAT RHYMES WITH "BALL"? _____ (**tall**) If child says tall & points score 1 for questions L & M and move on to N.

L. TELL ME THE WORD THAT RHYMES WITH "BALL". _____ **(tall)**

APPENDIX A Continued

Write word child says: _ _ _ _ _ _ _ _ _ _ _

M. FIND A WORD THAT BEGINS WITH THE /L/ SOUND (say LLL). _____
(Be sure to say the sound and not the letter.) (**last** or **little**)

*Write word the child says:*_ _ _ _ _ _ _ _ _ _ _

N. FIND A WORD THAT ENDS WITH THE /T/ SOUND (say TUH). _____
(Be sure to say the sound and not the letter.) (**caught, last, short, first, street**)

*Write word the child says:*_ _ _ _ _ _ _ _ _ _ _

O. Point to entire spread, POINT TO A PERIOD ANYWHERE ON THESE PAGES
____

P. WHAT DOES IT MEAN WHEN YOU SEE A PERIOD? ____
(example of correct response, "to stop or to pause")

_____/42 TOTAL
(BSCP1)

Please note any of the child's responses to the illustration and/or the text.

2. Sight Words: HERE IS RING OF WORDS. READ THEM TO ME THE BEST THAT YOU CAN AS I FLIP THROUGH THEM ONE AT A TIME. YOU MAY NOT KNOW ALL THE WORDS, AND THAT'S OKAY. JUST DO THE BEST THAT YOU CAN. (flip through cards facing child).

___ 1. the (B) ___ 4. a (B)
___ 2. of (E) ___ 5. to (B)
___ 3. and (B)

_____ /5 TOTAL (BSSW2)

3. Picture to Print Matching: HERE IS ANOTHER SET OF PICTURES AND SOME WORDS. FIND THE WORD THAT MATCHES WITH EACH OF THESE PICTURES (Prompt: WHAT IS THIS PICTURE? DO YOU SEE THE WORD THAT MATCHES THAT PICTURE?) Review all pictures with the child first to be sure they know what the pictures are showing. Redirect any words they give a different name. For example, "that could be a 'can', but lets call it a 'jar' for this activity."

___ 1. frog (Ei)
___ 2. jar (Eci

APPENDIX A Continued

___ 3. clock (Bci)
___ 4. helicopter (Cci)
___ 5. window (Ci)

_____ /5 TOTAL (BSPP3)

3a. Picture to Print Matching: HERE IS ANOTHER SET OF PICTURES AND SOME WORDS. FIND THE WORD THAT MATCHES WITH EACH OF THESE PICTURES (Prompt: WHAT IS THIS PICTURE? DO YOU SEE THE WORD THAT MATCHES THAT PICTURE?) Review all pictures with the child first to be sure they know what the pictures are showing. Redirect any words they give a different name. For example, "that could be a 'can', but lets call it a 'jar' for this activity."

___ 6. flute (Ei)
___ 7. chair (Ci)
___ 8. tuba (Ei)
___ 9. map (Ci)
___ 10. star (Bi)

_____ /5 TOTAL (BSPP3a)

4. **Sight Words:** HERE IS RING OF WORDS. READ THEM TO ME THE BEST THAT YOU CAN AS I FLIP THROUGH THEM ONE AT A TIME. YOU MAY NOT KNOW ALL THE WORDS, AND THAT'S OKAY. JUST DO THE BEST THAT YOU CAN. (flip through cards facing child).

___ 6. in (B)
___ 7. is (C)
___ 8. you (B)
____ 9. that (E)
____ 10. it (C)

_____ /5 TOTAL (BSSW4)

5. Speech to Print Matching: HERE ARE SOME MORE CARDS WITH WORDS. I WANT YOU TO POINT TO JUST THE WORD I SAY. Be sure to begin on the card with the word cloud. (flip through cards facing child).

___ 1. cloud (Ei)
___ 2. day (EcCc)
___ 3. bed (Ci)
___ 4. boat (Ci)
___ 5. bird (Eic)
___ 6. drum (Eic)
___ 7. moon (EiCi)
___ 8. fun (Ec)
___ 9. back (Ec)
___ 10. water (Ci)

_____/10 TOTAL (BSSP5)

APPENDIX A Continued

6. Word Reading: HERE ARE MORE WORDS YOU MAY OR MAY NOT KNOW. JUST DO THE BEST YOU CAN. READ THE WORDS YOU CAN AS I FLIP THROUGH THE CARDS. IF YOU DO NOT KNOW A WORD, TELL ME, WE'LL SKIP IT, AND GO ON TO THE NEXT. (flip through cards facing child).

___ 1. cup (Ci) ___4. map (Ci)
___ 2. dog (Cc) ___5. red (Cc)
___ 3. big (EiCc) _____ /5 TOTAL (BSWR6)

7. Phonemic Segmentation
THESE ARE PAGES WITH A SET OF 4 PICTURES ON THEM. PLEASE POINT TO THE PICTURE THAT MATCHES MY DIRECTIONS FOR THAT PAGE. Point to each picture as you say the word and say pause in your head each time you see the word pause in parentheses.

THESE PICTURES ARE: OUTSIDE, ICE SKATE, CLOCK, FISH. FIND WHAT YOU GET WHEN YOU PUT OUT AND SIDE TOGETHER. FIND OUT (pause) SIDE.

___ 1. outside (Ci)

THESE PICTURES ARE: PENGUIN, BOY, BULLDOZER, APPLE. FIND WHAT YOU GET WHEN YOU PUT BULL AND DOZER TOGETHER. FIND BULL (pause) DOZER.

___ 2. bulldozer (Ci)

THESE PICTURES ARE: CLOUDS, MONSTER, DOG, COW. FIND WHAT YOU GET WHEN YOU PUT MON AND STER TOGETHER. FIND MON (pause) STER.

___ 3. monster (Ec)

THESE PICTURES ARE: LEAF, BALL, MUFFIN, CARROT. FIND WHAT YOU GET WHEN YOU PUT MUFF AND IN TOGETHER. FIND MUFF (pause) IN.

___ 4. muffin (Ci)

THESE PICTURES ARE: DRAGON, CHIMNEY, KITE, BEACH. FIND WHAT YOU GET WHEN YOU PUT /B/ (BUH) AND EACH TOGETHER. FIND B (pause) EACH.

___ 5. beach (Ci)

THESE PICTURES ARE: RACKET, SNAKE, SHELL, SHOE. FIND WHAT YOU GET WHEN YOU PUT /SN/ AND AKE TOGETHER. FIND SN (pause) AKE.

___ 6. snake (Ei)

THESE PICTURES ARE: MOON, MOUSE, COW, CLOUD. FIND WHAT YOU GET WHEN YOU PUT /MMM/ AND OON TOGETHER. FIND /M/ (pause) OON.

___ 7. moon (B)

THESE PICTURES ARE: ROOM, PLAYGROUND, ROCKET, DESK. FIND CLASSROOM WITHOUT THE CLASS.

___ 8. room

THESE PICTURES ARE: SUN, FROG, KEY, MOP. FIND MONKEY WITHOUT THE MON.

___ 9. key

THESE PICTURES ARE: STAR, WING, ZEBRA, CARROT. FIND SWING WITHOUT THE /SSS/.

___ 10. wing

THESE PICTURES ARE: BOOK, SHELL, AIRPLANE, RAIN. FIND CRANE WITHOUT THE /C/ (say kuh sound)

___ 11. rain

_____ 11 TOTAL (BSPS7)

8. Word Reading HERE ARE MORE WORDS YOU MAY OR MAY NOT KNOW. JUST DO THE BEST YOU CAN. READ THE WORDS YOU CAN AS I FLIP THROUGH THE CARDS. IF YOU DO NOT KNOW A WORD, TELL ME, WE'LL SKIP IT, AND GO ON TO THE NEXT. (flip through cards facing child).

___ 6. car (Ei)
___ 7. set (Ec)
___ 9. run (Cc)
___ 10. tall (Ei)

___ 8. box (Eic)

_____ /5 TOTAL (BSWR8)

____/93 TOTAL (BS)

APPENDIX B

Pretest, Midtest and Posttest Rhyming Protocol

Shuffle cards before each administration. Start stopwatch at as you begin reading the first response card for this 2 min. timed test. Mark child's response on card with dry erase marker. Afterwards transfer information onto this sheet, check correct or incorrect, and give total numbers.

SAMPLE 1: "We're going to look at some pictures and find ones that sound the same. They rhyme." Point to each picture as you say, "My turn: bees, pants, gate, cheese." "Now I will find two that rhyme." Point to bees and cheese as you say, "Bees, cheese—these two sound the same. They rhyme. Bees, cheese." "Lets do another".

SAMPLE 2: "My turn: star, jacks, car, horse." "Now I will find two that rhyme." "Star, car—these two sound the same. They rhyme."

TESTING: "Now lets do some more. Remember, you point to the picture that rhymes or sounds the same as the top picture." **START STOPWATCH: 2 min.** Point to and name each picture. "Point to the one that sounds the same as____ (point to and name top picture). If no response within 3 seconds, probe, "Which one sounds the same as____(point to the top picture)"

				Correct	Incorrect
Total:					
RHYMING CARDS:					
Bat	**sun**	***cat***	**bike**		
Bell	***shell***	**kite**	**tank**		
Boat	***coat***	**house**	**pie**		
Bone	**cow**	**hill**	***phone***		
Book	**map**	**clothes**	***cook***		
Bow	***snow***	**shirt**	**bike**		
Bug	**sun**	***rug***	**cake**		
Bun	***sun***	**fruit**	**bird**		
Cab	**glue**	**yarn**	***crab***		
Cake	**fish**	**car**	***rake***		
Cent	**squirrel**	**lamb**	***tent***		
Chair	**spoons**	**fan**	***pear***		
Chicks	**bread**	**knife**	***bricks***		
Clip	**flag**	**snail**	***ship***		

Rhyming (con't)				Correct	Incorrect
Clocks	**hands**	***blocks***	**spoons**		
Cup	***pup***	**books**	**web**		
Deer	**tape**	**trunk**	***ear***		
Dice	**shell**	***mice***	**park**		
Dime	**suit**	**grapes**	***lime***		
Drum	**cat**	***thumb***	**snake**		
Face	**bear**	**door**	***vase***		
Fire	***tire***	**pot**	**door**		
Fish	**barn**	***dish***	**robe**		
Flag	**shell**	***bag***	**car**		
Flame	**mask**	***frame***	**broom**		
Frog	**boot**	**lock**	***dog***		
Fruit	**watch**	***boot***	**clown**		
Gate	***cake***	***duck***	**plate**		
House	**rake**	**desk**	***mouse***		
Kite	***light***	**cow**	**truck**		
Lake	**tire**	**rain**	***cake***		
Lamp	**pear**	**ball**	***stamp***		
Man	**shoes**	***pan***	**church**		
Moon	**cat**	***spoon***	**tire**		
Nest	**tongue**	***vest***	**moose**		
Nurse	***purse***	**snake**	**clock**		
Pail	***mail***	**girl**	**leaf**		
Pen	**rake**	**cheese**	***hen***		
Rat	**rake**	**phone**	***hat***		
Ring	**fox**	***swing***	**tree**		
Rock	***sock***	**cup**	**moon**		
Rope	**shells**	**hat**	***soap***		
School	**comb**	**truck**	***stool***		
Sled	**drum**	***bread***	**shells**		
Tie	***pie***	**witch**	**mouse**		
Top	***mop***	**map**	**tooth**		

Rhyming (con't)				Correct	Incorrect
Track	**sun**	**mop**	***black***		
Train	**mitt**	***chain***	**pie**		
Tree	**cup**	**soap**	**bee**		
Truck	**key**	***duck***	**tooth**		
Wheel	**pen**	***seal***	**lamp**		

APPENDIX C

Pretest, Midtest & Posttest Alliteration Protocol

Shuffle cards before each administration. Start stopwatch at as you begin reading the first response card for this 2 min. timed test. Mark child's response on card with dry erase marker. Afterwards transfer information onto this sheet, check correct or incorrect, and give total numbers.

SAMPLE 1: "We're going to look at some pictures and find ones that start with the same sound. I'm going to say the names of these pictures, and find two that start with the same sound." Point to each picture as you say, "door, dice, fish, plates." "Now I will find two that start with the same sound." Point to door say, "door, dice, these two start with the same sound: door, dice." "Now lets do another."

SAMPLE 2: "hat, moon, horse, tree." "Horse starts with the same sound as hat."

TESTING: "Now lets do some more. Remember, you point to the picture that starts with the same sound as the top picture." **START STOPWATCH: 2 min.** Point to and name each picture. "Point to the one that starts with the same sound as____ (point to and name top picture). If no response within 3 seconds, probe, "Which one starts with the same sounds as____(point to the top picture)"

				Correct	Incorrect
Total:					
ALLITERATION CARDS:					
Ball	**spoon**	***bag***	**cat**		
Barn	**light**	***bear***	**milk**		
Bee	**rock**	***bell***	**shoe**		
Boy	**church**	**dog**	***boot***		
Bug	***bag***	**sun**	**door**		
Cake	***train***	***rose***	**couch**		
Car	**doll**	**hen**	***cup***		
Chair	**car**	***church***	**frog**		
Cheese	**leaf**	**soap**	***chick***		
Deer	***door***	**nails**	**boat**		
Dog	***desk***	**fan**	**mop**		

Alliteration Cont'd				Correct	Incorrect
Door	**bed**	***duck***	**phone**		
Fan	**tub**	**saw**	***feet***		
Fish	**plane**	**swing**	***foot***		
Gate	***gum***	**book**	**flute**		
Gate	***goat***	**pants**	**tree**		
Goat	**truck**	**saw**	***girl***		
Hair	**mitt**	***hen***	**pants**		
Hand	**peach**	***horse***	**train**		
Heart	**clown**	**rock**	***house***		
Jet	**train**	**plant**	***jewels***		
Juice	**bell**	**goat**	***jar***		
King	***kite***	**pie**	**ship**		
Kite	**house**	***cat***	**man**		
Lamp	***leg***	**van**	**rose**		
Leaf	**man**	**bear**	***lips***		
Lock	***leaf***	**snow**	**ship**		
Logs	**snake**	***leaf***	**corn**		
Mail	**chair**	***milk***	**pot**		
Map	***man***	**bed**	**shark**		
Mitt	**sun**	***mouse***	**chain**		
Mop	***moose***	**ship**	**star**		
Nurse	**shoes**	**worm**	***nails***		
Nuts	***nose***	**cup**	**book**		
Pen	**fish**	**coat**	***pear***		
Pen	***pie***	**queen**	**milk**		
Rain	***rake***	**pig**	**house**		

Alliteration Cont'd				Correct	Incorrect
Rose	**shoe**	***ring***	**tub**		
Shark	**pot**	***shoes***	**hair**		
Soap	***socks***	**bird**	**tent**		
Teeth	**blocks**	***tire***	**phone**		
Tent	**clock**	**bear**	**top**		
Van	**snake**	***vest***	**rope**		
Witch	**flag**	**sun**	***worm***		

REFERENCES

Aiken, L.S., & West, S.G. (1991). *Multiple regression: Testing and interpreting interactions.* Thousand Oaks, CA: Sage Publications, Inc.

Anderson, D.R., Huston, A.C., Schmitt, K.L., Linebarger, D.L., & Wright, J.C. (2001). Early childhood television viewing and adolescent behavior. *Monographs of the Society for Research in Child Development, 66*(1, Serial No. 264).

Anderson, D.R., Lorch, E.P., Field, D.E., & Sanders, J. (1981). *The effects of TV program comprehensibility on preschool children's visual attention to television. Child Development, 52,* 151-157.

Arnold, D.H., Lonigan, C.J., Whitehurst, G.J., & Epstein, J.N. (1994). Accelerating language development through picture book reading: Replication and extension to a videotape training format. *Journal of Educational Psychology, 86 (2),* 235-243.

Baker, L., Mackler, K., Sonnenschein, S., & Serpell, R. (2001). Parents' interactions with their first-grade children during storybook reading and relations with the subsequent home reading activity and reading achievement. *Journal of School Psychology, 39,* 415-438.

Ball, S., & Bogatz, G.A. (1970). *The first year of Sesame Street: An evaluation.* Princeton, NJ: Educational Testing Service.

Beentjes, J.W.J., & van der Voort, T.H.A. (1988). Television's impact of children's reading skills: A review of research. *Reading Research Quarterly, 23*, 389-413.

Beentjes, J.W. & van der Voort, T.H. (1993). Television viewing versus reading: Mental effort, retention, and inferential learning. *Communication Education, 42,* 191-205.

Bogatz, G.A., & Ball, S. (1971). *The second year of Sesame Street: A continuing evaluation.* Princeton, NJ: Educational Testing Service

Bryant, J., & Anderson, D.R. (Eds.) (1983). *Children's understanding of TV: Research on attention and comprehension.* New York: Academic Press.

Bryant, P.E., MacLean, M., Bradley, L.L., & Crossland, J. (1990). Rhyme and alliteration, phoneme detection, and learning to read. *Developmental Psychology, 26,* 429-438.

Bus, A.G. & van Ijzendoorn, M.H. (1999). Phonological awareness and early reading: A meta-analysis of experimental training studies. *Journal of Educational Psychology, 91,* 403-414.

Calvert, S.L. (1994). Developmental differences in children's production and recall of information as a function of computer presentational features. *Journal of Educational Computing Research, 10,* 139-151.

Calvert, S.L., Huston, A.C., Watkins, B.A., & Wright, J.C. (1982). The relation between selective attention to television forms and children's comprehension of content. *Child Development, 53,* 601-610.

Calvert, S.L., Huston, A.C., & Wright, J.C. (1987). Effects of television preplay formats on children's attention and story comprehension. *Journal of Applied Developmental Psychology, 8,* 329-342.

Campbell, T.A., Wright, J.C., Huston, A.C. (1987). Form cues and content difficulty as determinants of children's cognitive processing of televised educational messages. *Journal of Experimental Child Psychology, 43,* 311-327.

Chera, P., & Wood, C. (2003). Animated multimedia 'talking books' can promote phonological awareness in children beginning to read. *Learning and Instruction, 13,* 33-52.

Christian, K., Morrison, F.J., & Bryand, F.B. (1998). Predicting kindergarten academic skills: Interactions among child care, maternal education, and family literacy environments. *Early Childhood Research Quarterly, 13,* 501-521.

Chu, M. (1995). Reader response to interactive computer books: examining literacy responses in non-traditional reading settings. *Reading Research and Instruction, 34,* 352-366.

Clay, M.M. (1979). *The Early Detection of Reading Difficulties.* Auckland, New Zealand: Heinemenn Educational Books.

Crawley, A.M., Anderson, D.R., Wilder, A., Williams, M., Santomero, A. (1999). Effects of repeated exposures to a single episode of the television program *Blue's Clues* on the viewing behaviors and comprehension of preschool children. *Journal of Educational Psychology, 91(4),* 630-637.

Danling, P., & Hong, J. (1995). Children's attention to and comprehension of explicit versus implicit information on television. *Journal of Educational Television, 21,* 71-84.

Davis, F.B. (1968). Research in comprehension in reading. *Reading Research Quarterly, 3*, 499-545.

de Jong, M.T., & Bus, A.G. (2002). Quality of book-reading matters for emergent readers: An experiment with the same book in a regular or electronic format. *Journal of Educational Psychology, 94, 145-155.*

de Jong, P.F., & Leseman, P.P.M. (2001). Lasting effects of home literacy on reading achievement in school. *Journal of School Psychology, 39,* 389-414.

Derley, R.M. (1995). *Interactive versus passive media presentation of a story: Processing and gender differences.* Unpublished master's thesis, The University of Kansas, Lawrence, Kansas.

Desmond, R.J., Singer, J.L., Singer, D.G., Calam, R., & Calimore, K. (1985). Family mediation patterns and television viewing: Young children's use and grasp of the medium. *Human Communication Research, 11,* 461-480.

Elliott, J., Lee, S.W., & Tollefsan, N. (2001). A reliability and validitiy study of the Dynamic Indicators of Basic Early Literacy Skills. *School Psychology Review, 30,* 33-50.

Evans, J. (1998). Responding to illustrations in picture storybooks. *Reading, 32,* 27-31.

Fisch, S.M. (2003). Characteristics of effective materials for informal education: A cross-media comparison of television, magazines, and interactive media. In F.C. Blumberg & E. Everson (Eds.), *The impact of media and technology on instruction*. Mahwah, NJ: Lawrence Erlbaum Associates.

Fisch, S.M. (2000). A capacity model of children's comprehension of educational content on television. *Media Psychology, 2,* 63-91.

Fisch, S., Shulman, J.S., Akerman, A., & Levin, G.A. (2002). Reading between the pixels: Parent-child interactions while reading online storybooks. *Early Education and Development, 13(4),* 435-451.

Flavell, J.H. (2000). Development of children's knowledge about the mental world. *International Journal of Behavioral Development, 24,* 15-23.

Good, R. H., Kaminski, R. A. (1996). Assessment for instructional decisions: Toward a proactive/prevention model of decision-making for early literacy skills. *School Psychology Quarterly, 11*, 326-336.

Good, R.H., & Kaminski, R.A. (Eds.) (2003). *Dynamic Indicators of Basic Early Literacy Skills*(6 th ed.). Eugene, OR: Institute for the Development of Educational Achievement. Available at http://dibels.uoregon.edu.

Good, R.H., Kaminski, R.A., Shinn, M., Bratten, J., Shinn, M., Laimon, L., Smith, S., & Flindt, N. (2004). *Technical adequacy and decision making utility of DIBELS* (Technical Report No. 7). Eugene, OR: University of Oregon.

Jensen, J.F. (1998). Interactivity: Tracking a new concept in media and communication studies. *Nordicom Review, 19,* 185-204.

Healy J.M. (1990). *Endangered minds: Why our children don't think.* New York: Simon & Schuster.

Huston, A.C., & Wright, J.C. (1983). Children's processing of television: The informative functions of formal features. In J. Bryant & D.R. Anderson (Eds.), *Children's understanding of TV: Research on attention and comprehension*(pp. 37 - 68). New York: Academic Press.

Huston, A.C., & Wright, J.C. (1989). The forms of television and the child viewer. In G. A. Comstock (Ed.), *Public Communication and Behavior*: Vol. 2 (pp.103-158). New York: Academic Press.

Huston, A.C. & Wright, J.C. (1997). Mass media and children's development. In W. Damon, I. Sigel, & K.A.Renninger (Eds.), *Handbook of child psychology*: Vol. 4. *Child psychology in practice* (5th ed., pp.999-1058). New York: Wiley.

Huston, A.C. & Wright, J.C. (1998). Television and the informational and educational needs of children. *The Annals of the American Academy of Political and Social Science, 557,* 9-23.

Huston, A.C., Wright, J.C., Marquis, J., & Green, S.B. (1999). How young children spend their time: Television and other activities. *Developmental Psychology, 35,* 912-925.

Kameenui, E.J., Carnine, D.W., & Feeschi, R. (1982). Effects of text construction and instructional procedures for teaching word meanings on comprehension and recall. *Reading Research Quarterly, 3*, 367-388.

Kerr, B.M., & Mason, J.M. (1994). Awakening literacy through interactive storybook reading. IN F. Lehr & J. Osborn (Eds.), *Reading, language, and literacy: Instruction for the twenty-first century* (pp. 133-148). Hilsdale, NJ: Lawrence Erlbaum Associates.

Kiousis, S. (2002). Interactivity: A concept explication. *New Media and Society, 4(3),* 355-383.

Labbo, L.D., & Kuhn, M.R. (2000). Weaving chains of affect and cognition: A young child's understanding of CD-ROM talking books. *Journal of Literacy Research, 32,* 187-210.

LeapFrog Schoolhouse (2004). *An Evaluation of theLeapTrack Assessment & Instruction System in Oakland 1st–4th Grade Classrooms.* Retrieved March 1, 2005 from http://www.leapfrogschoolhouse.com/content/research/LT_full_OAK.pdf

Lee, J.H., Bickham, D.S., Vandewater, E.A., & Huston, A.C. (2005). *Children's electronic media use and academic skills.* Manuscript submitted for publication.

Lee, J.H., & Huston, A.C. (2003). Educational televisual media effects. In E.L. Palmer & B.M. Young (Eds.), *The Faces of Televisual Media: Teaching, Violence, Selling to Children.* Mahwah, New Jersey: Lawrence Erlbaum Associates.

Lemish, D. & Rice, M.L. (1986). Television as a talking picture book: A prop for language acquisition. *Journal of Child Language, 13,* 251-274.

Linebarger, D.L. (1996). *The synergy between print and television*. Unpublished manuscript.

Linebarger, D.L. (2000). *Summative evaluation of Between the Lions.* Unpublished reported prepared for the WGBH Educational Foundation. Kansas City, KS: University of Kansas.

Linebarger, D.L., Kosanic, A.Z., Greenwood, C.R., & Doku, N.S. (2004). Effects of viewing the television program *Between the Lions* on the emergent literacy skills of young children. *Journal of Educational Psychology, 96,* 297-308

Lonigan, C.J., Bloomfield, B.G., Anthonly, J.L., Bacon, K.D., Phillips, B.M., & Samwel, C.S. (1999). Relations among emergent literacy skills, behavior problems, and social competence in preschool children from low-and middle-income backgrounds. *Topics in Early Childhood Special Education, 19,* 40-54.

Lonigan, C.J., Burgess, S.R., & Anthony, J.L. (2000). Development of emergent literacy and early reading skills in preschool children: Evidence from a latent-variable longitudinal study. *Developmental Psychology, 36(5),* 596-613.

Lonigan, C.J., & Whitehurst, G.J. (1998). Relative efficacy of parent and teacher involvement in a shared-reading intervention for preschool children from low-income backgrounds. *Early Childhood Research Quarterly, 13,* 263-290.

Lorch, E.P., Anderson, D.R., & Levin, S.R. (1979). The relationship of visual attention to children's comprehension of television. *Child Development, 50,* 722-727.

Luckin, R. (2001). Designing children's software to ensure productive interactivity through collaboration in the Zone of Proximal Development (ZPD). *Information Technology in Childhood Education*

Luckin, R., Connolly, D., Plowman, L., & Airey, S. (2003). Children's interactions with interactive toy technology. *Journal of Computer Assisted Learning, 19,* 165-176.

McLuhan, M. & Fiore, Q. (1967). *The medium is the message.* New York, New York: Bantam Books.

McMillan, S.J. (2002). Exploring models of interactivity from multiple research traditions: Users, documents, and systems. In L.A. Lievrouw & S. Livingston (Eds.), *Handbook of New Media: Social Shaping and Consequences of ICTs.* Thousand Oaks, CA: Sage Publications.

Matthew, K. (1996). The impact of CD-ROM storybooks on children's reading comprehension and reading attitude. *Journal of Educational Multimedia and Hypermedia, 5(3),* 379-394.

Meadowcroft, J.M, & Reeves, B. (1989). Influence of story schema development of children's attention to television. *Communication Research, 16,* 352-374.

Meyer, A. & Rose, D.H (1998). *Learning to read in the computer age.* Newton, MA: Brookline Books.

Millard, E., Taylor, C., & Watson, S. (2000). Books for babies means books for parents too: The benefits of situating the earliest stages of literacy in the framework of the wider community. *Reading, 34,* 130-133.

Missall, K.N., & McConnell, S.R. (2004). *Psychometric characteristics of individual growth and development indicators: Picture naming, rhyming, and alliteration.* (University of Minnesota, Center for Early Education and Development, April 2004). Technical report retrieved on Feburary 15, 2005, from http://ggg.umn.edu/techreports/dissemination.html#TechRep

National Research Council (1998). *Preventing reading difficulties in young children.* Washington DC: National Academy Press, 1998.

Neuman, S.B. (1988). The displacement effect: Assessing the relation between television viewing and reading performance. *Reading Research Quarterly, 23,* 414-440.

Neuman, S.B. (1995). *Literacy in the television age: The myth of the TV effect.* Westport, CT: Ablex Publishing.

Neuman, S.B. (1996). Children engaging in storybook reading: The influence of access to print resources, opportunity, and parental interaction. *Early Childhood Research Quarterly, 11,* 495-513.

Neuman, S.B., Burden, D., & Holden, E. (1990). Enhancing children's comprehension of a televised story through previewing. *Journal of Educational Research, 83,* 258-265.

Newcomb, A.F., & Collins, W.A. (1979). Children's comprehension of family role portrayals in televised dramas: Effects of socioeconomic status, ethnicity, and age. *Developmental Psychology, 15,* 417-423.

Rafaeli, S. (1988). Interactivity: From new media to communication. In R.P. Hawkins, J.M. Wiemann, and S. Pingree (Eds.), *Advancing Communication Science: Merging Mass and Interpersonal Process.* Newbury Park, CA: Sage Publications.

Revelle, G.L. Strommen, E.F., & Medoff, L. (2001). Interactive technologies research at the Children's Television Workshop. In S.M. Fisch & R.T. Truglio (Eds.), *"G" is for growing: Thirty years of research on Sesame Street.* (pp. 215-230). Mahwah, NJ: Lawrence Erlbaum Associates.

Rideout, V.J., Vandewater, E.A., & Wartella, E.A. (2003). *Zero to Six: Electronic Media in the Lives of Infants, Toddlers and Preschoolers.* The Kaiser Family Foundation, Menlo Park, CA.

Ricci, C.M., & Beal, C.R. (2002). The effect of interactive media on children's story memory. *Journal of Educational Psychology, 94,* 138-144.

Rice & Haight (1986). The "motherese" of *Mr. Rogers*: The dialog of educational television programs. *Journal of Speech and Hearing Disorders, 51,* 282-287.

Rice, M.L., Huston, A.C., Truglio, R., & Wright, J.C. (1990). Words from Sesame Street: Learning vocabulary while viewing. *Develomental Psychology, 26*, 421-428.

Rice, M.L., Huston, A.C. & Wright, J.C. (1982). The forms and codes of television: Effects on children's attention, comprehension, and social behavior. In D. Pearl, L.

Bouthilet, and J. Lazar (Eds.), *Television and behavior: Ten years of scientific progress and implications for the 80s* (p.24-38). Washington, DC: U.S. Government Printing Office.

Rice & Woodsmall (1988). Lessons from television: Children's word learning when viewing. *Child Development, 59,* 420-429.

Salomon, G. (1977). Effects of encouraging Israeli mothers to co-observe "Sesame Street" with their five-year-olds. *Child Development, 48,* 1146-1151.

Salomon, G. (1984). Television is "easy" and print is "tough": The differential investment of mental effort in learning as a function of perceptions and attributions. *Journal of Educational Psychology, 76,* 647-658.

Scarborough, H.S., Dobrich, W., & Hager, M. (1991). Preschool literacy experience and later reading achievement. *Journal of Learning Disabilities, 24 (8),* 508-511.

Senechal, M. & LeFevre, J. (2002). Parental involvement in the development of children's reading skill: A five-year longitudinal study. *Child Development, 73,* 445-460.

Smith, S.S., & Dixon, R.G. (1995). Literacy concepts of low-and middle-class four-year-olds entering preschool. *The Journal of Educational Research, 88(4),* 243-253.

Stevenson, H.W., & Neuman, R.S., (1986). Long-term prediction of achievement and attitudes in mathematics and reading. *Child Development, 57,* 76-93.

Storch, S.A., & Whitehurst, G.J. (2002). Oral language and code-related precursors to reading: Evidence from a longitudinal structural model. *Developmental Psychology, 38 (6),* 934-947.

Strickland, D.S., & Rath, L.K. (2000, August). *Between the Lions*: Public television promotes early literacy. *Reading Online, 42(2).* Retrieved January 6, 2005, from http://www.readingonline.org/articles.art_index.asp?HREF=/articles/strickland/index.html.

Sulzby, E. (1985). Children's emergent reading of favorite storybooks: A developmental study. *Reading Research Quarterly, 20,* 458-481.

Tunmer, W.E., Nesdale, A.R., & Wright, A.D. (1987). Syntactic awareness and reading acquisition. *British Journal of Developmental Psychology, 5,* 25-34.

Tunmer, W.W., Herriman, M.L., & Nesdale, A.R. (1988). Metalinguistic abilities and beginning reading. *Reading Research Quarterly, 23,* 134-158.

Valdez-Menchaca, M.C., & Whitehurst, G.J. (1992). Accelerating Language Development Through Picture Book Reading: A Systematic Extension to Mexican Day Care. *Developmental Psychology, 28,* 1106-1114.

Vandervelden, M.C. & Siegel, L.S. (1995). Phonological recoding and phoneme awareness in early literacy: A developmental approach. *Reading Research Quarterly, 30,* 854-875.

Vygotsky, L.S. (1978). The zone of proximal development. In M.Cole, V. John-Steiner, S. Scribner, & E. Soberman (Eds.). *Mind in society: the development of higher mental processes:* Cambridge, MA: Harvard University Press.

Wartella, E.A, Lee, J.H, Caplovitz, A.G. (2002). *Children and interactive media: An updated research compendium.* Available at http://www.digital-kids.net.

White, T.G., Graves, M.F., Slater, W.H. (1990). Growth of reading vocabulary in diverse elementary schools: Decoding and word meaning. *Journal of Educational Psychology, 82,* 281-290.

Whitehurst, G.J. & Lonigan, C.J. (1998). Child development and emergent literacy. *Child Development, 69 (3),* 848-872.

Whitehurst, G.J., Falco, F.L., Lonigan, C.J., Fischel, J.E., DeBaryshe, B.D., Valdez-Menchaca, M.C., & Caulfield, M. (1988). Accelerating language development through picture book reading. *Developmental Psychology, 24 (4),* 552-559.

Williams, P.A., Haertel, E.H., Haertel, G.D., & Walberg, H.J. (1982). The impact of leisure-time television on school learning: A research synthesis. *American Educational Research Journal, 19,* 19-50.

Woodard, E.H., & Gridina, N. (2000). *Media in the home 2000: The fifth annual survey of parents and children.* Philadelphia: University of Pennsylvania, The Annenberg Public Policy Center. Retrieved December 20, 2004, from http://www.appcpenn.org/mediainhome/survey/survey7.pdf.

Wright, J.C., Huston, A.C., Murphy, K.C., St. Peters, M., Pinon, M., Cantlin, R., Kotler, J. (2001). The relations of early television viewing to school readiness and vocabulary of children from low-income families: The Early Window Project. *Child Development, 72,* 1347-1366.

Wright, J.C., Huston, A.C., Scantlin, R., & Kotler, J. (2001). The Early Window Project: *Sesame Street* prepares children for school. In S.M. Fisch & R.T. Truglio (Eds.), *"G" is for growing: Thirty years of research on children and Sesame Street* (pp97-114). Mahwah, NJ: Lawrence Erlbaum Associates.

Winn, M. (1985). *The Plug-In Drug.* New York: Viking Press.

Zill, N. (2001). Does *Sesame Street* enhance school readiness?: Evidence from a national survey of children. In S.M. Fisch, & R.T. Truglio (Eds.), *"G" is for growing: Thirty years of research on children and Sesame Street* (pp. 115-130). Mahwah, NJ: Lawrence Erlbaum Associates.

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