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Early readers and electronic texts: CD-ROM storybook features that influence reading behaviors

Beginning readers' interactions with CD-ROM storybooks were studied to identify reading behaviors associated with this medium.

Technology is changing the face of modern life as many everyday tasks are computerized, from turning on an oven to accessing financial resources. It is clear that workers of the future, today's children, will need to be technologically literate to compete with industrialized societies in a global economy. The National Educational Technology Standards (NETS) Project (International Society for Technology in Education, 2002) pointed out that the world is now a different place and that in order to live, learn, and work successfully, it is vital that students have opportunities to use technology during their school years. They argued that technology should be used in meaningful ways to support the instructional goals of developing students who are effective problem solvers; decision makers; communicators; and informed, responsible, contributing citizens. Labbo and Reinking (1999) supported this view and made a distinction between learning *from* the computer, such as in drill and practice exercises, and learning *with* the computer in ways that stimulate thinking and result in changing students' orientations toward learning. They suggested a need for research to investigate the impact of technology on students' approaches to learning, arguing that technology has the potential to transform reading and writing and, therefore, literacy instruction.

Spurred on by business, parents, and school boards, technology is indeed finding its way into the classroom as teachers have growing access to technology for instructional purposes. To guide teachers in their use of technology in the classroom, NETS provides standards for what students should be able to do with technology at the end of specified developmental grade clusters. For students in the beginning reading stages, typically associated with the NETS grade cluster of pre-K–2, it is recommended that by the end of second grade, students should "use developmentally appropriate multimedia resources to support learning" (International Society for Technology in Education, 2002). Electronic texts, such as CD-ROM storybooks, are one example of how teachers of beginning readers can use technology to advance the goals of their reading program. CD-ROM storybooks present children's literature with text and illustrations similar to a traditional text and also include elements designed to enhance the reading experience for beginning readers. Much variation exists between publishers in the features and elements that are included in these storybooks, making each type or series somewhat different in how it attempts to support readers. However, many CD-ROM storybooks include audio and graphic animations where book characters talk and settings come alive. For example, on many pages of a story, "hotspots" appear that, when activated by the child, produce animated graphics, sound effects, and other features. Additional features allow students to manipulate and individualize the reading environment by choosing to highlight a word or phrase to hear an audio pronunciation, or

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students can click on a word to access its definition. In other instances, CD-ROM storybooks will present spelling analogies for readers when they click on a word within the text. CD-ROM storybooks may also read the entire story automatically, simulating a read-aloud experience for the child. These variations make it important for teachers to select CD-ROM storybooks carefully to ensure that their instructional goals will be met.

Benefits of CD-ROM storybooks

Studies investigating the use of CD-ROM storybooks for instructional purposes have found several benefits to children's literacy development (Chu, 1995; Lefever-Davis, 1999; Leu, 1997; Reinking, 1997). These electronic texts provide readers with the ability to self-select assistance, thereby increasing individual control over the learning environment. In other words, they are able to make the choice for themselves when and where they need help. When they come to an unfamiliar word or phrase, they can choose to click on the text to have the computer read it aloud for them. When students exercise this option, it removes the burden of decoding (McKenna, 1998). Students do not expend mental energy to decipher words nor do they have to struggle with new vocabulary. Therefore, theoretically, more time and energy are left to process meaning for comprehension.

Comprehension is further enhanced through animations contained in the CD-ROM storybooks that reinforce context by signaling story events and mood. In the story *The Three Little Pigs* (The Learning Company, 1996) an animated graphic is seen of the wolf blowing down the house while the pigs inside scream in fright. The context is established from watching this scene unfold via animation prior to children reading the text. Foreboding music emanates from the computer as children hear the pigs screaming and the wolf yelling—clues to the reader that something is about to happen. This pairing of graphics and audio not only enhances the context but also helps set the mood the author is trying to establish.

Lending support to the view that CD-ROM storybooks enhance reading comprehension, Pearman (2003) and Mathews (1996) conducted related studies with second- and third-grade students, comparing reading comprehension of CD-ROM storybooks to reading comprehension of traditional texts. Both studies found that students gave richer story retellings after reading CD-ROM storybooks. In addition, Doty, Popplewell, and Byers (2001) found that second graders scored higher on comprehension questions after reading CD-ROM storybooks.

Closely connected to aiding comprehension, vocabulary development is also enhanced through the use of CD-ROM storybooks. As students read CD-ROM storybooks, they hear story characters in animated scenes using words from the printed story in their speech. For example, in the same interactive story of *The Three Little Pigs* (The Learning Company, 1996) on the pages where the little pigs ask for the materials to build their homes, they verbalize the sentences found in the written text. The first instance of this occurs when the first little pig asks, "May I have some straw, sir?" After watching the animation and hearing these words spoken, the child reads the passage where these words are presented in the text. This provides support to the reader by enabling story vocabulary to be "previewed" prior to independent reading. This helps children connect spoken words with written words by putting them in context, helping to establish the meaning associated with various words or phrases.

Disadvantages of CD-ROM storybooks

However, not all researchers agree that features in CD-ROM storybooks are beneficial. Lewin (1996) argued that, over time, children may become dependent on these features to decode words or read the story rather than develop their own abilities. When children have the words pronounced for them by the computer, they stop making attempts to decode independently. Without practicing decoding skills, students may never develop the ability to decode words on their own. In the long run, an overreliance on certain electronic text features may hinder literacy development because the use of reading strategies does not become an integral part of the reading process for beginning readers (McKenna, 1998). Moreover, when children become dependent on the electronic support they stop taking risks and need prompts and assistance

with the same words repeatedly (Pearman, 2003). This is similar to the idea of learned helplessness (Kerr, 2001), which has been shown to emerge when teachers demonstrate lower expectations of students by immediately providing word pronunciations before children have a chance to use their own skills. Teachers today are encouraged to prompt children's use of cueing systems when they encounter a difficult word rather than simply pronounce a word. However, computers lack the ability to make instructional decisions regarding what type of assistance is most valuable in any given situation; rather, the computer simply provides the word pronunciation upon request.

Purpose of study

Due to the growing availability of technology in classrooms and increased attention to the use of technology by groups such as NETS, CD-ROM storybooks are becoming more widely used for instructional purposes. As the use of CD-ROM storybooks becomes more commonplace, more research is needed to examine the ramifications of such use on children's reading. While several studies (Doty, Popplewell, & Byers, 2001; Mathews, 1996; Pearman, 2003) have focused on the outcomes of CD-ROM storybooks with regard to their impact on vocabulary development and reading comprehension, less has been said about the effect on the process of reading. For example, due to the prevalence of computer and electronic games in homes today, many children approach reading CD-ROM storybooks as a game as opposed to reading a book. This orientation, plus children's use of features present in CD-ROM storybooks, merits further investigation. The purpose of this study was to look at the behaviors exhibited by students while reading CD-ROM storybooks to determine how these behaviors affected their approach to reading.

Participants and data collection

Participants were 11 students 6 to 7 years of age enrolled in a first-grade classroom and from an economically and culturally diverse elementary school in the south-central United States. Five girls and 6 boys representing a wide range of reading levels took part in the study. The study consisted of having each child read two interactive storybooks, referred to as CD-ROM storybooks or talking books.

The CD-ROM storybooks, which are part of the Reader Rabbit series (The Learning Company, 1996), were selected based on their appropriateness for this age of reader with regard to content and reading level. This series uses digitized pronunciations of selected words or sentences. In addition, the reader can select the option to have the entire story read aloud. The Reader Rabbit series also includes graphics with hot spots that, if selected, produce animations and sound effects. Most items in an illustration include a hot spot. With a click of the mouse, birds fly around the page, characters speak, and leaves on trees rustle. However, animations are not limited to those requiring readers to select or activate them; this series also includes graphics and sound effects that are activated automatically without prompting by the reader. For example, frequently, when clicking on the button to advance to a new page, sound effects and animations occur before the new page appears.

In order to be sensitive to the attention span of this age of learner, reading sessions were no longer than 20 minutes and many were much shorter. While this particular school had plenty of computers available for student use and students had daily opportunities to use them, typical computer use was geared primarily toward drill and practice exercises with occasional opportunities to visit specific Internet sites. Therefore, the students were enthralled with this new adventure of story reading via CD-ROM. They were excited about their involvement in the activity and enjoyed reading to the researchers.

The researchers instructed the children to read the stories as if they were alone and provided very little intervention, if any, during the reading sessions. Intervention was used only to get the reader back on track and focused on the reading rather than as an instructional opportunity. For example, occasionally the researchers found it necessary to direct the readers' attention back to the story, but very few other prompts were used.

During each reading, a running record was administered to assess student reading accuracy rate and to record behaviors exhibited by each student. The running record scoring sheet was adapted by increasing the width of the side margins to

TABLE 1
Participant profiles

Reading level	Tracking	Electronic feature dependency	Distraction	Spectator stance	Electronic feature limitations	Electronic features as tools
Better readers (above 95% accuracy rate)						
Seth		X	X	X	X	
Conner		X				X
Heather	X				X	
Clarice		X		X	X	
Middle readers (90–94% accuracy rate)						
Dakota	X	X	X	X	X	
Britney	X		X	X	X	
Brenda				X	X	X
Clayton						X
Struggling readers (below 90% accuracy rate)						
Natasha	X	X	X	X		
Gage	X	X		X		X
Tripp	X	X	X		X	X

accommodate observations made when students used features present within the CD-ROM storybooks. When students used electronic features such as clicking on words to have them pronounced or clicking to animate graphics, notes were inserted in the margins of the running record scoring sheet to describe specific observed behaviors. Accuracy rates were calculated to describe students on the basis of their reading proficiency in order to give some indication if observed behaviors occurred across proficiency levels. Of the 11 students participating in the study, 4 read the CD-ROM storybooks at or above 95% accuracy, 4 read with between 90% and 94% accuracy, and 3 read with below 90% accuracy. The lowest score was 85% (see Table 1). In addition, field notes were taken of researchers' observations of student behaviors as they read each CD-ROM storybook. Following data collection, both researchers analyzed the data together. Running records and field notes were examined to identify any behaviors specifically related to reading CD-ROM storybooks. Each document was read aloud by one of the researchers. As a behavior was noted, it was highlighted and recorded on a separate sheet in order to establish categories of behaviors. Categories were established if the behavior occurred with more than three readers. These open categories were then collapsed into six main categories by grouping similar behaviors. A definition for each category was then written and data were reread to ensure that all included behaviors were consistent with the derived definition.

Results

The 11 participants differed in their use and reaction to the electronic features within CD-ROM storybooks. For instance, Clayton (all student names are pseudonyms) seemed indifferent to the electronic features available to him and rarely activated them. In contrast, Gage relied heavily on their use to support his reading, and Seth used them primarily for their entertainment value. However, behaviors common across students revealed the following six main categories: tracking, electronic feature dependency, distraction, spectator stance, electronic feature limitations, and electronic features as tools. Table 1 lists the behaviors exhibited by each reader.

Tracking. Children in this study had a tendency to use the mouse or cursor to keep their place during reading. This behavior is similar to finger pointing

behaviors of beginning readers with traditional texts. However, the children in this study did not begin reading the CD-ROM storybooks in this manner. When they first began reading, children read the electronic text without the physical manipulation of the mouse, but as the reading episode continued and became more prolonged, the children began to use the mouse to keep their place. This behavior usually did not appear until midway through the text.

Britney, one of the readers in the middle group, read a 21-page story and didn't begin to track the print with the mouse until two thirds of the way through. To begin reading this text, she would position the cursor on the page corner in preparation for advancing to the next page. As the story progressed and the length of reading time became prolonged, Britney began to tire, and on page 14 she started to track the words with the cursor and did so to the end of the story. This pattern of behavior remained consistent with all levels of readers. For example, Gage was a struggling reader who soon realized that he could prompt the computer to read the entire text for him and would choose that option frequently. After listening to the computer read aloud, he would read the text independently while tracking the words with the mouse. Again, this appeared to be a function of fatigue, as he did not track the print at the beginning of his reading.

Electronic feature dependency. Children frequently used electronic features such as clicking on words and sentences to enable the computer to pronounce words for them instead of making an attempt to read independently. For example, Dakota would often click on unknown words immediately upon encountering them rather than attempting to pronounce them on his own. Tripp, like Dakota, also used the computer to pronounce words. He did not appear to be learning the words the computer read for him because he would click on the same words repeatedly throughout the story. Students also enabled the pronunciation feature even with words they had read independently in the text before. There were times when students would make a feeble attempt at decoding a word, but they were not persistent in their attempts, choosing to click on the word instead.

This reliance on the digital pronunciation became almost habitual for some readers, drastically diminishing the use of their own skills at decoding. This was particularly true for Gage, who frequently began to sound out words but quickly abandoned those attempts and prompted the digital pronunciation feature. This behavior became more pronounced the longer he read, to the point where he made no attempts to decode and selected the option to have the entire page read aloud for him. This strategy appeared to enable him to follow the story line and gain meaning without employing decoding skills.

Distraction. As the students became more involved in reading the CD-ROM storybooks, some of them became increasingly distracted by the features. For example, on most pages of the story, before the reader could begin reading, animations would appear and play out a scene before the story words would appear. These animation features seemed to be distracting, particularly for Heather, a strong reader, who regularly placed the cursor on the arrow to turn the page immediately following her reading and sighed impatiently waiting for the automatic animations to end. She was not interested in activating any of the optional animations and, indeed, seemed more irritated than entertained by them.

These animation features dramatically prolonged the reading time required to complete the story for struggling as well as strong readers and seemed to result in physical fatigue on the part of the students. As the students became tired of reading, several tended to shift into more of an "observation mode," using the animation features as a sort of "mental break." This became a predominant strategy for Seth and Tripp, who clicked on every graphic on the page to see what items included hot spots that activated animations before they turned their attention to reading.

Spectator stance. Some of the readers approached the electronic text environment as a source of entertainment. Some even referred to the activity as a game. This was particularly evident with Gage, who would click on every graphic on the page to see if it had animation features. As he did so, he verbalized, "I like this game." Similarly, Natasha, shortly into her first reading of an electronic text, would slide into a spectator stance and have the computer read the entire page aloud for her while she watched the computer animations.

Natasha quickly adopted this passive approach and on most pages did not actively engage in reading the text at all. In another example of this spectator stance, several of the students made a game of finding the wolf in the graphics. This behavior was encouraged by the graphics, because the wolf appeared in a hide-and-seek fashion throughout the story, often peering around trees and disappearing quickly.

The difference between this category and the category of distraction is, in essence, the reader's mental orientation toward the task. In the distraction category, readers viewed the hot spot features as a distraction; in the spectator stance category, the feature appealed to their orientation of the reading task as being more of a game or source of entertainment.

Electronic feature limitations. Limitations imposed by the technological features also led to student frustrations with the electronic text format. For example, because the graphics with animations were so dense, the simple task of turning the page was slow, taking several seconds. This frustrated some of the readers who became impatient waiting for the chance to continue reading. For example, it was so slow that Seth would clap his hands impatiently waiting for the next page to load and advance. Brenda, too, found the length of time needed for the pages to advance burdensome. She would often sigh exasperatedly as she waited for the page to turn.

Useful features of these particular CD-ROM storybooks were the vocalizations and animations that would begin immediately after a page was turned. Characters would begin talking, and graphics would be automatically activated without prompting by the reader. Britney would place her cursor on the arrow to turn the page and begin to read on the next page, only to be interrupted by the computer. She expressed her frustration at not being able to turn off this feature by making "ugh" sounds impatiently while she waited for the computer animations to end so that she could continue with her reading.

Electronic features as tools. Some of the readers tended to use the computer pronunciations as a model for their own reading, which seemed to promote a sense of self-confidence. For instance, one of the stronger readers, Conner, would have the computer read entire lines and then follow up by reading the same lines independently, echoing the same voice inflections as the computer narration. At other times, another student, Gage, would activate the feature to read a longer passage and read along with the computer. After doing this several times, Gage finally read an entire page independently, saying afterward, "I read that in my mind," meaning he didn't need the computer assistance anymore. Because Gage, while reading independently, substituted several words but retained the overall meaning, it was possible that he was relying on his auditory memory to read the passage independently rather than using his decoding skills. Nonetheless, the digital pronunciations did appear to improve his self-confidence and persistence in reading the text. The digital pronunciations also provided a model of fluent reading for Gage. He struggled with the text when he read independently, but when he had the computer read the text first, his subsequent reading became much more fluent.

The voice pronunciation feature was also used to confirm students' predictions of words in the text. Natasha, who would read a word and then click on it to make sure she was correct, exhibited use of this function. She continued to do so throughout the text, clicking on words she had read with success previously.

These children seemed to really embrace the benefits of the electronic features and understood the role that the computer could play in assisting them. In one of the stories, Gage clicked on an unfamiliar word purposefully, saying, "I just need a little help." Clearly, Gage was using the electronic features as tools to support his reading.

Discussion

Results from this study indicate CD-ROM storybooks have the potential to support readers and promote reading skill. The beginning readers were very much aware of the capabilities of these electronic features and used them specifically to promote their reading. However, the extent and manner in which readers used the support varied. For instance, the struggling readers were more likely to use the tools to support the actual reading process. They used the digital pronunciations to

familiarize themselves with a word, confirm their predictions, and gain meaning. This group also used the cursor to track the text making it easier to keep their place while reading independently. In contrast, it appeared that proficient readers used the digital pronunciation tool in a more sophisticated manner. They used it to fine-tune their reading, using the digital pronunciations as a model for voice intonation and expression.

This study also highlights features of CD-ROM storybooks that may prove to be distractions for students. The length of time it takes for pages to turn disrupts the reading process, delays the opportunity for students to begin reading, and increases their frustration level. This frustration seemed particularly evident for the more proficient readers. While this feature is certainly related to the hardware that is used to play the CD-ROM storybooks, it is a limitation to be considered.

Related to this limitation, the overabundance of hot spots available to readers promoted a spectator stance and sense of play on the part of the reader rather than strategic reading. When these children's attention became focused predominantly on activating graphics and sound effects, they began to view the storybook event as more of a game. A distinction is being made here between the hot spots located within the illustrations and the automatically activated animations that follow the story line. The hot spots embedded in the graphics put the readers in a spectator stance in which they approached the reading in much the same way as a child approaches playing an electronic game. Their attention was on the graphic features of the illustrations as opposed to the text. In cases where these hot spots do not advance the story line, they have the potential to distract. For example, it serves no purpose in promoting reading comprehension or word decoding to have birds flying around the page in a story where birds are not even secondary characters.

The digital pronunciations were a predominant feature of the CD-ROM storybooks used in this study and were interpreted as a support and a distraction for developing beginning readers' skills. As mentioned previously, readers used this feature to confirm their predictions and to serve as a model for fluent reading. However, this feature also could be seen as a distraction. The ready access to digital pronunciations allowed some readers to take on a more passive role and become dependent on this feature rather than sharpen their decoding skills.

Instructional implications

Overall results from this study point out the advantages and disadvantages of using CD-ROM storybooks for beginning readers. This knowledge can be useful to teachers when designing lessons. In order to support specific instructional goals, teachers will need to select CD-ROM storybooks with features that promote their intentions. For example, if the intent is to promote reading comprehension, the animations and sound effects that occur automatically can be beneficial, because they can help to set the mood and establish a setting for the story. However, if the instructional focus is on decoding, these same features might introduce some negative as well as positive elements. The animations can establish a context that is important in decoding, but they can also distract readers from reading the text. Care will have to be taken to ensure that CD-ROM storybooks are being used efficiently to promote rather than reduce time spent reading. Labbo et al. (2003) offered advice and resources including websites that describe lesson plans and examples of teachers incorporating computers effectively in their daily instruction.

Specific recommendations based on the results of this study suggest it is prudent to be aware of the potential distraction and plan lessons that minimize those distractions and maximize the benefits. For example, in order to take advantage of the length of time it takes for some CD-ROM storybooks to advance their pages, teachers should preview the story to find the pages that take the longest to upload and construct an appropriate prompt or cue to which students complete a written response. For example, for the story "The Three Little Pigs," the teacher might have a response sheet available for the page where the wolf is about to come to the last of the pigs' homes, the brick house, to blow it down. The children can write their prediction as to whether the wolf will be successful or not. Depending on the literacy development of the child, the response sheet can be simplified by having students select from three or four pictorial options, or more advanced students might write their own sentences predicting the outcome.

In order to take advantage of the animation features of CD-ROM storybooks and their ability to promote a mood or establish a context, the teacher can do an initial reading of the story in a shared reading format with a large group. A projector can be used to enlarge the image onto a screen while the teacher or computer reads the story aloud. Some CD-ROM storybooks include a feature that highlights words as they are pronounced by the computer. This feature is especially appealing in a shared reading experience because it draws the children's attention to the text in much the same manner as the teacher does when using a pointer to follow text in traditional stories. However, in this electronic format, the teacher's arm is not blocking illustrations or additional text. While reading the CD-ROM storybook, the teacher can discuss the story elements and make predictions. More advanced learners might discuss which story elements the reader can infer from electronic features and which are specifically stated in the text. Reading the CD-ROM storybook with the whole class initially will help to ensure the students have gained a basic knowledge of the story and story vocabulary. Subsequent independent readings can occur with individual students in a listening center.

Again, in an attempt to keep students focused on the reading task, the teacher should set a purpose for reading. In the particular CD-ROM storybooks used in this study, each story came with three versions. One version was traditional and read by a narrator. Different characters from the story read two other versions from their particular viewpoints. If the traditional version is read during shared reading, students can be instructed to read a different version during independent reading and make comparisons between the two.

These examples of using CD-ROM storybooks in the classroom strive to maximize the unique features present in these resources. Many more possibilities exist for embracing these features and using them to teachers' advantage.

Use CD-ROM storybooks with care

Much can be said about the power and potential benefits of using CD-ROM storybooks with beginning readers. One of the most intriguing examples is the ability of CD-ROM storybooks to set a mood and context for a story in a highly appealing manner. Story schema is activated and many story words are introduced so as to engage readers and entice them into the story. These storybooks can also support struggling readers' initial attempts at unfamiliar vocabulary and increase their confidence and tendency to take risks with new words. Therefore, CD-ROM storybooks can indeed be a powerful tool and an asset to the teaching of reading.

However, there are also elements of CD-ROM storybooks that require caution or, at least, an informed perspective when choosing this resource as an instructional tool. For instance, readers who become too engaged in the animation features of the texts will have less time available for text reading. This should cause concern because, as researchers like Allington (2001) have contended, the amount of time children spend reading in school is already woefully inadequate.

In addition, teachers must be cognizant of the potential of CD-ROM storybooks to promote a passivity on the part of readers, putting them into a sort of spectator stance where they let the computer do the work of reading rather than becoming actively engaged in the reading process. CD-ROM storybooks make it easy for readers to abandon their strategic use of cueing systems to decode words and read for meaning.

Finally, the limited number of available titles in CD-ROM format may make the selection of developmentally appropriate stories that support specific instructional goals a challenge for teachers. In addition, the expense of CD-ROM storybooks compared to traditional texts may impede the availability of a wide range of CD-ROM storybooks on a variety of reading levels, which raises the issue of equitable access.

Beginning readers pose special challenges for teachers working to develop literacy skills in these young children. As any teacher knows, children develop their literacy skills in their own unique time frame. Therefore, it is common for teachers to have students in their classes who represent a range of developmental levels. However, one thing is certain. Beginning readers need many opportunities to interact with text. The more successful opportunities they have, the more accomplished they become. Teachers can benefit from many resources designed to engage children in successful reading

opportunities, and CD-ROM storybooks can provide one of those resources (McKenna, 1998).

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