

Picture Storybooks Go Digital: Pros and Cons

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An increasing number of picture storybooks for young children have become available electronically, and there has been an explosion in children's storybook apps, especially since tablet computers such as iPads have become popular. Today's e-books have evolved significantly from platforms that once only displayed simple digitized versions of print books to tools that can now support highly interactive, multimedia experiences. At a minimum, multimedia additions to electronic picture storybooks include at least an oral reading of the story text. In addition, they may involve symbolic elements typically not used with print books: live-action video, digital graphics, animations, music, sound effects, and interactivity of text (e.g., highlighting of text while it is narrated). Some educators are of the opinion that the multimedia additions are unnecessary and may even work counterproductively. Interaction with adults is still considered to be the optimal way to familiarize children with stories and the varied and rich vocabulary in picture storybooks. On the other hand, additional features may provide new opportunities for text comprehension.

In the age of Common Core State Standards (National Governors Association Center for Best Practices & Council of Chief State School Officers, 2010), teachers may wonder whether e-books are appropriate tools for familiarizing 4- to 6-year-olds with children's literature and contributing to a positive relationship with reading that lasts a lifetime: When young children have learned to enjoy books, they will continue to read, whereby technical reading and oral language skills keep improving, resulting in sustained motivation to read (Mol & Bus, 2011). The gold standard of book reading to 4- to 6-year-olds is interactive reading that combines an oral rendition of text with clarification about the story text through the actions of pointing at pictures and highlighting details mentioned in the text (Whitehurst & Lonigan, 2001). In addition to building comprehension skills, shared book reading may also promote print knowledge, especially when parents actively focus children's

attention on print features (e.g., Justice & Ezell, 2000). Therefore, teachers of preschoolers and kindergarten children may want to explore whether additional multimedia features can bolster similar or additional beneficial effects of e-book reading. As the number of living storybooks available on the Internet and through apps and other digital media increases, it becomes more and more imperative to examine effects of electronic books that allow young children to hear a story and explore a range of activities while the tale moves along.

Shared Book Reading

One of the first studies of the Leiden group appeared to give interactive, multimedia books on the computer the green light (de Jong & Bus, 2004). The study compared the gold standard of *shared* print book reading with *independent* reading of interactive books on the computer. In the shared reading condition, the adult stimulated children to make inferences (e.g., “Do you see why the bride cannot sit on the luggage carrier?”) or to make a connection between the text and picture (e.g., paraphrasing the text the experimenter pointed to the picture, saying, “See, Little Tiger is carried first by Little Bear, and then by the strong wolf and the strong goat”). In the independent e-book condition, children “read” a story from the same book series on their own. The digitized Janosch books (1998a, 1998b) included, apart from an oral rendition of the tale, click-accessible hotspots that revealed a sound or animation, mostly inconsistent with the story text (e.g., a tea towel turns into a dove). With simple filmic means, the illustrations in the book were animated to dramatize events highlighted in the story text (e.g., the doctor bends toward the X-ray saying: “Ah, a faulty stripe.”). Other depictions in the illustration that were not highlighted in the text were not animated.

Children’s retellings of the story text were of the same quality whether children shared the book with an adult who actively involved the children by asking questions (the gold standard of reading) or “read” the animated, interactive computer version on their own. There was no evidence that the added eye and ear candy (the hotspots revealing effects that were surprising but mostly not helpful for understanding the story text) distracted children to the detriment of story comprehension. Apparently, for parents or teachers looking for viable options for children to listen to stories, e-books can meet the need without placing a heavy burden on the adult. Researchers from the Joan Ganz Cooney Center (Chiong, Ree, Takeuchi, & Erickson, 2012) even conclude that attempts by adults to share interactive e-books with their child may distort the e-book reading

experience. Interactive e-books are mostly designed in a way that does not allow adults to access and control settings to customize a shared reading.

The researchers asked 32 pairs of parents and their 3- to 6-year-old children to share both a print book and an e-book. Half of the pairs read a *basic* e-book (where pictures appear on the computer but no multimedia features are included), and the other half read an *enhanced* e-book (which included highly interactive, multimedia experiences). The results buttressed the argument that it is preferable to choose print or basic e-books when you read to children and want to prioritize literacy-building experiences over ones intended “just for fun.” The enhanced e-book was much less effective than a print and basic e-book in supporting the benefits of shared reading, probably because the e-book enhancements in the target book were not designed in a way that allows parents to customize interactive experiences. Apps included fun animations that may easily provoke *non-content related actions* (e.g., behavior- or device-focused talk, pushing hands away). In sum, the extra features of enhanced e-books appeared to distract adults and children alike from the story, negatively affecting the nature of conversation and the amount of detail children recall.

Bells and Whistles in Enhanced E-Books

Unlike traditional printed picture storybooks, electronic storybooks show less homogeneity in design features due to a variety of bells and whistles (de Jong & Bus, 2003; Korat & Shamir, 2004; Roskos, Brueck, & Widman, 2009). In some books, pictures are similar to those in the printed version of the book, but other books may include animated (details of) pictures. Apart from an oral rendition of text, electronic picture storybooks may include sound effects and background music. Furthermore, some electronic stories include games or other interactive features such as hotspots, often revealing some kind of audio or visual effect when clicked on. How do these e-book features affect children’s language and literacy development?

Animated Illustrations

The Leiden group found beneficial effects of e-books that presented animated illustrations instead of static ones in addition to an oral rendition of text (e.g., Smeets & Bus, 2012b; Verhallen & Bus, 2010; Verhallen, Bus, & de Jong, 2006). In these studies, first- and second-language learners repeatedly heard either a storybook with animated illustrations that dramatize the story, as in the Janosch series (e.g., 1998a, 1998b), or an electronic version of a similar story with merely static pictures. Text

comprehension—especially vocabulary—improved when children “read” the animated e-book. We assume that the animated parts of pictures make it easier for children to match relevant details in illustrations with oral text, thus facilitating word and text comprehension. Animated details attract more visual attention than other parts, which may promote contiguity between oral text and illustration; that is, corresponding text is pronounced simultaneously with animated details in the illustration. For example, the text “Winnie is furious” in the story *Winnie the Witch* (Thomas & Gorky, 1996) is accompanied by an illustration showing an angry-looking witch making wild movements, which may help to coordinate the text with Winnie’s behavior. Likewise, camera effects, such as zoom, may help to match relevant details in illustrations with oral text, thereby supporting children’s text comprehension.

Normally, children fixate more than 90% of their time on the illustrations in picture storybooks while they listen to an oral reading of text (e.g., Evans & Saint-Aubin, 2005) and, what probably is most important, they fixate more often and longer on details in illustrations that are highlighted in the story text than on elements that are not (Verhallen & Bus, 2011). That is, while looking at illustrations in books, children search for elements that are highlighted in the story text. For example, while listening to a story about a mouse who wants to pick strawberries and therefore brought his wheelbarrow with him, we see their eyes successively fixate on the mouse, the strawberries, and the wheelbarrow. Lavishly illustrated storybooks for young children may complicate children’s finding their way through the illustration and may instead coordinate *what* children look at in illustrations with the oral text. Take, for instance, the storybook *Rokko the Crocodile* (de Wijs, 2001). One of the illustrations shows Rokko and his parents watching a dozen crocodile eggs, waiting for Rokko’s siblings to appear. The illustration shows, in addition to intact eggs, some eggs that are broken. Sometimes a baby crocodile’s snout is visible, which demonstrates how young crocodiles appear from an egg. However, other broken eggs show a tail, which could also mean that a crocodile is crawling inside the egg. By and large, there is much room for errors in interpreting the story language (e.g., what is meant by *siblings* and what does *appearing* mean?).

Simultaneous processing of story text and illustrations, as is facilitated by animated e-books (Schnotz & Rasch, 2005), may explain why animated versions of picture storybooks were preferable to versions with only static pictures. Holding verbal and visual information in working memory at the same time may help children build stronger connections between visual and verbal information. When a word is processed through both the verbal

and visual channels, this stimulates dual coding of information (Paivio, 1986), which facilitates storing and retaining word meanings. It seems evident that the quality of animations is vital. Film-like presentations of stories may not have the same effects when they include “wild” animations that do not match the story text. The “crowdedness” of animated presentations, requiring children to process simultaneously through multiple modalities that do not match, may even cause overload of the brain, which may reduce learning about the story language. We expect, therefore, negative results for cartoon-like e-books that include numerous animations that do not match the story language.

Sound Effects and Music

Likewise, additional audio features in electronic books are perceptually salient and thus likely to elicit and sustain children’s attention (e.g., Barr, Zack, Garcia, & Muentener, 2008). Moreover, background music may lend support to story comprehension, for instance by stressing the characters’ moods (e.g., sadness or happiness). Adding the sound of *knocking* on a door, birds *whistling*, or a motor *humming* may help clarify these words’ meanings. When sounds are coded simultaneously with the oral text, dual coding may facilitate storage and retrieval of unknown words (Paivio, 1986).

A recent study (Smeets, van Dijken, & Bus, 2012) shows that background music and sounds are not beneficial for all children, however. When children are diagnosed with severe language impairments (SLI), aural multimedia additions distort the beneficial effects of video stories. Instead of supporting text comprehension by emphasizing suspense, stressing moods (such as happiness or sadness), and clarifying the meanings of words, the addition of music and sounds seems to complicate the perception of speech by these children. Differential effects of video and music as this study revealed for SLI children have not been examined in normal populations, but it may be worth the effort to find out which elements of video storybooks make these e-books more or less effective in other groups (for instance in easily distractible groups).

The finding that music and sounds were detrimental for word learning in children with SLI has far-reaching implications for e-book development. In many storybook apps, the volume of the soundtrack is loud and not adjustable, which may be a problem for children with language delays in particular. In Disney’s *Cars 2*, the narration can barely be heard with the exciting background music and sound effects of race cars driving by. The storybook app *Magic Gold Fish* by Yasmin Studios includes hotspots with sound effects (e.g., a fish splashing in the water) that are very loud

in comparison with the narration. Interestingly, the app *Pansjo Tummy* developed by ThenQ includes an option to turn off background music and narration separately; such a feature makes an e-book more adaptive to support learning in different target groups.

Interactivity in Enhanced E-Books

Games—Too Many Choices?

Largely due to the increased popularity of touch screen devices, a considerable quantity of e-books includes interactive features such as puzzles, coloring, or memory games, but there is concern for the educational quality of these stories (e.g., de Jong & Bus, 2003; Korat & Shamir, 2004; Roskos et al., 2009; Zucker, Moody, & McKenna, 2009). These activities might be entertaining and increase children’s motivation (e.g., Ricci & Beal, 2002), but they may also promote a “game-playing mode” rather than stimulate children to focus on the story (de Jong & Bus, 2002; Labbo & Kuhn, 2000).

A study targeting one of the first digitized picture storybooks that appeared on the Dutch market, *P.B. Bear’s Birthday Party* (Davis, 1996), showed that too many choices of interactive options is risky given that most young children bring a game-playing mentality to the computer (personal communication with Linda Labbo, April 19, 2004). Each screen of *P.B. Bear’s Birthday Party* offered a choice of hotspots to click on resulting in one or more of the following:

- Speech feedback for the complete text on the screen or speech feedback for single-text phrases or individual words
- A film-like presentation of the events (e.g., P.B. Bear starts unwrapping the package as described by the text)
- Animations (clicking on rebus-like icons that replace the nouns in the printed text, the written word appears simultaneously with short, 4.5-second animations and their pronunciation)

As none of the actions happened automatically, the program opened up the possibility to revert to game playing without paying attention to the story text. The result, as concluded by de Jong and Bus (2002), was that the iconic modes of this book (e.g., animated illustrations, animations, games) attracted the 4- and 5-year-old participants’ attention at the expense of listening to the oral story text. After six 15-minute sessions, only a minority of the children in this study had listened to the entire story text more than once, even though they had sufficient opportunity to

read the story six times. Actually, children explored *P.B. Bear's Birthday Party* in bits and pieces, activating animations, accessing text fragments, and ignoring connected text. As a result, the children in the experimental condition did not know the story content better than those in a control condition, who played some other computer game and did not hear the story about P.B. Bear. A game-playing disposition may dominate with such books unless teachers carefully establish what students are expected to do with their time with e-books.

Hotspots

In general it is assumed that interactivity is especially effective due to children's active involvement in extracting meanings (Sénéchal, 1997; Sénéchal et al., 1995). Television shows for young children that promote active involvement have been demonstrated to support learning more than programs without this feature (e.g., Crawley, Anderson, Wilder, Williams, & Santomero, 1999). Nickelodeon's *Dora the Explorer* and *Blue's Clues* e-books include, therefore, a "tutor" who makes eye contact with children, asks them questions, pauses for the child to respond, and reacts to the child's answer. Likewise, the first generation of enhanced e-books included hotspots that elaborated on story events or on words in the text. For instance, the story *'I'll Make You Well Again,' Said the Bear* (Janosch, 1998b) contained a scene where Tiger is given an injection prior to an operation. A click on the needle triggers a visualization of how the fluid spreads out in the body. Exploring more recent e-books, we came across many more examples of hotspots that support comprehension of text and story events. In the Dr. Seuss series developed by Oceanhouse Media and Dr. Seuss Enterprises (e.g., *A Cat in the Hat*), objects are defined when clicked on, similar to how parents or teachers may explain the meanings of difficult words (e.g., Biemiller & Boote, 2006; Dickinson & Smith, 1994; Elley, 1989).

Korat and colleagues have reported that e-books with a built-in option to receive word definitions on demand promote word learning (e.g., Shamir & Korat, 2009) in both typically developing children (Shamir, Korat, & Shlafer, 2011) and children at risk for language delays (Shamir et al., 2011). The studies reveal significant pre- to posttest gains in word learning but do not offer concrete evidence for the effects of interactive word-meaning explanations beyond exposure to text alone. Therefore, in a recent study (Smeets & Bus, 2012a), we tested the effectiveness of hotspots that trigger a definition of a difficult word when clicked in comparison with a read-only control condition. For instance, in *Bear Is in Love With Butterfly* (van Haeringen, 2004), a definition of the word *shy* was audio recorded and linked to a hotspot in the illustration. When the mouse touches Bear's

red head, a green circle appears around Bear’s head, which means that the child has found a hotspot. After clicking on the hotspot, the voiceover explains Bear’s mindset: “Bear is shy, his cheeks have turned red.”

These hotspots enhanced growth in vocabulary beyond encounters with words in text (e.g., Biemiller & Boote, 2006; Blewitt et al., 2009). Hotspots were especially beneficial when words were somewhat familiar and children succeeded at the pretest to select a picture that reflects the target word. That is, when words were receptively familiar prior to the intervention, hotspots improved expressive word knowledge (i.e., saying the word and using it in a sentence). We did not find evidence for (expressive) word learning when the words were completely unknown at pretest.

Questions

Children are more actively involved when they are prompted to answer questions. Segers and Verhoeven (2002; 2003), for instance, let children work independently with e-books that included vocabulary games. Children could be asked to place a cup of coffee on the kitchen table, to answer a question (such as, Can a carrot be bought in a bakery?), or to point out or color a certain object in the illustration.

Multiple-choice questions were presented in the e-books focused on in our study (Smeets & Bus, 2012a). For instance, when Bear in the story *Bear Is in Love With Butterfly* (van Haeringen, 2004) is fanning the fire, the story is interrupted for a question by the computer assistant: “Bear is fanning the fire. In which picture can you see that?” To answer the question, children can click on one of three pictures that appear on screen (the correct image among two distracters). The assistant gives feedback regarding the correctness of the response and provides clues in the cases of incorrect responses. We compared a questioning approach with hotspots that provide definitions after clicking on the hotspot. Our findings provide evidence for the assumption that effects are superior for multiple-choice questions that encourage children to make—rather than take—meaning (Moreno & Valdez, 2005). Even when words were completely unfamiliar prior to listening to the story, questions promoted growth in word knowledge.

Highlighting Print

Many enhanced e-books are furnished with tools of digital guidance that may focus children’s attention on print. When printed text is available, it might change while it is read by either turning blue (e.g., *P.B. Bear’s Birthday Party* [Davis, 1996]), highlighting, increasing in size, or

underlining. In some multimedia e-books, the iconic modes of words are visible in combination with the written word. In *P.B. Bear's Birthday Party*, for instance, a small-sized picture replaces the printed form of objects (e.g., bed, orange juice, and marmalade). The printed word appears after a click on the small-sized picture, simultaneously with a short animation and pronunciation of the word. Most animations represent the meaning of the noun. For example, the drum starts to move and sounds like a drum. From an experiment with *P.B. Bear's Birthday Party*, it appeared that this multimedia feature may stimulate interaction with text, resulting in internalization of orthographic features of words (de Jong & Bus, 2002).

A feature that is present in many e-books is a “karaoke-bar” that emphasizes words in synchrony with the reader’s voice. For instance, in Disney’s storybook apps *Cars 2* and *Pooh's Birthday Surprise*, words are highlighted when they are read aloud. In an eye-tracking study, de Jong and Bus (2012) have demonstrated that highlighted text attracts children’s visual attention tremendously and more so when children are more advanced in print knowledge. More importantly, such features have been demonstrated to improve print knowledge such as word recognition (de Jong & Bus, 2012; Korat, 2010) and letter-reading skills (Gong & Levy, 2009).

Besides a reading of the whole text, stories often include options to hear individual words read aloud, either entirely or in segments, which is designed to increase children’s awareness of the relation between letters and sounds. For instance, touching words in a storybook app activates a read-aloud of that particular word. For beginning or struggling readers, whole-word reading software can lead to significant gains in written-word recognition, written-word naming, and phonological awareness (e.g., de Jong & Bus, 2002) and can even be equally effective as one-to-one tutoring with an adult in terms of phonological attainment. Especially considering that the most frequent cause of reading difficulties is weaknesses in phonological decoding skills, text-to-speech options can be valuable additions in the earliest years of reading education.

From Research to Practice

A nonstarter of a story cannot wow as an app, no matter how fabulous its bells and whistles are (Smith, 2011). However, the firm belief that children benefit most from sharing traditional print books with an adult has yet to be proved, as there is growing evidence to suggest that some of the promising features of optimally designed e-books may even outperform traditional shared print book reading.

So far, the search for interactive, multimedia features to enrich “good” storybooks has revealed the following:

- Animated pictures that include motion and zoomshots provide more clues from which children can extract meanings of difficult words than static pictures, especially when animations highlight elements from the oral text and nonverbal elements are coordinated with verbal elements in text.
- Effects of visual and audio features in enhanced e-books are not yet unraveled, with the exception of SLI children, in which the music and sounds (though not the animated pictures) may interfere with learning.
- Choices between iconic features and text reading have the disadvantage that children mostly prefer the animations and iconic elements at the expense of listening to the book’s story text.
- Interactive features like hotspots and questions targeting complex words in the story text support growth in vocabulary more than listening to text alone.
- When children have become active participants in the interaction with the e-reader device by answering multiple-choice questions, interactivity is particularly beneficial (word learning improved by almost 20%).

While 4- and 5-year-old children might dislike print book reading sessions when they are frequently interrupted for questions, questions within interactive e-books may increase children’s motivation (Kamil, Intrator, & Kim, 2000). Parents might not know which words to comment on or which events to discuss. E-books, on the other hand, are often designed in collaboration with educators, which results in age-appropriate and more challenging interactions.

However, without a model of book reading routines built up by prior encounters with books read to children by adults, interaction with electronic books might not be possible. In the early stages of book reading, children enjoy interaction with adults more than the book; they need adults to narrow the gap between their everyday world and the world of the book, and caregivers typically read the pictorial content of an illustrated story and its accompanying text more idiosyncratically to younger or less experienced children than to older or more experienced ones (Bus & de Jong, 2006). Also because it is fun and supportive of the emotional bonding with the child, it is important that parents and preschool teachers continue reading to younger age groups.

In sum, this chapter has described that e-books can provide benefits over printed books. However, a lot depends on the quality of e-books, as

cutting-edge research in this area has revealed. It is parents' and teachers' responsibility to guide children in their activities with e-books and on the Internet, because children's own choices might not be the ones that should be preferred in a learning context. Young children show an almost universal preference for the exciting commercial programs that fail necessary qualities (Bus & Neuman, 2009).

Many teachers are not that comfortable with technology and fail the expectation and disposition that they can use technology for their own purposes. In the Netherlands, teachers rarely incorporate computer stories into their curriculum or encourage targeted viewing of television stories as an at-home activity. They qualify e-books rather as edutainment than serious learning materials. However, our findings concerning the effects of electronic stories on emergent literacy skills suggest that alternative ways of encountering stories may be a profitable addition to adult-led book reading at home and in kindergarten classrooms. Electronic stories are useful in allowing children to engage in independent reading before they are capable of reading conventional printed texts on their own.

TRY THIS!

- Illustrations in picture storybooks are works of art that must be interpreted (Schickedanz & Collins, 2012). Think of ways in which technology may help with this.
- Try out an interactive e-book for yourself. Experiment with the interactive features and think about how these features affect your reading of the text. (For a demo of interactive videobooks with questions posed by a built-in tutor, you can visit the bereslim website at web.bereslim.nl/bereslim/bereslimme-boeken/demo-bereslimme-boeken.html.)

DISCUSSION QUESTIONS

1. After reading this chapter, are you convinced that in the age of the CCSS, electronic storybooks can contribute to a positive experience with literacy development that lasts a lifetime?
2. The authors note that e-books are designed for children to “read” independently and that e-books' designs do not match the experiences of shared adult-child reading. Discuss the role of parents and teachers in young children's e-book reading activities.

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