

Educating the Other America

Top Experts Tackle
Poverty, Literacy, and Achievement
in Our Schools

edited by

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effects, and singing can be used effectively to orient children to content and build knowledge of literacy skills. Together, these chapters describe how informational technologies can be used to influence literacy, both in its traditional verbal form as well as its increasingly interactive forms.

Kathleen A. Roskos in Chapter 17 brings us back to the classroom. In the tradition of ecological psychology, she describes how environments in schools and classrooms can “coerce” more effective learning opportunities. Educational intervention can be enhanced by partitioning the physical space in coherent ways, using signage intentionally, and placing a variety and complexity of material resources, which supports stronger, richer, deeper student learning.

What these chapters in Section III make clear is that when we recognize children’s needs and tailor instruction using specific design principles to better to meet these needs, students are able to succeed and achieve literacy outcomes at higher levels than ever before.

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Design Features in Living Books and Their Effects on Young Children’s Vocabulary

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Because children from impoverished backgrounds often receive less language stimulation at home than children from nonimpoverished backgrounds, they are at heightened risk for poor academic readiness and achievement. They often are deprived of shared book reading—an activity that fosters literacy development in a unique way. A wealth of studies show that books are a powerful tool in the process of becoming literate, probably because they bring children into contact with a particular type of language (e.g., Bus, 2001; Bus, van IJzendoorn, & Pellegrini, 1995; Frijters, Barron, & Brunello, 2000; Sénéchal, LeFevre, Thomas, & Daley, 1998). Books tell stories using words and phrases that rarely occur in other language situations; think of phrases such as *for all it’s worth*, *a soft slant of wind*, *the sun is high in the sky*, and so forth.

As we enter a new technological era, picture storybooks are made available in a digitized format that preserves all of the relevant qualities of the print version, such as a narrative and illustrations, but adds numerous additional features. We have begun to test whether children benefit from the digitized versions of storybooks available through a plethora of new media (e.g., Internet, television). We want to find out whether and how electronic books could remedy some limitations of traditional paper storybooks without spoiling children’s pleasure in stories. We are interested in their potential contribution to interventions that intend

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to call a halt to the depressing cycle of poor environments creating poor school performance.

Good examples of digitized picture storybooks that retain all print book qualities but simultaneously add new features are plentiful, even for the youngest children. *Nijntje*, *Maisy*, and *Musti*, all popular book series for the very young and originally only available as picture storybooks, are broadcasted by Dutch educational television, on sale as DVDs (which are often much cheaper than the original print books), or accessible through the Internet. Because even the youngest children are spending increasing amounts of time with screen media at the expense of time spent reading books independently or with adults (Rideout, Vandewater, & Wartella, 2003; Zeijl, Crone, Wiefferink, Keuzekamp, & Reijneveld, 2005), we would like to determine whether these alternate forms of picture storybooks have the potential to increase story and text comprehension.

Because books usually are viewed as static objects consisting of fixed words on pages, it is only logical that research so far has mainly focused on how adults' comments and nonverbal support scaffold children's text comprehension. Now that picture storybooks are available in digital—or "living"—versions, it is important to explore the effects of digital books, especially when parents are less likely to read several times per week to their child. In this chapter, we explore evidence that some electronic stories, available through a plethora of new media, have additional features that act as intermediaries between child and story text, especially in groups lagging behind in language proficiency.

It is unlikely that digital storybooks will replicate entirely the adult-child interactions that occur when reading print-based books. For example, electronic stories do not provide a venue for focused language exchange, enabling responses to children's language and thinking and providing exposure to the adult language (e.g., Raikes et al., 2006). Researchers, however, have suggested that additional features of digital storybooks such as film, music, and sound may have potency to serve as "electronic scaffolds" to support children's text understanding and memorization of words and phrases (e.g., Bus, de Jong, & Verhallen, 2006; McKenna, 1998).

Thus far, the main focus of research on living books has been on—according to de Jong and Bus (2003)—the most common multimedia additions: iconic features such as hidden animations and animated illustrations. So far there is a paucity of research testing effects of so-called *computer assistants*, stand-ins for adults who now and then appear on the screen to ask questions or provide help. Such additions to the next generation of living books may make the books not only cognitively but also emotionally more rewarding. In line with our previous research of book sharing (Bus, 2001; Bus & van IJzendoorn, 1988, 1995, 1997; Bus, Belsky, van IJzendoorn, & Crnic, 1997), it is imaginable that a computer assistant who interacts with the child may neutralize the absence of intimacy in encounters with living books.

PICTORIAL AND ICONIC FEATURES AS OBSTRUCTIONS OF NARRATIVE COMPREHENSION

Many exemplars of the first-generation digitalized picture storybooks typically provided unrelated interactive animations that could be accessed by clicking on parts of the pictures accompanying the text. We came across such hidden animations in about 60% of all living books produced in the years 1998–2002 (de Jong & Bus, 2003). For instance, the digitized version of Mercer Mayer's *Grandma and Me* (1994)—one of the first living stories ever available—includes animations hidden in the illustrations in addition to animated pictures synchronized with the oral text. When the cursor changes, you can click the mouse, which results in surprises: singing flowers, a dancing picture on the wall, or columns with ants marching over the screen. We can imagine that such additions may add to children's motivation and interest in hearing the story over and over; however, it is also imaginable that such additions distract children from the story. Because these features may encourage children to think of the story as a game, they may in turn interfere with the children's comprehension of the story (see Bolter, 1998; Labbo & Reinking, 1999; Leu, 2000).

We explored effects of such additions to living books by observing how children interact with the Dutch-spoken Janosch series and testing effects of repeated encounters with these electronic books (de Jong & Bus, 2004). Just like in *Grandma and Me*, there are many visual and sound effects hidden in most screens that can be found by moving the cursor over the illustrations. For instance, when Tiger (Janosch, 1986) is having an x-ray taken during an examination by a physician, a click on the light bulb above the x-ray machine makes the physician pick up the bulb and eat it, with crackling sounds to accentuate the action. A click on the omnipresent Tiger Duck in the same story makes a spring between the head and tail stretch out as far as it can, then recoil to unite the body parts again. A content analysis of about 50 living books that were on the market in the Netherlands between 1995 and 2002 revealed that only a small percentage of these hidden animations (9.4%) were congruent with the narrative (de Jong & Bus, 2003). One of the rare examples of a congruent animation can be found in the same scene at the physician's: an x-ray picture appears when we click on Tiger, probably an effective way to illustrate what the outcome is when a person is x-rayed. Such additions may add to children's understanding of complex words in the story text.

In a large-scale study based on the Janosch series, we found evidence that the presence of such animations diverts children's attention from the text. Similar to what Labbo and Kuhn (2000) observed, the hidden animations were so attractive to young children that they loaded about six animations on each screen of the story. We did not, however, find evidence for the suggestion by James (1999), based on four case studies, that young children are so completely infatuated with these hidden animations that they rarely finish navigating through the complete story. Even though our participants had a choice—playing with these optional

hidden animations or listening to the text—they continued listening to the story, probably because simultaneous film images of the story appeared. Most participants preferred to hear the complete story more than once.

We also did not find support for the hypothesis that understanding of the text decreases when children trifle with the hidden animations (de Jong & Bus, 2004), a result that matches findings reported by Ricci and Beale (2002). After 12 sessions with the electronic storybooks, children's comprehension was at about the same level as when the story was read to the children the same number of times. This result differs from Labbo and Kuhn's (2000) hypothesis that children's text understanding will lag behind when incongruent animations embedded in the pictures guide children's attention away from the storyline. They noticed that Roberto, a kindergarten child with a basic concept of stories and story features, often lapsed into passive viewing when the special features in the electronic book were inconsistent with the story. He seemed to enjoy the hidden animations, but this affective motivation did not lead to increased understanding of the story.

ANIMATED ILLUSTRATIONS AS INCENTIVES FOR STORY AND TEXT COMPREHENSION

The *Maisy* episodes available on television and DVD are very similar to the *Maisy* books by Lucy Cousins; they each contain stories about breakfast, baking cookies, and cleaning up the house. The difference between the television show and the storybooks is that in the television show, static illustrations are transformed into film images, music is added to enhance or support impressions, and pictures are completed with relevant sounds (child's voices, a mooing cow, falling drops). For instance, the first illustration in the *Maisy* book *Badje* [*Maisy's Pool*] (1999) shows *Maisy* and her friend *Tallulah* sitting in the grass lethargic from the heat. The text tells that they are warm. By adding motion, sound, and music, the DVD version of this same story strengthens the impression that *Maisy* and *Tallulah* are warm. In the initial scene, *Maisy* and *Tallulah* are chasing each other but with visibly decreasing enthusiasm. Their voices sound dull in an increasing degree until *Tallulah*, worn out by the heat, collapses. The fading music supports the impression evoked by these images: It is too warm to chase each other.

As suggested by various authors (e.g., Calvert, Huston, Watkins, & Wright, 1982; Neuman, 1997), additional features of multimedia stories such as motion and camera work (zooms, cuts, and pans) may supply children with sources of information that act as mediators between the children and text. Because few contemporary children do not have access to a television or computer, most have learned how to process film information—the grammar of cuts, pans, zooms, and edits—into their final interpretation of a story (Robinson & Mackey, 2003). These additional features may be profitable because they enable the learner to fill gaps in text comprehension (Mayer & Moreno, 1998). Because children hold verbal and nonverbal representations in their working memory at the same time, they

are able to build referential connections between, for example, seeing how the water flows away through a hole in the bath and the text telling that the bath leaks (Paivio, 1986). Sharp and colleagues (1995) found corroboration for the hypothesis that short stories accompanied by a helpful video framework supported 6-year-old children's story recall and interpretation more than stories accompanied by mainly static images. In examining third graders' recall and inferential abilities, Neuman (1989) found that students who watched a multimedia story recalled more story elements than students exposed to only one medium. These results with young children, however, could not be replicated with older and more advanced pupils. Results from Neuman's (1992) study examining the influence of different media presentations on fifth graders' inferences about two mystery stories did not support the hypothesis that multimedia stories supported learning more than printed stories. Both media elicited similar story-processing strategies.

We hypothesize, therefore, that older children may have greater imaginative skills and background knowledge, allowing them to reconstruct story images and create verbal representations from text without an additional set of processing tools (Pressley, Cariglia-Bull, Deane, & Schneider, 1987). Multimedia may be especially profitable when print book-reading experiences are out of children's reach in traditional verbal settings because children's language proficiency lags behind and there are too many gaps in understanding to fill by guessing at the story meaning and the language (Sharp et al., 1995). In line with this hypothesis, a study by Uchikoshi (2005) found positive relationships between viewing book-based television shows and language and literacy outcomes in groups of kindergarten children learning English as a second language.

One of our experiments that included 135 three-year-olds, mainly from families at risk, tested effects of repeated encounters with *Maisy* stories (Bus & de Jong, 2006). In one group, we alternated a static version of a *Maisy* story with an animated version of the same story, thus imitating what often happens in daily life. For example, children may watch a *Maisy* television program at home and then have the same story, in book format, read to them in preschool. In the other group, the examiner shared the *Maisy* books with individual children. Afterward, we tested these 3-year-old children's knowledge of complex words and phrases such as *milking the cow*, *starving*, *clearing away the mess*, *right on time*, *piles of shopping*, *on the inside*, *on the outside*, and other words and phrases that are more complex than those typically heard in daily communication at this young age. We found that alternating reading the static story with viewing a multimedia version of the same story produced higher scores on questions about the story's core vocabulary than did the static condition alone, suggesting that the additional features of multimedia stories acted as mediators between the children and the story text.

In the same vein, we carried out a series of experiments at schools in the inner city of The Hague—which is mainly populated by immigrant families—testing the ability of book-based animated stories, when well designed and produced, to have positive effects on young viewers' narrative comprehension and

language skills (Verhallen & Bus, 2007; Verhallen, Bus, & de Jong, 2006). In the first study, two versions of the same book were presented on the computer; however, one version included static images and the other included multimedia additions (e.g., cinematic techniques such as zooms, pans, cuts, and sound effects). The main character in this story, a witch, has a problem: Because her house and everything in it, including the cat, is black, she often stumbles over the cat. The multimedia version often adds to the static version of the book; for example, the camera may zoom in on the facial expressions of the witch, thereby emphasizing her emotional responses simultaneously named in the story text.

We concluded that in a group of 5-year-old participants, all of whom were learning Dutch as a second language and were from low-educated families, living books seem to provide a framework for understanding stories and remembering linguistic information, a result that matches our findings with the 3-year-olds. Children profited more from repeated encounters with the multimedia storybook, which was indicated by more complete retellings. Furthermore, after four repetitions lasting 24 minutes, children had learned seven new words in the multimedia situation (12%–14% of the words we suspected children would not know)—twice as many as the average number (three or four) they learned with static pictures. In other words, new processing tools such as motion and camera work help to convey content instead of diverting attention from the story or the language. Note that these results were found in groups of kindergarten children who, in comparison to their peers, lag behind in language proficiency and are at great risk of developing a reading problem at school. We expect less pronounced results in average groups due to the fact that those children are less dependent on scaffolding for understanding the story text.

TEMPORAL CONTIGUITY

One of our earlier studies (de Jong & Bus, 2002) showed that outcomes of experiments are different when the animated pictures are not contiguous with the narration. While exploring the effects of *P.B. Bear is jarig* [P.B. Bear's Birthday Party] (Davis, 1996), one of the first living books available in the Netherlands, we discovered that when children were given a choice of several options, pictorial and iconic options were chosen at the expense of listening to the story text (de Jong & Bus, 2002). In the living book *P.B. Bear's Birthday Party*, children have a choice—listen to the text or watch the animated illustration—but they cannot do both at the same time. The text about P.B. Bear, the main character, going to the bathroom to wash his face after he woke up is disconnected from the animated illustration showing P.B. Bear washing up. The designers decided not to synchronize the oral text with the animated illustration but, rather, with visual changes in the print. By highlighting the print while it was spoken they expected to strengthen children's awareness of letter-sound relationships.

We noticed that the iconic mode of electronic books (clicking on illustrations and icons) attract 4- to 5-year-olds' attention at the expense of reading the full page and text fragments (see Greenfield et al., 1996). After six 15-minute sessions, the difference in the number of readings was dramatic. Most children in the electronic story condition heard no more than about half of the text one and a half to two and a half times. In the regular book-reading condition, the complete story was read to the children six times. As a result, most participants in the living book condition did not memorize many words and phrases from the verbatim text. When an adult took advantage of the same amount of time, six sessions each lasting 15 minutes, to read the print book version to the children, the children made much more progress in text comprehension. In other words, the availability of animated acts of story events including motion, music, and appropriate sounds interferes with the narrative when these options are not linked to the narrative text and children have free play. If animations are available in addition to the narration and children have a choice to either watch the animation or listen to the text, most 4- and 5-year-old children prefer the iconic information at the expense of the narration.

Therefore, presenting animations congruent with the narration simultaneously rather than successively may be of overriding importance in guiding children (Mayer & Moreno, 1998). Or, put differently, it is not just the synergy of various information sources that supports text comprehension (Neuman, 1997); effects also depend on temporal contiguity of various verbal and nonverbal information sources. To explain these results, we hypothesized that film images draw attention selectively to contiguous content, thereby helping children with many gaps in text understanding to select picture information relevant for processing the story text (Greenfield et al., 1996; James, 1999; Kamil, Intrator, & Kim, 2000). When there are many gaps in children's understanding of the story text, we can imagine that a reduced information load as a result of multimedia guidance may help children to figure out the meaning of unknown words and phrases and to memorize those words and phrases after repeatedly experiencing images simultaneous with the narration. Features such as motion, zooms, cuts, and pans provide children with an additional guide in selecting the important or central content of the images that relate to the text, just as a spotlight on a stage tells the audience where to look. These features probably limit the overload of information offered by illustrations with numerous irrelevant details. As the two different classes of information—one specialized for information concerning nonverbal objects and events and the other for dealing with language—are fine-tuned, they may support and expand each other in conveying the same content even more than picture storybooks (Paivio, 1986). Children with a low level of language proficiency who are unfamiliar with 10% or more of the story vocabulary may benefit especially from multimedia additions because they are more in need of additional support (Verhallen et al., 2006).

REPETITION: A NECESSARY PREREQUISITE

When there are gaps in children's understanding of the language used in stories, repetition may be especially indispensable for understanding and memorizing unfamiliar vocabulary and grammatical structures (e.g., Sulzby, 1985). There are surprisingly few book-reading studies that test obvious questions. For example, do young children get bored after a few repetitions of the same story, as may become manifest by decreased attentional arousal, thereby bringing learning to a halt? Or, do they stay attentive even after several repetitions, resulting in acquiring new language? Most important for the questions raised in this chapter, do living books have more potencies to keep children interested even after several repetitions of the same story? To answer these questions, we tested how immigrant kindergarten children with a comparatively low proficiency in the language of schooling—an increasing part of the school population not only in the Netherlands but all over the world—respond to repetition of age-appropriate picture storybooks with and without multimedia additions.

Studies of children watching television suggest that children are more inclined to continue investing mental effort in programs when their appraisals of coping options are high. That is, when given a choice between watching television and playing, children are more inclined to focus their eyes on the screen when information matches their level and they expect to benefit from their efforts (e.g., Anderson & Lorch, 1983; Bickham, Wright, & Huston, 2001; Crawley, Anderson, Wilder, Williams, & Santomero, 1999; Huston & Wright, 1983). In line with this *active theory*, we may expect that children only benefit from repetition of stories when their appraisals of their coping options are high. If children are lacking support in understanding a story, their aversive systems may become active after a few repetitions, and they may become less and less inclined to continue their efforts to understand the story text. This theory may explain our previous finding that children with low language proficiency benefited more from repeated encounters with multimedia stories than from repeated encounters with picture storybooks without additional multimedia information sources (Verhallen et al., 2006). We therefore expect that when story text is difficult for young children, their attentional arousal may decrease when the story is repeated several times without providing additional sources of information that enable them to derive the meaning of words and phrases from the context. By contrast, with the provision of additional information, as is available in some digitized picture storybooks, they may continue to invest mental effort, thus benefiting more from repeated encounters with the story. In other words, repetition is not by definition annoying or profitable but only on condition that children's appraisals of coping options are high.

Alternatively, it is hypothesized that arousal increases in response to attention-catching features in multimedia stories. A wealth of studies in the domain of mediated communication such as television and advertising support the idea that features of new media such as motion, music, and sound elicit more psychophys-

iological arousal (e.g., Lang, 2006). For instance, according to *motion effect theories*, an inherent preference for moving objects is manifested in physiological changes such as a decrease in heart rate, increase in skin conductance of electricity when external stimuli are presented, and changes in brain electrical activity (Sundar & Kalyanaraman, 2004). As a consequence of more immersive mediated experiences such as compelling tunes and engaging scenes, multimedia stories may preserve more psychophysiological arousal in response to the affective and motivational intensity of the stimuli even after repeated encounters with the same story (Lang, 2006). This alternative model therefore predicts an overall higher level of attentional arousal in response to the affective and motivational intensity of the stimuli in multimedia stories; however, according to this model, it is not very likely that such arousal mediates learning from multimedia stories.

EFFECTS OF BOOK CHARACTERISTICS ON ATTENTIONAL AROUSAL

In line with the active theory, we expected that children's attentional arousal would decrease when a story was repeated on several occasions without additional sources of information. Children may continue to invest mental effort when there are additional sources of information that enable them to derive the meaning of words and phrases, thus promoting their learning from repeated encounters with the story. In other words, we tried to find evidence that repetition is only boring or unprofitable when children do not get sufficient support in understanding the story text. Similar to numerous studies of television and advertising but different from what typically occurs in studies of book reading or watching educational television programs, we assessed psychophysiological activity as an indicator of attention (Ravaja, 2004). We measured electrodermal reactivity because this measure is known to increase when children concentrate on activities such as doing mental arithmetic problems (Dawson, Schell, & Filion, 2000; Pecchinenda & Smith, 1996; Ravaja, 2004).

Verhallen and Bus (2007) found evidence that multimedia stories are more likely than stories with static pictures to retain attentional or motivational arousal over sessions. The skin conductance was registered every 500 msec by applying a constant voltage (0.5V) to electrodes placed on the palmar surfaces of the medial phalanges of the second and third finger of the nondominant hand. To code the data, we developed a computer program to assess the number of changes in skin conductance of at least .02 micro Siemens. When a multimedia story was presented four times, the average number of 6 skin conductance responses per minute in Session 2 slightly increased to an average number of 7 skin conductance responses per minute in Session 4, a score far beyond the score of 1–3 responses per minute in a state of rest (Dawson et al., 2000). By contrast, arousal level gradually decreased from an average score of 7 skin conductance responses per minute in Session 2 to a score of 4 per minute in the fourth session when a story with just static pictures was repeated time after time. This meant that in the group that was read to from the

static story, attentional arousal had fallen back to a level statistically significantly lower than the group that was read to from the multimedia story. The statistically significant decrease in arousal after three repetitions we observed for the static story may indicate that aversive systems become active earlier when the book is static, thus reducing the chance that children benefit from repeated encounters with the same story. Multimedia stories, by contrast, retain their appeal for at least four repetitions, which suggests that they are more eligible for supporting continuation of attentional or motivational activation (Lang, 2006).

Another unique result of this study is that a sustained level of arousal mediates the relationship between multimedia additions and text comprehension. This indicates that an external characteristic variable such as the availability of multimedia takes an internal meaning by sustaining children's attentional arousal. There is strong evidence for the theory that attentional arousal elicited by multiple deliveries of information plays an essential role in the causal chain of learning from electronic stories. The children in the multimedia condition may have retained a higher arousal level because they experienced this version as more redundant and therefore supportive than children in the static condition. Consequently, they may have continued their efforts to improve text comprehension, thereby memorizing more words and phrases. Children invest more mental effort in using or processing what they see and hear when they perceive the story as more redundant and comprehensible (Crawley et al., 1999), the final result being that they memorize more information from the program. When, by contrast, only static illustrations were available and children's perception was more dependent on text comprehension, aversive systems became active earlier. Note that these results are found in groups of kindergarten children who, in comparison with their peers, lag behind in language proficiency and are at great risk for developing a reading problem at school. We expect less pronounced results in groups of typical learners due to the fact that they are less dependent on scaffolding for understanding the story text.

When designing new living books, it is important to take into account that the added value of multimedia stories is not just that they are a new form of media; rather, the important factor is the ability of the story representation to retain attentional arousal while children explore the story. For this reason, the quality of multimedia stories has to comply with the strictest requirements. When designing multimedia stories, the story content and not the entertainment value should be the main source of inspiration. Furthermore, in the context of reviewed research, it should be a priority to make the story understandable by adding redundancy and not to add features explaining separate words and phrases.

CONCLUSION

Teachers and parents are inclined to mistakenly characterize living books as an "easy" medium, suggesting that they require less mental investment by children than print books, which, by contrast, are assumed to activate children's minds

(Salomon, 1984). Our finding that living books, more so than the static versions of the same books, can keep children aroused even after the umpteenth time that they hear the story opposes this assumption. We also did not find evidence supporting another preconception; namely, that attention-catching motion pictures dispel attention for language. Children's text understanding benefited more from multimedia stories than from static stories, a result that we were able to replicate several times. These misrepresentations of the effects of digitized stories keep teachers and other caregivers from introducing living books despite an expanding number of computers available in classrooms.

We should also take into account that—according to a series of seminal studies that tested when and how additional media such as motion, sound, and music affect learning—not all electronic stories are equally supportive of text understanding. We observed negative effects for lapsed time between narration and corresponding animations and animations that were incongruent with the story (de Jong & Bus, 2002; Labbo & Kuhn, 2000). Such features divert children's attention from the story text and decrease the number of readings of text in favor of iconic and pictorial explorations. By contrast, congruent animations presented simultaneously, rather than successively, with corresponding narration by using animation, zooms, cuts, and pans, seem to promote learning from repeated encounters with the story (Calvert et al., 1982; de Jong & Bus, 2002, 2004; Neuman, 1997; Verhallen et al., 2006). Our research so far also suggests that children with a low level of language proficiency who are unfamiliar with 10% or more of the story vocabulary benefit the most from such principles, probably because they are most susceptible for differences in the quality of scaffolds (Verhallen et al., 2006).

Based on our results so far, we hypothesize that attentional arousal is one of the mechanisms by which external characteristic variables, such as combining animated pictures with the narrative, may take on internal psychological meaning. We used psychophysiological measures to determine that stories with multimedia additions are more successful in holding children's attention when stories are repeated several times. Aversion becomes manifest at an earlier session when stories only include static pictures. The results match with *the active model* that was developed to explain learning from television viewing (Anderson & Lorch, 1983; Bickham et al., 2001; Huston & Wright, 1983): Children invest more mental effort in using or processing what they see and hear when they perceive the program as more comprehensible (Crawley et al., 1999) and redundant, the final result being that they memorize the program better and learn more. Because a static storybook provides little support to fill in gaps in children's text understanding, children's appraisals of their own ability to comprehend a story decrease; as a result, they learn less and less from repeated encounters with the story. We expect that outcomes would be less pronounced in groups of typical learners, as they are less dependent on scaffolds in understanding the story text.

Our findings indicate that digital storybooks should be considered assets rather than problems, providing kindergarten children who, in comparison to their peers,

lag behind in language proficiency and are at great risk of developing a reading problem at school new chances to advance their language skills (Tyner, 1998). Children profit from a synergistic intervention, especially when they have few background experiences to help them understand a storyline and derive the meaning of unfamiliar words and sentences from additional information sources. More precisely, when children have limited proficiency in the language of instruction—a situation that is becoming more and more common all over the world—additional iconic information may help to convey story content and story language, just as adult-child interactions do during book reading. Well-designed book-based programs on television and Internet sites that include multimedia might be a great way to promote at-risk children's story understanding and linguistic skills at home and in school.

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The Limits of the Self-Teaching Hypothesis

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The National Assessment of Educational Progress (NAEP), or Nation's Report Card, was designed to monitor the academic attainment of our nation's school children. In this, its core purpose is to provide the information needed to ensure that all children, regardless of background or region, receive full educational opportunity. Toward that end, the outcomes of the NAEP are divided into three broad performance categories: *proficient*, corresponding to solid grade-level performance; *advanced*, corresponding to superior performance; and *basic*, indicating partial mastery of the knowledge and skills required for grade-level lessons and learning. Although the NAEP was conceived in the 1960s, it was not until the early 1990s that the funding, policy, and technology came together to return useful information about our nation's progress. The first usefully large-scale assessment in reading was administered in 1992, and the results stunned the nation.

The big surprise of the 1992 NAEP (Mullis, Campbell, & Farstrup, 1993) was not that merely 25% of tested fourth graders demonstrated reading at or above grade level (i.e., *proficient* and *advanced*). The big surprise of the 1992 NAEP was that the scores of fully 40% of tested fourth graders, nationwide, fell below the *basic* category; among children of poverty, 80% fell below *basic*. Given that 8% of students in the test sample were deemed incapable of taking the test for reasons of limited English proficiency or special educational profiles, the implication was that nearly half of our nation's students lacked the minimal knowledge and skills required for grade-level learning.

The 1992 NAEP told us that our schools were failing. Most especially, they were failing those very children who depend most of all on school for their formal education—those very children for whom public education was principally instituted.

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