Examination of the Role of Book Layout, Executive Function, and Processing Speed On Children's Decoding and Reading Comprehension

Karrie E. Godwin[1] (kgodwin1@kent.edu)

Cassondra M. Eng[2] (cassonde@andrew.cmu.edu)

Rachael Todaro[1] (rtodaro@kent.edu)

Grace Murray[1] (gmurray5@kent.edu)

Anna V. Fisher[2] (fisher49@andrew.cmu.edu)

[1]Kent State University, Department of Educational Psychology, 150 Terrace Drive, Kent, OH 44243 USA

[2]Carnegie Mellon University, Department of Psychology, 5000 Forbes Ave. Pittsburgh, PA 15213 USA

Abstract

Books designed for beginning readers typically intermix text with illustrations in close proximity. Prior research suggests this standard layout may reduce literacy skills due to increased attentional competition between text and illustrations. The current study extends this work by examining whether manipulations to the book layout can enhance reading performance and explores whether individual differences in executive function and processing speed are related to children's decoding and reading comprehension when reading books which utilize the standard layout. Separating text and illustrations improved reading comprehension. Preliminary results also suggest working memory, inhibitory control, and processing speed are related to reading performance.

Keywords: attention; selective sustained attention; reading; reading fluency; decoding; reading comprehension; illustrations; executive function; inhibitory control; working memory; processing speed

Introduction

Several lines of research support the idea that enhancements intended to promote engagement often do so at the cost of reducing attention to relevant information and thereby reduce learning. For example, prior research has found reduced learning outcomes in toddlers' ability to learn novel words or content from books with manipulative features (such as pop-ups) compared to standard picture books (Tare, Chiong, Ganea, & DeLoache, 2010). Similarly, math manipulatives that are perceptually rich can have the unintended consequence of focusing children's attention on object features and/or play rather than on the underlying mathematical principles. For instance, McNeil, Uttall, Jarvin, and Sternberg (2009) found that elementary school children who worked with concrete manipulatives (i.e., colorful and detailed coins and bills) to solve word problems involving money made *more* errors than children who used no manipulatives as well as children who used less perceptually rich manipulatives (i.e., black and white bills and coins in which superfluous details were removed). Recent research has also found that kindergarten children spend more time off-task and obtain lower learning outcomes when the learning environment is decorated (e.g., environments containing posters, displays, artwork) compared to learning environments that are visually streamlined (Fisher, Godwin, & Seltman, 2014). These examples all serve to highlight occasions where enrichments intended to promote engagement may have unintended consequences for both attention and learning.

When considering books designed for beginning readers, a similar situation might arise. The standard layout often intermixes text and illustrations in close proximity (see Figure 1A). The detailed and colorful illustrations are intended, in part, to promote engagement and motivation to read; however, the illustrations may also inadvertently increase attentional competition between text and illustrations thereby reducing decoding and perhaps comprehension (Godwin, Eng, Fisher, 2017).

While there are potentially important reasons for including illustrations in text (e.g., enhancing motivation, providing additional information, contributing to text coherence; Carney & Levin, 2002; Fang, 1996), our work suggests this standard book layout is less optimal for beginning readers. Specifically, young children made frequent gaze shifts away from the text when reading books in the standard layout (i.e., in which text and illustrations were in close proximity). Critically, gaze shifts away from the text were negatively related to decoding (Godwin et al., 2017). These results are consistent with the possibility that the close proximity of text and illustrations can create competition for attentional resources, a situation that may be particularly problematic for young children given both the protracted developmental trajectory of attention (see Ruff & Rothbart, 2001 for review) and their emergent literacy skills.

Reading is a critical skill children must acquire, as reading becomes a primary tool for future learning –when students must 'read to learn' (National Association for the Education of Young Children, 1998). For many children,

learning how to read is a challenging task; a variety of factors contribute to the difficulty of the task including: meager pre-reading skills, developmental disorders (e.g., ADHD), learning disabilities (e.g., dyslexia), and weaknesses in general cognitive functioning (e.g., working memory, processing speed) (e.g., Biederman et al., 2004; Dykman, & Ackerman, 1991).

Our prior research (Godwin et al., 2017), points to the possibility that book layout could be augmented to help promote children's developing literacy skills. In the present study, we address this question experimentally to examine book layouts that may reduce attentional competition. We also investigate what role individual differences in cognitive functioning might play on reading performance when children read books in the standard layout. Specifically, we investigate whether the typical book layout compounds issues for decoding and comprehension in children with weak executive function skills and slow processing speed.

There is reason to believe children with weaker cognitive functioning will find the standard book layout especially challenging. For example, children with weak inhibitory control may find they are unable to resist becoming distracted by the illustrations, resulting in less time spent attending to the text thereby disrupting decoding and reducing reading comprehension. Similarly, children with low working memory (WM) capacity may struggle to maintain a coherent representation of a word, sentence, or story when their attentional focus is continually shifting between the text and illustrations. Lastly, children who are less proficient at processing information may be more vulnerable to distraction. The attentional burden imposed by the close proximity of text and illustrations may increase as children spend greater amounts of time processing text. Consequently, both decoding and comprehension may be hampered by these frequent disruptions to the reading process.

Thus, the present research examines (1) whether separating text and illustrations results in a more optimal book design for beginning readers and (2) investigates if executive function (e.g., WM, inhibitory control) and processing speed influence children's vulnerability to the detrimental effects of the close proximity between illustrations and text, a layout common in books for beginning readers.

Experiment 1

Participants

Participants included 50 first- and second-grade children (Cohort 1 N=28, *Mage* = 7.41 years, *SD* = 0.54, 14 females, 14 males; Cohort 2 N=22 *Mage* = 7.20 years, *SD* = 0.61, 9 females, 12 males, 1 unreported). Participants were recruited from schools in and around Pittsburgh, Pennsylvania and tested individually in a quiet room adjacent to their classroom.

Design and Procedure

To maintain a high level of ecological validity, children read aloud a commercially available book designed for beginning readers from the *Hooked on Phonics Learn to Read* series (*Good Job Dennis* by Amy Kraft). The story was presented on a laptop computer. A RED250 mobile eye tracker was used to measure children's patterns of attention allocation indexed by gaze shifts. Book layout was manipulated within-subjects. For cohort 1, half of the book was presented in the standard layout (i.e., with text and illustrations in close proximity; see Figure 1A) and half of the book was presented in the partially separated layout (i.e., text was presented adjacent to but physically separated from the illustrations, Figure 1B). For cohort 2, half of the book was presented in the standard layout and half of the book was presented in the fully separated layout (i.e., text and illustrations were presented on separate pages, see Figure 1C). The presentation order (standard or manipulated layout [i.e., partially or fully separated] first) was counterbalanced across participants. Decoding was assessed prior to reading the story using an independent measure, the Word Recognition in Isolation Test, and also while children were reading the story using a Running Record. To assess comprehension, a post-test was administered. Details regarding all measures are provided below.

Measures

Gaze Shifts

A RED250 mobile eye tracker (SensoMotoric Instruments, Inc.) was used to measure children's patterns of attention allocation. On each page of the book, text, illustration, and white space AOI's were created. The SMI BeGaze Eyetracking Analysis Software was then used to calculate gaze shifts away from the text AOI's (i.e., to illustrations or white space AOI's) and the average number of gaze shifts per page was then calculated.

Decoding Measures

Here we use decoding to refer to the accurate recognition or identification of words in text, which is considered one important component of reading fluency (Rasinski, 2004). Two measures of decoding were used: the Word Recognition in Isolation Task and a Running Record.

Word Recognition in Isolation Task A modified Word Recognition in Isolation (WRI) task measured participants' ability to decode words fluently (Morris, 2013). Participants were shown leveled lists of words. Participant's scores were based on the number of words correctly read aloud (out of 100 words) within the time limit.

Running Record (RR) While participants read the story aloud, the research assistant recorded the participant's decoding accuracy for each word in the story. The proportion of correct responses was calculated (Clay, 1972).

Figure 1: Panel A shows the Standard layout in which text and illustrations are presented in close proximity (as designed by the publisher). Panel B presents the partially separated layout in which text is presented adjacent to, but physical separated from the illustrations. Panel C presents the fully separated layout in which the text and illustration are presented separately and sequentially.

Reading Comprehension Post Test

Retelling Prompt Retelling is a common measure of reading comprehension used with young children (Nilson, 2008). Retelling measured participants' recall of specific story events. Accuracy was scored by calculating the number of key events recalled correctly for each condition (standard or manipulated layout [partially or fully separated]). Scores are the proportion of correct responses.

Story Questions Six story questions (SQ) were administered to measure participants' memory for story details. For example, in the story various animals escape from a pet store (e.g., cats, dogs, birds, rabbits, frogs). Children were asked to recall which pets escaped. Children received full credit if the child identified 4 or more animals that escaped and 0 points if they provided an incorrect response or failed to recall the animals. Partial credit was possible if the child correctly recalled a subset of the animals. Accuracy on SQ was scored as the proportion of correct responses for each layout condition.

Results

Reading Performance

Overall children exhibited a level of decoding consistent with performance of beginning readers (WRI *Ms* ≥.62). The text was considered to be of appropriate difficulty level based on children's relatively high RR scores (*Ms*≥.88); see Table 1.

Table 1: Descriptive statistics.

Layout	WRI	RR	SQ	Retelling	Gaze Shifts
Standard	.62 (.26)	.88 (.21)	.66 (.19)	.44 (.27)	16.38 (12.93)
Partially Separated		.90 (.17)	.88 (.18)	.54 (.21)	7.54 (6.07)
Standard	.73 (.19)	.96 (5.02)	.65 (.28)	.39 (.20)	7.30 (4.5)
Fully Separated		.96 (6.20)	.65 (.25)	.31 (.15)	5.37 (4.36)

Note. Means(SD), RR=Running Record, SQ=Story Questions

Effect of Book Layout

Gaze Shifts. Book layout influenced children's patterns of attention allocation. Children made more frequent gaze shifts away from the text in the standard layout compared to either the partially separated (paired sample $t(25)=5.11$, $p<.0001$) or the fully separated layout (paired sample $t(18)=2.46$, $p=.024$); see Figure 3. It is important to note that children in cohort 2 (standard vs. fully separated) made far fewer gaze shifts in the standard layout than children in cohort 1 (standard vs. partially separated), a concern we return to in the Discussion.

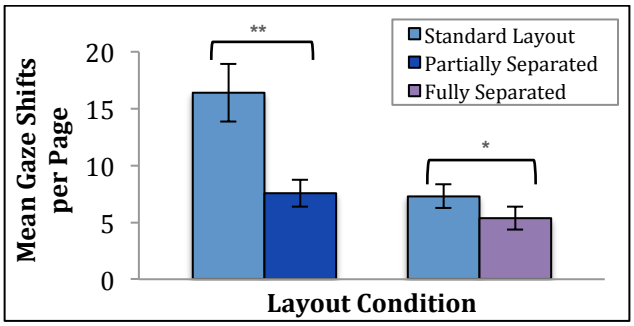

Figure 3: Average gaze shifts away from text as a function of book layout (Note. * = $p<.05$; ** = $p< .0001$).

Decoding and Reading Comprehension. There was no significant effect of book layout on children's decoding (RR) (all paired sample *ts* ≤ -1.33, *ps* ≥ .19). In contrast, book layout had a significant effect on children's reading comprehension scores; see Figure 4. The partially separated layout enhanced comprehension as children obtained significantly higher SQ scores in the partially separated layout ($M=.88$, $SD=.18$) compared to the standard layout ($M=.66$, $SD=.19$); paired sample $t(27)=-4.12$, $p<.0001$. For retelling, a marginally significant benefit for the partially separated layout was found ($M=.44$, $SD=.27$ vs. $M=.54$, $SD=.21$ standard and partially separated layouts respectively; paired sample $t(27)=-1.8$, $p=.08$). However, there was no significant difference in SQ scores between the standard and fully separated layouts (paired sample $t(21)=.0$, $p=1.0$). For retelling, there was some indication that children performed better in the standard layout ($M=.39$, $SD=.20$) compared to the fully separated layout ($M=.31$, $SD=.15$); although this effect was marginally

significant (paired sample $t(21)=1.97$, $p=.06$). Furthermore, regardless of book layout, gaze shifts were negatively correlated with decoding; (WRI: $rs \geq -.77$, $ps < .0001$; RR: $rs \geq -.55$, $ps \leq .004$). Thus, children who were less proficient readers (indexed by both decoding measures: WRI, RR) tended to make more gaze shifts away from the text.

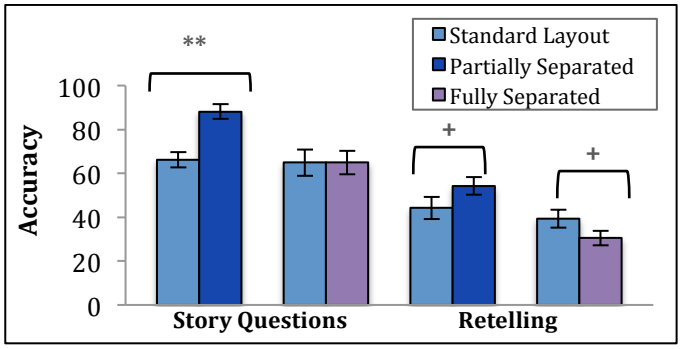

Figure 4: Reading comprehension accuracy (SQ, Retelling) as a function of layout (Note. + = $p<.10$; * = $p<.05$; ** = $p<.0001$).

The findings from Experiment 1 are consistent with the hypothesis that close proximity of text and illustrations may result in competition between these sources of information. By physically separating text and illustrations (either partially or fully) gaze shifts away from the text can be reduced, allowing beginning readers to more readily maintain their attention to the text. Additionally, less proficient readers (indexed by the WRI and RR) tended to make more gaze shifts away from the text than more proficient readers. This finding may indicate that beginning readers are relying in part on illustrations to support (or perhaps to circumvent) decoding, a question we are exploring in future research. The results also point to the possibility that comprehension can be enhanced by utilizing a partially separated layout to increase the spatial separation between text and illustrations. Thus, the results of Experiment 1 indicate that the standard layout can be detrimental to children's literacy. However, there are likely individual differences in children's susceptibility to the detrimental effects that the standard layout may impose. In Experiment 2, we begin to examine this possibility.

Experiment 2

Method

Participants

Participants were first-, second-, and third-grade students (N= 51; 25 females, 26 males; *Mage*=7.77 years, *SD*=.88). Participants were recruited from local schools participating in a Pre-K-12 educational technology outreach program, and a youth summer camp both located at a public university in a Midwestern city in the United States. Children were tested individually in a room adjacent to their classroom or camp.

Design and Procedure

As in Experiment 1, children read aloud commercially available books designed for beginning readers in which text and illustrations were in close proximity. Two new books were selected to ensure generalizability of the findings (*Ruby's New Home* by Tony and Lauren Dungy and *Gideon* by Olivier Dunrea). The books were modified (text shortened to 161 words) to ensure children could complete the books within a single session. Children were randomly assigned to a book (*Ruby's New Home* or *Gideon*). The procedure and reading measures in Experiment 2 were analogous to those in Experiment 1, minor modifications are detailed below. Children also completed an individual difference assessment (described below) to measure executive function and processing speed.

Measures

Decoding measures (WRI and RR) and the retelling task were identical to those used in Experiment 1.

Story Questions As in Experiment 1, six story questions were administered to measure participants' memory for story details. However, in Experiment 2 a multiple-choice format was utilized. Participants were asked to choose the correct answer from four pictorial response options. For example, in the Gideon story, the main character plays in different locations with various animals. Participants were asked to identify details about a particular encounter (e.g., "Who did Gideon chase in the meadow?") by pointing to the corresponding pictorial response option (i.e., butterflies). Accuracy was scored as the proportion of correct responses.

Individual Difference Assessment Battery

Executive Function Measures

We utilize Miyake et al.'s (2000) theoretical framework, which asserts that executive function (EF) is comprised of three interrelated but separable components including: inhibition, working memory (referred to as updating) and shifting. In this study we focus on two of these components: inhibition and working memory. Details regarding the measures are provided below.

Working Memory (WM) Task Verbal WM was indexed by a simple and complex word span task. In the simple word span task, a list of familiar words (judged by the MacArthur Communicative Development Inventory; Dale & Fenson, 1996) was read aloud and participants were asked to repeat the words in the same order in which they were presented. In the complex word span task, participants were asked to repeat the words in the reverse order. List length increased after participants correctly completed two lists within a given set. The minimum set size was a list length of 2 words and the maximum set size was 6. The participant's score was the largest set size recalled correctly.

Inhibitory Control and Processing Speed Task The Heart and Flowers task (Davidson, Amso, Anderson, & Diamond,

2006) measured individual differences in inhibitory control as well as processing speed. In this task, participants are presented with a series of hearts and flowers on a computer screen. Participants were instructed to press the response button on the same side as the stimulus when a heart was presented and to press the response button on the opposite side of the stimulus when a flower appeared. The task included 57 trials over three blocks. In Block 1: 12 heart trials were presented, Block 2 included 12 flower trials, and Block 3 was comprised of 33 mixed trials (i.e., both hearts and flowers could appear). For each block, participants' speed (RT) and accuracy were calculated. Performance on the congruent trials (Block 1) was taken as an index of processing speed as it is thought to tap participant's prepotent response. Performance on the mixed block (Block 3) was taken as an index of inhibitory control.

Results

Data collection is currently in progress, preliminary results are presented below.

Reading Performance

Overall children exhibited high levels of decoding as reflected in their WRI (M=.92, SD=.14) and RR (M=.96, SD=.11) scores. The decoding measures were significantly correlated (r=.92, $p \leq .0001$). Both the WRI and RR were significantly correlated with performance on the SQ ($rs \geq .37$, $ps \leq .008$), suggesting decoding and comprehension are related. Children's relatively strong performance on the SQ (M=.82, SD=.26) indicates participants understood key elements from the story - despite difficulty recounting the story in the retelling task (M=.17, SD=.16).

While the results of Experiment 1 indicate that the standard layout can be detrimental to children's literacy, there is likely individual differences in children's susceptibility to the attentional competition that the standard layout may impose. In order to examine what role pertinent individual differences might play, a correlation analysis was conducted. The findings are reported below (see Table 2).

Role of EF and Processing Speed

Working Memory (WM) Recall that two WM memory measures were administered: a simple and complex word span task (M=3.96, SD=.66; M=2.71, SD =.73 respectively) The tasks were significantly correlated (r=.43, p=.002). Thus, a WM composite was created by standardizing children's scores using Z-scores and averaging the standardized scores together. A marginally significant relationship was found between the WM composite and the independent measure of decoding (WRI: r=.27, p=.06). The association between WM and SQ, an index of reading comprehension, was significant (r =.31, p=.03).

Inhibitory Control Accuracy and RT on the Heart and Flower mixed block (congruent and incongruent trials presented randomly) were utilized as indices of inhibitory control. Accuracy on the inhibitory control task (M=.69, SD=.13) was positively and significantly correlated with decoding (WRI: r=.35, p=.01; RR: r=.36, p=.01)[1].

Processing Speed Accuracy and RT on the congruent trials from the Heart and Flower task were utilized to assess processing speed. Accuracy (M=.97, SD=.05) was positively and significantly correlated with decoding (WRI: r=.41, p=.003; RR: r=.41, p=.003). RT (M=478.80ms, SD=103.29) was negatively correlated with decoding (WRI: r=-.25, p=.09); however, this association was only marginally significant. Accuracy on the processing speed task was also found to be positively correlated with reading comprehension (SQ: r=-.37, p=.009).

Table 2: Experiment 2 Correlation Matrix.

Measures	2	3	4	5	6	7	8	9
1. WM	.31*	.02	.21	.063	.27+	.18	.31*	-.01
2. ICtrl	1	.35*	.22	-.31*	.35*	.36*	.10	.02
3. ICtrl RT		1	-.21	.33*	.01	.02	.01	.05
4. PSpd			1	-.04	.41*	.41*	.37*	-.10
5. PSpd RT				1	-.25+	-.21	.03	.09
6. WRI					1	.92*	.37*	.08
7. RR						1	.44*	.08
8. SQ							1	.26+
9. Retell								1

Note. * = p< .05, + = p<.10. ICtrl = Inhibitory Control; PSpd = Processing Speed

Preliminary results from Experiment 2 indicate individual differences in cognitive functions are associated with differences in decoding and reading comprehension in the standard layout and point to the possibility that children with strong EF skills and better processing speed may be less vulnerable to the detrimental effects imposed by the standard layout.

Discussion

Typically, beginning reader books provide textual and illustrative information in close proximity. We aimed to create a more optimal book design by physically separating the text and illustrations. We examined the effect of this manipulation on children's decoding and comprehension. Increasing physical separation between text and illustrations reduced attentional competition as evidenced by the reduction in the number of gaze shifts children made away from the text in both the partially and fully separated layouts compared to the standard layout. The partially separated layout also improved children's comprehension. Although more research is needed to identify additional features of optimal book design for beginning readers, the present study points to the possibility that even small layout changes may help improve literacy.

[1] Exclusion of a potential outlier (WRI=.22) renders the correlation with inhibitory control non-significant (p>.05). This effect may stabilize once the full sample is collected. However, this child is currently the youngest participant in the study (5.96 years) the possibility of age (or reading experience) being a potential moderator remains an open question.

The present study also investigated whether individual differences in cognitive functioning impact reading performance in the standard layout. We hypothesized that the standard layout compounds issues for children with weak EF skills and slow processing speed, resulting in decrements in decoding and reading comprehension. The preliminary findings are partially consistent with this hypothesis. Inhibitory control and processing speed accuracy were positively associated with decoding, which is an integral component of literacy (Pikulski & Chard, 2005), while WM and processing speed accuracy were also related to reading comprehension. Future research is needed to investigate whether these effects are heightened in certain clinical populations (e.g., children with Autism, ADHD). For instance, children with autism may be particularly sensitive to visual clutter and distractions (e.g., Hanley et al., 2017). Thus, we might anticipate that these children would also show greater benefits from reading stories in which text and illustrations are not in close proximity.

The findings from this work are promising, however, a number of limitations should be addressed in future research. First, although children in Experiment 1 consistently made more gaze shifts in the standard layout compared to the manipulated layouts, there is a sizeable difference in the number of gaze shifts children made in the standard layout across two separate samples of children (cohort 1 and 2). Further replications with larger samples are needed to better understand these inconsistent gaze shift patterns. Furthermore, it will be important to connect eye tracking data with individual difference data to extend the results from Experiment 2 and determine if children with weak EF and slow processing speed are more likely to make more frequent gaze shifts away from the text. Future research should include additional age groups to evaluate if the effect of layout is moderated by age and reading experience. In conclusion, separating text and illustrations is a promising and easy to implement modification that may make books more conducive for beginning readers.

Acknowledgments

We thank Kristen Boyle, Mengjiao Wu, Kali Sebastian, Aimee Wildrick, Eleni Magiassos, Erika Zuga, Freya Kaur, for help collecting data, Annette Kratcoski and Phelan Fletcher for help with recruitment. We thank the children, parents, and teachers for making this work possible. This work was supported in part by NSF (# BCS-1730060) awarded to A.F. and K.G and the Institute of Education Sciences, U.S. Department of Education, through grant R305B150008 to Carnegie Mellon University. The opinions expressed are those of the authors and do not represent the views of the Institute or the U.S. Department of Education.

References

Biederman, J., Monuteaux, M.C., Doyle, A.E., Siedman, L.J., Wilens, T.E., Ferrero, F., Morgan, C.L., & Faraone, S.V. (2004). Impact of executive function deficits and attention - deficit/hyperactivity disorder (ADHD) on academic outcomes in children. *Journal of Counseling and Clinical Psychology, 72*(5), 755-766.

Carney, L.N., & Leven, J.R. (2002). Pictorial illustrations still improve students' learning from text. *Educational Psychology Review, 14*(1), 5-26.

Clay, M. (1972). The early detection of reading difficulties: A diagnostic survey.

Dale, P.S., & Fenson, L. (1996). Lexical development norms for young children. *Behavior Research Methods, Instruments, & Computers*, 28, 125-127.

Davidson, M.C., Amso, D., Anderson, L.C., & Diamond, A. (2006). Development of cognitive controls and executive function from 4 to 13 years: Evidence from manipulations of memory, inhibition, and task switching. *Neuropsychologia, 44*(11), 2037-2078.

Dykman, R.A., & Ackerman, P.T. (1991). Attention deficit disorder and specific reading disability: Separate but often overlapping disorders. *Journal of Learning Disabilities, 24*(2), 96-103.

Fang, Z. (1996). Illustrations, text, and the child reader. What are pictures in children's storybooks for? Read. Horizons 37: 130–142.

Fisher, A.V., Godwin, K.E., & Seltman, H. (2014). Visual Environment, Attention Allocation, and Learning in Young Children: When too much of a good thing may be bad. *Psychological Science, 25*(7), 1362-1370.

Godwin, K., Eng, C.M., & Fisher, A.V. (2017). Gaze shifts between text and illustrations are negatively related to reading fluency in beginning readers. *Proceedings from the 39th Cognitive Science Conference*. London: Cognitive Science Society.

McNeil, N.M., Uttall, D.H., Jarvin, L., & Sternberg, R.J. (2009). Should you show me the money? Concrete objects both hurt and help performance on mathematics problems. *Learning and Instruction, 19*(2), 171-184.

Miyake, A., Friedman, N.P., Emerson, M.J., Witzki, A.H., & Howerter, A. (2000). The unity and diversity of executive functions and their contributions to complex "frontal lobe" tasks: A latent variable analysis. *Cognitive Psychology, 41,* 49-100.

Morris, D. (2013). *Diagnosis and correction of reading problems* (2nd ed.). New York, NY: Guilford Press.

National Association for the Education of Young Children (1998). Learning to read and write: Developmentally appropriate practices for young children. A joint position statement of the International Reading Association and the National Association for the Education of Young Children. *Young Children*, *53*(4), 30–46.

Nilson, N.L. (2008). A critical analysis of eight informal reading inventories. *The Reading Teacher, 6*(17), 526-536.

Pikulski, J.J., Chard, D.J. (2005). Fluency: Bridge between decoding and reading comprehension. *The Reading Teacher, 58*(6), 510-519.

Rasinski, T. V. (2004). Assessing Reading Fluency Pacific Resources for Education and Learning. *Honolulu, Hawaii*.

Ruff, H.A., & Rothbart, M.K. (2001). Attention in early development: Themes and variations. New York: Oxford University Press.

Tare, M., Chiong, C., Ganea, P., & DeLoache, J. (2010). Less in more: How manipulative features affect children's learning from picture books. *Journal of Applied Developmental Psychology, 31*(5), 395-400.