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Impact of Professional Development on Preschool Teachers' Print References During Shared Read Alouds: A Latent Growth Curve Analysis

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Abstract: This large-scale, experimental study aimed to (a) describe the extent to which teachers of preschool children at risk for reading difficulties make references to print during whole-class, shared-book read alouds and (b) empirically test the extent to which participation in professional development influences teachers' frequency of references to print during shared read alouds across the academic year. Eighty-five preschool teachers working in targeted-enrollment preschool programs were randomly assigned to receive professional development aimed at increasing their use of print referencing or to a comparison condition involving alternative training; all teachers implemented a shared read aloud program in their classrooms. Implementation was documented via twice-monthly videotaping of shared read aloud sessions. Videos were coded for the frequency of print references and analyzed using latent growth curves. Despite considerable variability in teachers' use of print referencing, findings showed sustained, meaningful changes in teachers' use of print referencing with results favoring those who experienced the experimental professional development. Implications concerning effective professional development for supporting preschool children's emergent literacy skills are discussed.

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Today, about one half of young children participate in publicly-funded preschool programs (National Institute for Early Education Research, 2000). These programs are designed to provide high-quality learning opportunities for children at elevated risk for later academic difficulties (Dickinson, McCabe, & Essex, 2006). Research suggests, however, that the quality of many such programs is less than optimal, particularly with respect to the language and literacy environment provided (e.g., Justice, Mashburn, Hamre, & Pianta, 2008; LoCasale-Crouch et al., 2007; Mashburn, 2008). Experts have suggested that professional development for preschool teachers is one means to elevate classroom quality and increase the provision of key language and literacy instructional supports (Dickinson, Darrow, & Tinubu, 2008; Landry, Swank, Smith, Assel, & Gunnewig, 2006; LoCasale-Crouch et al., 2007). In this study, we investigated the influence of professional development (PD) aimed at changing one aspect of teachers' language and literacy instructional practices, namely, the extent to which they explicitly referenced print during whole-class shared-book read alouds. As we discuss, this particular intervention technique has considerable empirical support with respect to its causal impacts on young children's emergent literacy development (e.g., Justice & Ezell, 2000, 2002; Lovelace & Stewart, 2007; National Early Literacy Panel, 2008), making it a worthwhile topic for professional development.

EMERGENT LITERACY DEVELOPMENT AND SHARED READ ALOUDS

Emergent literacy is a theoretical construct referring to the notion that early literacy and language experiences, and the skills that these develop, provide the foundation for children's later literacy outcomes (Whitehurst & Lonigan, 1998, 2001). An important emphasis in emergent literacy perspectives is that literacy development begins quite early in life, far earlier than historically had been thought. A corollary of this perspective, and one particularly pertinent today given the number of children participating in preschool, is that the early childhood classroom is a rich context for promoting aspects of emergent literacy development, including oral language skills, phonological awareness, and print knowledge (Dickinson, 2006; Teale & Sulzby, 1989). These learning opportunities are believed to be most effective when they are embedded in "purposeful, goal-directed activities" (Teale & Sulzby, 1989, p. 4; see also Justice & Pullen, 2003; Kaderavek & Justice, 2004; Whitehurst & Lonigan, 1998). Adult-child shared read alouds offer a developmental context that is consistent with this perspective, because it is inherently a purposeful literacy activity (Teale & Sulzby, 1989). Consequently, shared read alouds within preschool classrooms are

receiving increased attention as one context through which children's literacy skills can be explicitly enhanced.

A number of empirical studies (e.g., Aram, 2006; Justice & Ezell, 2002; Neuman, 1996; Neuman & Roskos, 1993; Rosenhouse, Feitelson, Kita, & Goldstein, 1997) have presented findings regarding the efficacy of shared read alouds in promoting children's language and literacy skills (see also Bus, van IJzendoorn, & Pellegrini, 1995; Hindman, Connor, Jewkes, & Morrison, 2008; Mol, Bus, & de Jong, 2009; National Early Literacy Panel, 2008, for review). Wasik, Bond, and Hindman (2006), for example, found that coaching preschool teachers to increase their use of certain conversational techniques (e.g., open-ended questions) during adult-child shared read alouds increased children's receptive language, expressive language, and alphabet knowledge. This research is grounded within a larger literature emphasizing the use of read alouds as a means for developing specific oral language skills, including grammatical complexity and vocabulary knowledge (e.g., Whitehurst et al., 1988).

Of relevance to this study, shared read alouds may be particularly effective for promoting children's print knowledge. Print knowledge refers to a child's knowledge of the functions and forms of print (e.g., capital and lowercase letters, left to right directionality, top and bottom of the page) and letter-sound correspondences (Adams, 1990; Clay, 2001; Purcell-Gates, 1996). Young children's developing print knowledge includes the understanding that print carries meaning (i.e., corresponds to spoken language) and that books and print are organized in particular ways (Justice & Ezell, 2002, 2004; Lovelace & Stewart, 2007). Longitudinal studies demonstrate that print knowledge is consistently one of the better predictors of children's later reading and spelling skills (Adams, 1990; Ehri, 2006; Hammill, 2004; Lomax & McGee, 1987; National Early Literacy Panel, 2008; Scarborough, Ehri, Olson, & Fowler, 1998). For instance, the recent report of the National Early Literacy Panel (2008) showed that specific indices of print knowledge, including alphabet knowledge and concepts about print, were correlated with future decoding skills at levels similar to measures of phonological awareness and oral language. As such, print knowledge is considered an essential emergent literacy skill for preschool-aged children to acquire (Justice & Ezell, 2004; Whitehurst & Lonigan, 1998) and is increasingly emphasized in state and national learning standards for early childhood education (National Early Literacy Panel, 2008). Bracken and Crawford's (2010) recent compilation of information on all 50 states' early childhood education standards, for example, showed that every state included recognizing and naming the 26 letters in their current standards.

Of importance, several studies have shown that children's development of print knowledge can be explicitly facilitated during shared read aloud interactions in which the adult reader embeds questions, comments, and nonverbal references to print (Justice & Ezell, 2000, 2002; Lovelace & Stewart, 2007; National Early Literacy Panel, 2008; Whitehurst et al., 1994). For example, adults may point out elements on books' covers and track print while reading

to facilitate basic understanding of book and print organization (e.g., title, author, print directionality). Adults may also use verbal and nonverbal prompts to facilitate the development of more complex print knowledge such as the concepts and features of letters and words (e.g., “What is the first letter on the page? What sound does it make?”; Justice & Ezell, 2004; Zucker, Justice, & Piasta, 2009). This approach to shared read alouds, referred to as print referencing, has been causally linked to greater print awareness and knowledge in preschool-aged children (Ezell & Justice, 2000; Girolametto, Weitzman, Lefebvre, & Greenberg, 2007; Justice & Ezell, 2000; Justice, Kaderavek, Fan, Sofka, & Hunt, 2009; Justice & Lankford, 2002; Justice, McGinty, Piasta, Kaderavek, & Fan, 2010; van Bysterveldt, Gillon, & Moran, 2006) and can be incorporated into shared book reading naturally without taking away from comments and questions that support children’s language growth and story comprehension (Zucker et al., 2009). Most of the prior work on print referencing involves adult embedding of a very modest number of comments and questions about print into read aloud activities. Study of print-referencing use by preschool teachers indicated no significant relation between amount of teacher print references and the quality of read alouds (Zucker et al., 2009); moreover, recent work by Justice and colleagues showed that teacher use of a print-referencing style over an academic year did not have any impacts on children’s language growth as compared to children who received business-as-usual reading styles (Justice et al., 2010).

Adults’ print referencing is an important means for directing children’s attention toward print because young children rarely attend to print when they look at storybooks. Evans and Saint-Aubin (2005), for instance, found that 4-year-old children looked at the illustrations 18 times more often than they looked at text. Justice, Skibbe, Canning, and Lankford (2005) further substantiated these results, finding that 4-year-old children look at print only 2% of the time when engaged in an adult–child shared read alouds (see also Evans, Williamson, & Pursoo, 2008; Justice, Pullen, & Pence, 2008). Other studies, such as that by Yaden, Smolkin, and Conlon (1989), indicate that children’s extratextual talk during shared read alouds also tends to reflect attention to illustrations rather than print. Augmenting these findings are research studies indicating that adults’ typical reading styles generally do not focus children’s attention on print (Justice & Ezell, 2000, 2004; Zucker et al., 2009). Parents largely confine their verbal references during shared read alouds to aspects of the illustrations (Ezell & Justice, 2000; Phillips & McNaughton, 1990) unless children initiate print-related talk (Bus & Van IJzendoorn, 1988). Preschool teachers also tend to make few references to print when reading to their pupils (e.g., Girolametto et al., 2007; Zucker et al., 2009), and these are typically confined to simply labeling the title and author of a book being shared (Martinez & Teale, 1993; Teale & Martinez, 1996). The consequence of such limited attention to print during shared read alouds is that preschool-aged children’s print knowledge generally does not improve as a result of shared read aloud experiences (Evans, Shaw, &

Bell, 2000; Justice & Ezell, 2000, 2002, 2004) unless adults provide greater-than-typical levels of print referencing (Ezell & Justice, 2000; Girolametto et al., 2007; Justice & Ezell, 2000; Justice, Kaderavek, et al., 2009; Justice & Lankford, 2002; Justice et al., 2010).

PRINT REFERENCING AND PROFESSIONAL DEVELOPMENT

Theoretical perspectives regarding the value of explicit instruction for facilitating children's literacy development govern the professional development experience assessed in this study. As we have discussed previously, adults (and children) appear to pay little direct attention to print during their early read aloud experiences. Explicitness, as applied to the teaching of literacy, is considered an important aspect of effective instruction (Senechal, LeFevre, Smith-Chant, & Colton, 2001). This perspective is derived in part from seminal theories on teaching. For instance, Bruner (1966) noted that "intellectual development depends upon a systematic and contingent interaction between a tutor and a learner" (p. 6). More recently, Adams (1990) contended that children's early literacy learning (particularly growth in alphabetic knowledge) is contingent upon their explicitly "attending to new relations" between parts and pieces (p. 74). Although limited attention has addressed explicitness as a critical concept of literacy instruction with very young children (but see longitudinal links between explicit instruction in print knowledge and positive child reading outcomes as noted by Whitehurst & Lonigan, 1998), research by Connor, Morrison, and Slominski (2006) found that preschool-aged children's amount of exposure to explicit code-focused activities within their classrooms reliably predicted their alphabet and letter-word identification growth.

As we have noted previously, research has consistently shown that adults in general and early childhood teachers in particular rarely embed explicit talk about print into their reading interactions with children; therefore, within this particular context, children's learning about print is largely implicit in nature. PD therefore appears necessary if not sufficient for increasing preschool teachers' explicit referencing of print during read alouds, which in turn can significantly increase children's knowledge about print over time. Some prior studies have shown that adults may be coached to better utilize such verbal and nonverbal references to print during reading (Ezell & Justice, 2000; Girolametto et al., 2007; Justice & Ezell, 2000; Justice, Kaderavek, et al., 2009). For instance, Justice and Ezell (2000) taught 14 parents to implement a print-referencing style when reading to their preschool-aged children using a brief, 15-min observational learning approach involving a video demonstration, practice reading, and immediate feedback. Parents who received this instruction significantly increased their rates of print referencing across a 1-month period as compared to those who did not receive such instruction. These results

were replicated using a similar observation learning procedure for 12 graduate students in speech and hearing sciences (Ezell & Justice, 2000).

Relatively little work has focused on teachers, although recent research by Girolametto and colleagues (2007) showed that print-referencing training can be efficacious for preschool teachers. These researchers randomly assigned eight preschool teachers to receive a 2-day inservice workshop (12 hr) on developing children's language and emergent literacy skills; the use of print referencing when reading with children (and during other activities, such as crafts) was explicitly focused on in this workshop. These teachers used twice as many verbal print references when assessed 2 weeks following completion of training and compared to teachers assigned to receive equivalent, alternative PD. Authors (Justice, Kaderavek et al., 2009) reported preliminary findings from a subsample of teachers ($n = 23$) involved in the present study, also indicating that teachers who received training used significantly greater rates of print referencing up to 14 weeks posttraining when compared to those in a comparison condition. Moreover, children enrolled in trained teachers' classrooms demonstrated significantly greater print knowledge gains than those enrolled in comparison classrooms.

The latter findings suggest that print-referencing training may be one effective means of supporting preschool teachers in developing children's emergent literacy skills. These findings are consistent with accumulating evidence demonstrating the impact of PD in promoting preschool teachers' use of high-quality classroom language and literacy practices (e.g., Dickinson & Caswell, 2007; Jackson et al., 2006; Landry et al., 2006; Neuman & Cunningham, 2009; Wasik et al., 2006). For instance, Jackson and colleagues (2006) found that teacher completion of a 15-week PD course positively affected the language and literacy practices in teachers' classrooms. Specifically, the teachers who received the PD greatly improved their classroom quality compared to control teachers, which led to significant gains by their students in verbal analogies, letter identification, and awareness of print. Dickinson et al. (2008) also used PD to help Head Start teachers to increase their use of strategies shown to improve student language outcomes. Teachers participated in a 3-day training in August with a follow up training in January. The teachers were provided with coaching and support in the beginning of the school year, which led to an increase in thought provoking questions and extended conversation sequences. As a final example, work by Landry et al. (2006) supports the promise of PD in improving preschool teachers' language and literacy practices when implemented at-scale. Landry and colleagues implemented a statewide PD summer workshop for Head Start teachers, which involved a 4-day, small-group intensive training with 2-day refresher trainings over the course of 2 years. During the school year, teachers also participated in monthly meetings and ongoing problem solving. Their results suggested not only a positive influence of the workshop on changing teachers' instructional behaviors but also positive outcomes for children.

The purpose of the present study was to expand the literature concerning print-referencing instruction, and PD for preschool teachers in general, by examining the effectiveness of PD aimed at increasing teachers' verbal and nonverbal print references during classroom shared read alouds across a full academic year. The study particularly focused on teachers' change over time in use of print references, as previous studies have noted particular difficulties in promoting sustained change in teachers' language and literacy instructional practices as a result of PD (e.g., Jackson et al., 2006; Landry et al., 2006). The print-referencing PD followed many of the principles utilized in previous work and shown to effect changes in teachers' language and literacy practices, such as those just described. The print-referencing PD was also designed to include components of effective PD as gleaned from the larger literature: (a) a strong theoretical basis (e.g., using current research and theoretical frameworks; see Dole, 2003; Joyce & Showers, 1995; Little, 1993), (b) an explicit focus on instructional techniques and subject matter (Fishman, Marx, Best, & Tal, 2003; Garet, Porter, Desimone, Birman, & Yoon, 2001), (c) an emphasis on measurable student outcomes (Darling-Hammond & McLaughlin, 1995; Dole, 2003; Guskey, 1985), (d) continuous and ongoing support (Fleet & Patterson, 2001; Garet et al., 2001; Landry et al., 2006), and (e) opportunities for participant involvement (Garet et al., 2001; Spillane, 1999, 2002). Specifically, we provided teachers with an initial 8-hr inservice workshop that included an overview of children's print knowledge and emergent literacy development, information concerning the purpose, logic, and efficacy of print referencing during adult-child shared-book reading in impacting children's print knowledge gains, and opportunities to observe and practice print-referencing techniques. In addition, following the workshop, teachers received ongoing support in the form of (a) individual feedback letters noting strengths and weakness in print-referencing implementation and (b) a 3-hr refresher workshop during which general principles and techniques of print referencing were reviewed.

The study addressed two main research questions. First, to what extent do preschool teachers utilize print referencing during whole-class, shared read alouds, and second, to what extent does participation in PD impact teachers' print referencing during such read alouds? We expected that teachers who experienced PD on print referencing would exhibit greater frequencies of print references than teachers who experienced an alternative form of PD. To our knowledge, only three other studies (Girolametto et al., 2007; Justice, Kaderavek, et al., 2009; Zucker et al., 2009) have sought to describe and/or impact the extent to which preschool teachers explicitly reference print when reading books to their pupils. The present study expands upon this literature by involving a much larger sample of teachers and utilizing repeated observations of their read alouds, thus achieving increased internal and external validity, and by considering the heretofore unexamined question of whether changes in teachers' print referencing as a result of PD are sustained and maintained over time (i.e., an entire academic year). An additional post hoc research aim involved

examining the extent to which variability in teachers' print referencing was due to book effects. Potential book effects were explored given evidence that particular books may afford different opportunities for teachers and child to engage with print. Specifically, previous studies have indicated that books containing interesting fonts and print embedded in illustrations may be more conducive to print referencing (Justice & Lankford, 2002; Smolkin, Conlon, & Yaden, 1988; Smolkin, Yaden, Brown, & Hofius, 1992; Zucker et al., 2009).

METHOD

The present multistate study was conducted at two project sites, located in Virginia and Ohio. The project randomly assigned preschool teachers to one of three conditions: high-dose print referencing (HDPR), low-dose print referencing (LDPR), or high-dose regular reading comparison (HRRR). All teachers received identical sets of 30 storybooks to complete a 30-week reading program in their classrooms. Teachers assigned to the first two conditions (HDPR and LDPR) received identical PD aimed at increasing their print referencing during classroom shared read alouds. The difference between the two sets of teachers concerned how often they were to implement reading sessions in their classrooms; specifically, teachers in the HDPR condition were asked to utilize print referencing during four whole-class read alouds per week, whereas teachers in the LDPR were asked to utilize print referencing during two whole-class read alouds per week. Teachers assigned to the HRRR comparison condition received professional development on a topic unrelated to print referencing and were asked to conduct four whole-class read aloud per week utilizing their regular reading style.

Teachers' PD activities, the 30-week reading program, and data collection occurred in two waves. Wave 1 occurred during the 2005–2006 academic year; Wave 2 occurred during the 2006–2007 year. Additional details concerning the larger project are described in Justice, Kaderavek (2009), Justice, McGinty et al. (2010), and Breit-Smith, McGinty, Justice, Kaderavek & Fan (2009).

Participants

Eighty-five preschool teachers participated in the study across sites and cohorts. One additional teacher initially enrolled in the project discontinued participation midyear. All teachers were volunteers and provided informed consent. Thirty-one teachers were randomly assigned to the HDPR condition, 26 were assigned to the LDPR condition, and 28 were assigned to the HRRR comparison condition.

The majority of teachers were female (95%, $n = 81$) and White, non-Hispanic (64%, $n = 54$). Approximately 28% of teachers were African

American ($n = 24$), 2% were Hispanic/Latino ($n = 2$), 1% were Native American/Indian ($n = 1$), and 5% were Multiracial ($n = 4$). Teachers ranged in their levels of education. For 15% of teachers ($n = 13$), their highest degree was a high school diploma. Twenty-seven percent ($n = 23$) had an associate's degree, 36% ($n = 31$) had a bachelor's degree, and 21% ($n = 18$) had master's or other advanced degrees. Teachers had an average of 11 years of preschool teaching experience ($SD = 8.87$; range = 0–38 years) and 15 years of overall teaching experience ($SD = 9.97$, range = 0–40 years). The majority of teachers held certification to teach at the prekindergarten (67%, $n = 57$) and/or kindergarten (44%, $n = 37$) levels. Twenty-one percent ($n = 18$) also held Child Development Associate credentials.

All teachers taught in preschool classrooms serving children considered to be at risk for academic difficulties due to socioeconomic factors. Thirty-three taught in Head Start classrooms, 39 taught in Title I or state-subsidized classrooms, and 13 taught in private preschool centers that accepted vouchers. A random selection of children sampled from these classrooms (2–13 children per classroom; $n = 550$) indicated that the average age of children served was 52 months at the beginning of the preschool year ($SD = 4.56$). Forty-nine percent ($n = 267$) of the children were female, and 42% ($n = 229$) were White, non-Hispanic, 37% ($n = 206$) were African American, 8% ($n = 45$) were Multiracial, 7% ($n = 41$) were Hispanic/Latino, and 2% ($n = 13$) were of other races/ethnicities (3% unreported). The majority of children spoke English at home (88%, with 10% unreported). Average yearly income for children's families was between \$20,000 and \$30,000, with 57% of the sample falling at or below this range (15% unreported). Sixteen percent ($n = 90$) of children's mothers had not obtained a high school diploma, 45% ($n = 246$) had achieved a high school diploma but no college degree, 13% ($n = 71$) had technical training beyond high school, 8% ($n = 45$) had an associate's degree, 5% ($n = 29$) had a bachelor's degree, and 1% ($n = 6$) had an advanced graduate degree (12% unreported).

Descriptive information for teachers in each of the three study conditions, along with relevant child characteristics, is presented in Table 1. The proportion of teachers teaching in private preschools was slightly larger than expected in the HDRR comparison condition and slightly less than expected in the LDPR condition ($p = .083$). No other significant differences among conditions were found for teacher or child characteristics ($ps > .141$; see Table 1).

Procedure

Participating teachers were asked to implement a book reading program in their preschool classrooms. During the 30-week program, teachers read 30 commercially available children's storybooks as a whole-class, shared read aloud activity. The books were selected particularly for features supportive of

Table 1. Teacher and child characteristics by condition

Characteristics	Condition			Group Comparison
	HDPR	LDPR	HDRR	
Teacher characteristics				
<i>n</i>	31.00	26.00	28.00	
% female	96.77	92.31	96.43	$\chi^2(2, N = 85) = 0.749, p = .682$
Race/ethnicity				
% White, non-Hispanic	70.97	61.54	58.62	$\chi^2(8, N = 85) = 5.101, p = .836$
% African American	19.35	34.62	32.14	
% Hispanic/Latino	3.23	0	3.57	
% Native American/Indian	0	0	3.57	
% Multiracial	6.45	3.85	3.57	
Highest degree attained				
% HS diploma	19.36	3.85	21.42	$\chi^2(14, N = 85) = 8.667, p = .886$
% Associate's degree	25.81	23.08	32.14	
% Bachelor's degree	35.48	42.31	32.14	
% Graduate degree	19.36	30.77	14.29	
Preschool teaching experience				
<i>M</i>	9.25	12.30	11.82	Welch's $F(2, 52.194) = 1.157, p = .322$
<i>SD</i>	7.53	8.53	10.39	
Overall teaching experience				
<i>M</i>	14.80	15.08	16.46	$F(2, 81) = 0.223, p = .801$
<i>SD</i>	10.32	9.90	9.93	
Credentials				
% Prekindergarten certification	75.86	82.61	59.26	$\chi^2(2, N = 79) = 3.684, p = .159$
% Kindergarten certification	50.00	54.55	48.00	$\chi^2(2, N = 73) = 0.208, p = .901$
% Child development Associate	20.69	21.74	29.17	$\chi^2(2, N = 76) = 0.591, p = .744$
Program type				
% Head Start	48.39	38.46	28.57	$\chi^2(4, N = 85) = 8.254, p = .083$
% Subsidized	38.71	57.69	42.86	
% Private	12.90	3.85	28.57	
Child characteristics				
<i>n</i>	201.00	165.00	184.00	
Age (months)				
<i>M</i>	51.96	52.67	51.87	$F(2, 547) = 1.592, p = .204$
<i>SD</i>	4.47	4.71	4.53	
% female	48.00	53.94	44.02	$\chi^2(2, N = 549) = 3.452, p = .178$
% speaking English at home	97.71	97.37	97.01	$\chi^2(2, N = 493) = 0.777, p = .743$
(Continued on next page)				

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Table 1. Teacher and child characteristics by condition (Continued)

Characteristics	Condition			Group Comparison
	HDPR	LDPR	HDRR	
Race/ethnicity				
% White, non-Hispanic	42.05	42.86	43.50	$\chi^2(8, N = 533) = 11.473, p = .176$
% African American	35.38	41.61	39.55	
% Hispanic/Latino	12.31	5.59	4.52	
% Multiracial	8.72	6.83	9.60	
% Other	1.54	3.10	2.82	
Maternal education (highest degree attained)				
% No HS diploma	15.79	17.22	21.95	$\chi^2(10, N = 486) = 14.761, p = .141$
% HS diploma	54.39	47.68	49.39	
% HS diploma plus technical training	11.70	21.19	11.59	
% Associate's degree	8.77	6.62	12.20	
% Bachelor's degree	8.19	5.96	3.66	
% Graduate degree	1.17	1.32	1.22	
Family income				
% \$0–\$15,000	33.13	36.05	38.85	$\chi^2(8, N = 467) = 8.848, p = .355$
% \$15,001–\$30,000	33.13	29.25	30.57	
% \$30,001–\$45,000	18.40	14.97	14.65	
% \$45,001–\$60,000	8.59	6.12	9.55	
% >\$60,000	6.75	13.61	6.37	

Note. Categories may not sum to 100% due to rounding. HDPR = high-dose print referencing; LDPR = low-dose print referencing; HDRR = high-dose regular reading comparison; HS = high school.

use of print references, such as large or interesting fonts or speech bubbles. Books were identical and read in the same order across the three conditions (HDPR, LDPR, HDRR). All teachers were provided with a schedule that prescribed which book should be read during each week of the project, with the same book read multiple times per week.

Teachers in the three conditions differed systematically in the number of book readings per week and the manner in which books were read. Regarding the former, teachers in the high-dose (HDPR, HDRR) conditions read the scheduled book four times within a week; teachers in the low-dose condition (LDPR) read the book two times within a week. Regarding the latter, teachers in the print-referencing conditions were encouraged to read using the print-referencing style espoused in the PD they received, as described next. To facilitate these teachers' use of print references when reading, the books provided to teachers in the HDPR and LDPR conditions included inserts enumerating two print-referencing targets per book and how these targets might be addressed. Although teachers in these conditions were asked to reference these

targets at least twice per read aloud, teachers were encouraged to generally apply the print-referencing style to read alouds and thus varied in the extent to which it was used (see Table 2). Teachers in the HDRR condition did not receive print-referencing PD; thus, these teachers were expected to use their regular reading style during the whole-class, shared read alouds.

Professional Development. All participating teachers received PD, as previously noted. Although the content of PD varied according to whether teachers were assigned to a print-referencing (HDPR, LDPR) or comparison (HDRR) condition, equivalent amounts of training were provided to all teachers, which included (a) an 8-hr inservice workshop in the fall, prior to the beginning of the academic year; (b) a 3-hr refresher workshop in the winter; and (c) receipt of targeted feedback on classroom reading style twice during the academic year.

Teachers assigned to the two print-referencing conditions received the same PD, which was intended to increase their use of print references during whole-class, shared book readings. During the fall inservice, the following content was addressed: (a) a general overview of children's emergent literacy development followed by detailed information regarding children's development of print knowledge, (b) use of print referencing as a means for facilitating children's print knowledge, (c) specific targets to address with print referencing (book and print organization, print meaning, words, letters), and (d) research findings linking print referencing to children's print knowledge gains. To address this content, a variety of means were used, including provision of printed materials (the project manual *Calling Attention to Print*; Justice & Sofka, 2005), observation and analysis of videos depicting adult-child shared read aloud interactions, and opportunities to practice/role play using print references by reading storybooks aloud to workshop partners. The winter refresher inservice reviewed the print-referencing information initially presented at the fall workshop. Inservice materials are available upon request.

In addition, on two occasions teachers in the HDPR and LDPR conditions received modest individual feedback on their use of print references during whole-class read alouds based on videos submitted by teachers (details of videotaping follow). Specifically, two videos for each teacher (at Weeks 8 and 22 of implementation) were reviewed by research staff. In a written letter, research staff noted one or two specific strengths regarding each target teachers were to address in readings during this week (e.g., "Your examples were quite clear; I especially enjoyed how you had the children think of other words that started with T like 'tiger.'") as well as any specific concerns (e.g., the teacher did not address a specific target). A sample feedback letter is provided in Appendix A. Largely, this feedback was provided to recognize teachers' efforts in regularly submitting videotapes for the purposes of the larger study.

Teachers in the HDRR condition received PD unrelated to print referencing. The importance of shared book reading and high-quality book reading practices, in general, was the topic of both the fall and winter inservice

Table 2. Teachers' print-referencing behaviors across the year

Week	<i>n</i>	<i>M</i>	<i>SD</i>	Range	% Print Meaning	% Book/ Print Org	% Letters	% Words
Full sample								
Week 2	80	18.488	19.582	0–100	9	39	11	41
Week 4	84	24.393	24.492	0–133	4	33	51	12
Week 6	80	23.638	25.354	0–124	4	30	50	16
Week 8	82	29.402	28.926	0–124	5	15	45	35
Week 10	79	27.608	23.705	0–96	4	15	27	54
Week 12	75	24.160	23.819	0–117	4	34	52	9
Week 14	79	24.582	28.518	0–186	4	31	17	48
Week 16	83	36.229	30.640	0–145	3	23	65	9
Week 18	82	31.768	34.789	0–192	5	15	51	30
Week 20	81	14.975	14.202	0–57	17	59	3	21
Week 22	83	25.181	21.069	0–100	13	29	48	10
Week 24	82	22.793	22.465	0–112	6	35	11	47
Week 26	77	18.117	15.091	0–71	6	17	31	47
Week 28	75	18.693	16.896	0–113	26	39	8	27
Week 30	77	30.104	27.463	0–130	6	11	45	38
High-dose, print referencing								
Week 2	28	23.040	22.471	2–100	8	34	12	46
Week 4	30	27.270	21.346	6–96	3	32	53	12
Week 6	28	30.390	29.255	4–124	3	27	53	18
Week 8	30	35.200	31.013	1–124	4	13	49	34
Week 10	29	36.520	23.582	0–96	2	14	30	55
Week 12	26	28.580	17.835	0–71	3	27	60	10
Week 14	29	34.720	36.019	2–186	2	29	19	51
Week 16	30	43.400	34.348	4–145	2	24	63	10
Week 18	30	43.300	36.726	2–192	4	10	55	31
Week 20	30	18.770	14.706	3–57	13	58	4	25
Week 22	31	31.060	20.123	7–99	9	24	58	9
Week 24	30	27.770	21.971	0–112	8	33	11	49
Week 26	27	21.850	9.879	7–38	4	13	33	50
Week 28	26	21.460	14.196	1–60	17	38	9	36
Week 30	27	37.070	30.321	0–130	6	9	43	43
Low-dose, print referencing								
Week 2	24	26.580	20.701	9–91	8	34	11	48
Week 4	26	39.850	28.353	7–133	3	28	60	10
Week 6	25	35.040	23.877	6–82	4	25	54	17
Week 8	25	42.560	29.351	5–107	3	12	45	40
Week 10	23	37.780	21.080	7–88	4	10	27	59
Week 12	22	41.320	28.308	10–117	3	37	53	7
Week 14	22	33.950	23.400	8–91	4	27	14	55
Week 16	25	49.600	28.386	15–118	3	22	67	8

(Continued on next page)

Table 2. Teachers' print-referencing behaviors across the year (*Continued*)

Week	<i>n</i>	<i>M</i>	<i>SD</i>	Range	% Print Meaning	% Book/ Print Org	% Letters	% Words
Week 18	24	45.000	37.265	11–189	4	14	52	30
Week 20	24	22.960	13.225	9–52	20	59	3	19
Week 22	25	34.800	21.517	6–100	13	30	49	8
Week 24	25	32.280	21.443	5–97	5	36	12	48
Week 26	23	27.520	17.315	1–71	5	15	34	46
Week 28	23	27.170	20.854	4–113	33	34	8	26
Week 30	23	43.220	21.938	16–98	4	11	46	39
High-dose, regular reading (comparison)								
Week 2	28	7.000	5.957	0–24	17	70	7	7
Week 4	28	6.960	7.496	0–27	16	64	3	18
Week 6	27	6.070	6.610	0–29	11	74	10	5
Week 8	27	10.780	13.160	0–41	13	38	30	19
Week 10	27	9.370	13.613	0–62	14	37	15	34
Week 12	27	5.930	6.911	0–25	22	57	9	12
Week 14	28	6.710	8.068	0–36	14	61	16	10
Week 16	28	16.610	15.683	0–49	5	21	66	7
Week 18	28	8.070	10.653	0–40	12	45	19	23
Week 20	27	3.670	4.057	0–16	21	65	0	14
Week 22	27	9.520	10.973	0–47	27	43	12	18
Week 24	27	8.480	16.780	0–75	5	43	10	41
Week 26	27	6.370	8.854	0–38	13	39	12	36
Week 28	26	8.420	8.773	0–32	26	56	9	9
Week 30	27	11.960	18.266	0–74	10	22	53	15

Note. org = organization.

workshops. For these teachers, the feedback letters from research staff included general recommendations for improving their whole-class read alouds.

Assessment of Teachers' Use of Print References. Teachers in all conditions were provided with video equipment that they retained for classroom use upon completion of the study. Teachers submitted bimonthly videos of their study-related, whole-class, shared read alouds beginning in Week 2 of the project and continuing through Week 30. Of the possible 1,275 videos requested, 1,198 (92.9%) were received. The majority of teachers (58.8%, $n = 50$) submitted all 15 videos, and 95.3% ($n = 81$) submitted at least 10 videos. One teacher submitted 9 videos, two teachers submitted 8 videos, and one teacher submitted 3 videos. Videos served multiple purposes within the project: (a) to provide teachers with two instances of individualized feedback on implementation (Week 8 and Week 22 videos only), (b) to generally encourage implementation

fidelity, and (c) to document changes in teachers' use of print referencing throughout the year.

The latter was achieved by coding videos using the project's Fidelity Coding Checklist (FCC; Justice, Sofka, Sutton, & Zucker, 2006). The FCC is a systematic observational tool used to code the raw frequency with which teachers referenced print across four mutually exclusive categories: (a) Print Meaning, or when print is talked about as conveying meaning (e.g., the metalinguistic concept of reading; the meaning of environmental print in illustrations); (b) Book and Print Organization, or when the organization or conventions of print are discussed (e.g., directionality, book parts); (c) Letters, or when attention is explicitly called to letters, letter names, and/or letter-sound correspondences (also including the concept of a letter, letter forms, uppercase vs. lowercase); and (d) Words, or when attention is explicitly called to words in print form (e.g., concept of a word, word length, identification). Extratextual teacher utterances were scored when explicitly referencing any of the four FCC categories, with these scores summed to derive a composite measure representing the raw frequency with which a teacher exhibited print-referencing behavior; utterances explicitly referencing multiple FCC categories were coded at the most complex category (e.g., a reference to both print meaning and a specific word was coded as Words). A sample FCC code sheet is provided in Appendix B (see also Zucker et al., 2009).

The psychometric quality of this tool is an important consideration given its centrality to this study. With respect to reliability of implementation, all videos were coded by research staff who had completed FCC training and exhibited 80% agreement with at least three master-coded videos. In addition, 20% of videos were double-coded and high interrater reliability was achieved, as demonstrated by an intraclass correlation coefficient of .96. Correlations of FCC scores across the 15 videos also showed moderate-to-high test-retest reliability (average $r = .64$, $SD = .10$). With respect to validity, teachers' FCC scores are positively related to teachers' levels of education ($r = .50$, $p = .006$), years of teaching experience ($r = .38$, $p = .047$), and general classroom quality as measured by the Classroom Assessment Scoring System: PreK ($r = .43$, $p = .026$; Pianta, La Paro, & Hamre, 2006). Finally, teachers' FCC scores have also been linked to child growth in print knowledge under specific classroom conditions; McGinty, Justice, Piasta, & Kaderavek, 2010).

RESULTS

Descriptive Analyses: Extent of Print Referencing

Across time points, teachers in the three conditions made references to print in whole-class shared read alouds to varying extents ($M = 30.83$, $SD = 26.35$ for HDPR; $M = 36.04$, $SD = 25.16$ for LDPR; $M = 8.40$, $SD = 11.38$ for

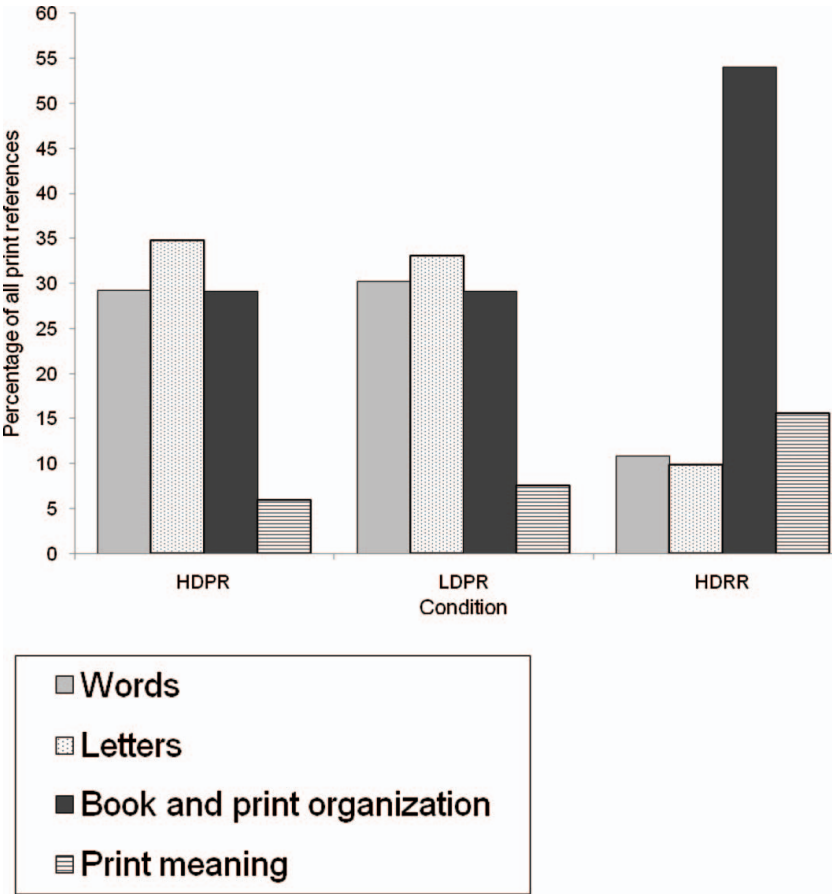


Figure 1. Percentages of print references by Fidelity Coding Checklist domain and professional development condition. *Note.* HDPR = high-dose print referencing; LDPR = low-dose print referencing; HDRR = high-dose regular reading comparison.

HDRR). Figure 1 presents the percentage of print references by FCC category. The majority of print references focused on Letters in the print-referencing conditions, followed by references to Words and references to Book and Print Organization. General references to Print Meaning were made considerably less often. In HDRR comparison condition, the majority of print references focused on Book and Print Organization followed by references to Letters, Words, and Print Meaning.

Descriptive statistics for teachers’ total use of print references by condition and time point are presented in Table 2. Means were not necessarily stable across time points, indicating variability in teachers’ use of print references across the

year. Similarly, large standard deviations and ranges indicated variation in print referencing across teachers. Both types of variation were considerably lower within the HDRR comparison condition as opposed to the two print-referencing conditions. Whereas the range in frequency of print references was 0 to 192 and 1 to 189 in the HDPR and LDPR conditions, respectively, the frequency in the HDRR comparison condition ranged only from 0 to 75.

Growth Curve Analyses: Impact of PD on Print Referencing

To empirically test the extent to which PD impacted teachers' print referencing, latent growth curve models were fit to the data and differences among the three conditions (HDPR, LDPR, HDRR comparison) were statistically analyzed. This analysis proceeded in two steps (Francis, Schatschneider, & Carlson, 2000). First, an unconditional, freed-loading latent growth curve model (Bollen & Curran, 2006, pp. 98–103) was fit to the data. A freed-loading latent growth curve model differs from a standard latent growth curve model in that some of the loadings that constrain the form of growth are allowed to be estimated. This has the effect of not forcing growth to be linear, or even curvilinear. After this model was fit to the data, study condition was included as a predictor to investigate overall differences in level and rate of change in print-referencing behavior. These latent growth curve models were estimated using MPlus software (Muthén & Muthén, 2008).

Growth curve modeling was chosen due to the number of advantages it confers over other methods for assessing change over time (Bollen & Curran, 2006; Francis et al., 2000). First, the growth curve analysis permitted use of multiple data points and modeled teachers' change in print-referencing behaviors over the entire academic year. Both intercept (i.e., frequency of print referencing at a given point in time) and slope (i.e., rate of change in print-referencing behavior over time) were estimated, with change thus modeled as a continuous rather than incremental process. Second, growth curve analysis did not require complete teacher data; as time is explicitly incorporated into the analysis, assessment points could differ between teachers. Third, the freed-loading latent growth model, in particular, allowed for consideration of the more complex form of growth evident in the current data (Bollen & Curran, 2006, pp. 98–103). As evidenced in the descriptive statistics, change in teachers' print referencing from the beginning to end of the year was non-linear. Freed-loading latent growth curve models are the most flexible means of modeling nonlinear change.

The observed variables for the freed-loading latent growth curve analysis were the frequencies with which teachers exhibited print referencing as assessed every 2 weeks across the academic year, for a total of 15 possible measures per teacher over the 30-week period. Observed variables were modeled as a function of two latent factors representing intercept and slope (see Figure 2).

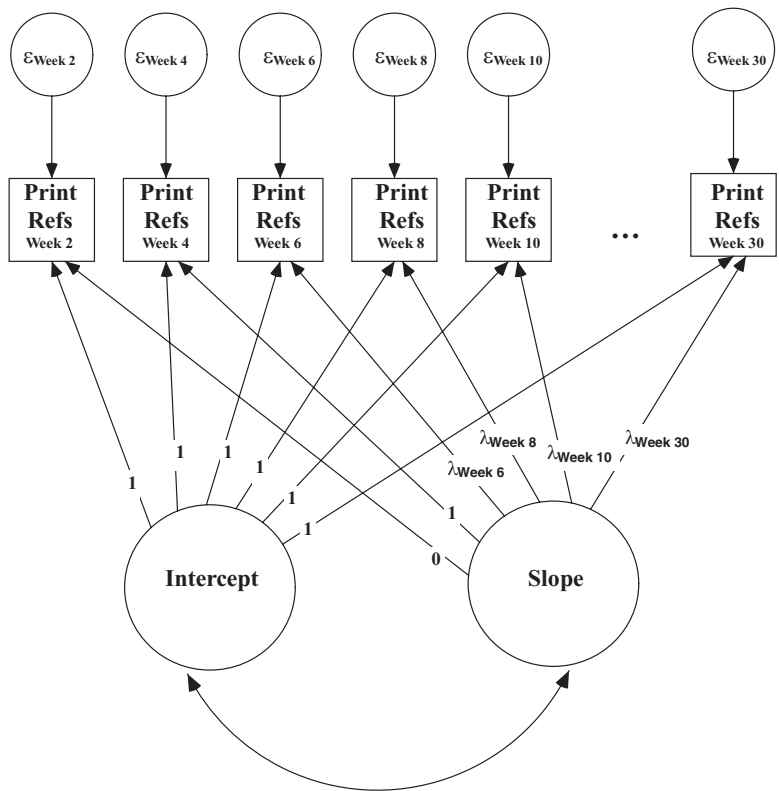


Figure 2. Structural model for unconditional freed-loading latent growth curve model.

For the intercept factor, loadings of observed variables were constrained to 1. For the slope factor, loadings were constrained to 0 and 1 for observed print references at Week 2 and Week 4, respectively, and allowed to freely vary for all other weeks (Bollen & Curran, 2006, pp. 98–103). This parameterization (a) centered the analysis at Week 2 and (b) estimated the metric of time (i.e., the slope loadings for Week 6 through Week 30). The intercept is thus interpreted as the mean frequency of print references at the beginning of the year, and the slope between any two time points is interpreted relative to the amount of change between the first two time points (i.e., Week 2 and Week 4).

Results for the unconditional model with this parameter specification are presented in Table 3. Across study conditions, the unconditional model showed a fitted mean of 18.09 print references at the beginning of the year, with considerable variability in use of print references both between-teachers and between-time points (i.e., variances). The between-time point variability is evident in the fitted latent growth curves depicted in Figure 3. Teachers’

Table 3. Latent growth curve parameters for unconditional and condition models of teachers’ print-referencing behaviors

	Unconditional Model			Conditional Model		
	Estimate	SE	p	Estimate	SE	p
Means						
μ Intercept	18.087	1.914	<.001	5.987	2.221	.007
μ Slope	4.345	2.040	.033	1.674	1.075	.119
Loadings (slope)						
λ Week2	0			0		
λ Week4	1			1		
λ Week6	1.162	0.548	.034	1.218	0.601	.043
λ Week8	2.202	0.982	.025	2.302	1.083	.034
λ Week10	1.521	0.668	.023	1.624	0.750	.030
λ Week12	0.695	0.435	.110	0.708	0.461	.125
λ Week14	1.088	0.597	.068	1.207	0.677	.075
λ Week16	3.598	1.560	.021	3.792	1.752	.030
λ Week18	3.291	1.443	.023	3.512	1.641	.032
λ Week20	−0.796	0.560	.155	−0.839	0.617	.174
λ Week22	1.387	0.572	.015	1.484	0.652	.023
λ Week24	0.986	0.463	.033	1.045	0.513	.041
λ Week26	−0.602	0.515	.243	−0.642	0.565	.255
λ Week28	−0.704	0.586	.230	−0.748	0.641	.243
λ Week30	1.947	0.862	.024	2.060	0.967	.033
Covariance						
ψ Intercept, Slope	44.760	20.342	.028	27.585	13.123	.036
Variances						
ψ Intercept	201.192	39.500	<.001	123.303	25.400	<.001
ψ Slope	11.942	10.954	.276	7.668	7.486	.306
Unique variances						
VAR(ε Week2)	155.125	25.357		157.645	25.655	
VAR(ε Week4)	359.958	57.134		355.400	56.370	
VAR(ε Week6)	259.026	41.964		259.064	41.910	
VAR(ε Week8)	412.018	68.067		413.265	68.195	
VAR(ε Week10)	247.627	41.032		245.453	40.663	
VAR(ε Week12)	266.129	42.599		264.280	42.242	
VAR(ε Week14)	430.257	68.096		430.153	68.103	
VAR(ε Week16)	360.200	66.456		364.121	66.993	
VAR(ε Week18)	428.969	72.837		425.853	72.406	
VAR(ε Week20)	53.751	10.041		54.214	9.963	
VAR(ε Week22)	93.727	17.725		93.732	17.711	
VAR(ε Week24)	173.115	28.783		174.578	28.962	
VAR(ε Week26)	100.878	17.642		99.871	17.347	
VAR(ε Week28)	167.153	28.468		167.496	28.444	
VAR(ε Week30)	339.391	55.254		340.760	55.396	
Condition on intercept						
HDPR				16.288	3.186	<.001
LDPR				20.634	3.304	<.001

(Continued on next page)

Table 3. Latent growth curve parameters for unconditional and condition models of teachers’ print-referencing behaviors (*Continued*)

	Unconditional Model			Conditional Model		
	Estimate	SE	p	Estimate	SE	p
Condition on slope						
HDPR				3.735	2.066	.071
LDPR				3.553	2.070	.086
Model fit						
$\chi^2(df)$		337.939(102)*			368.792(128)*	
CFI		0.781			0.785	
TLI		0.775			0.773	
RMSEA		0.164			0.148	
SRMR		0.082			0.078	
Loglikelihood value		−4281.534			−5348.088	

Note. HDPR = high-dose print referencing; LDPR = low-dose print referencing; CFI = comparative fit index; TLI = Tucker–Lewis index; RMSEA = root mean square error of approximation; SRMR = standardized root mean square residual.

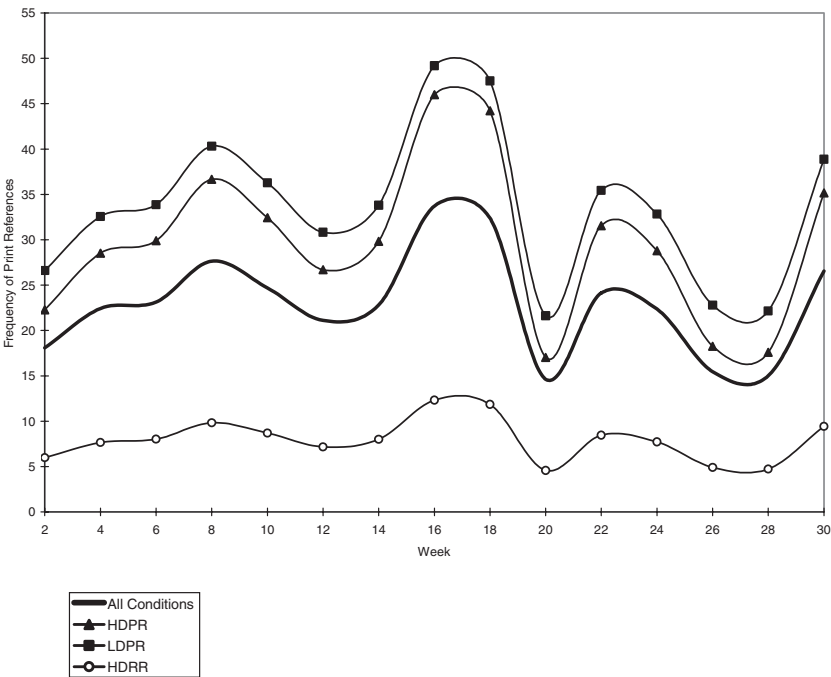


Figure 3. Latent growth curves for teachers’ print-referencing behaviors across the year. *Note.* HDPR = high-dose print referencing; LDPR = low-dose print referencing; HDRR = high-dose regular reading comparison.

frequency of print references increased and decreased throughout the year, with decreases occurring between Weeks 8 to 12, Weeks 16 to 20, and Weeks 22 to 28. The rates at which teachers' use of print references changed across the year also fluctuated. For example, the rate of change between Week 2 and Week 6 was slightly greater than that of the change between Week 2 and Week 4 (i.e., 1.16 times greater according to the loading). In Figure 3, the largest acceleration is seen between Weeks 14 to 16 and Weeks 28 to 30, with the greatest deceleration between Weeks 18 and 20.

The type of PD experienced by teachers was hypothesized to account for some of the between-teacher variance, and a conditional model in which study condition was dummy-coded and included as a predictor of the intercept and slope factors was fit to the data (Bollen & Curran, 2006). Four conditional models were estimated to make pairwise comparisons among the three study conditions at the beginning and end of the academic year; the growth curves and fit statistics generated by the alternative parameterizations were the same. The first conditional model was centered at Week 2 and utilized the HDRR comparison condition as the reference group, testing for differences in print referencing between teachers in this condition versus those in the HDPR and LDPR conditions at the beginning of the year. The second conditional model was also centered at Week 2 but utilized the LDPR condition as the reference group, testing for differences between teachers in the LDPR and HDPR conditions at the beginning of the year. The third and fourth models were recentered at Week 30 with the HDRR comparison condition and the LDPR condition as the reference groups, to test for differences between teachers in the three study conditions at the end of the year.

Results for the conditional model comparing teachers who received print-referencing PD (i.e., HDPR and LDPR) versus the HDRR comparison are presented in Table 3 and Figure 3. The conditional model provided a significantly better fit to the data than the unconditional model ($-2\log\text{likelihood difference} = 2133.12$, $p < .001$; Tabachnick & Fidell, 1996). Descriptively, the conditional model demonstrated that (a) accounting for study condition reduced the between-teacher variance (e.g., reduced by 22% to 24% in the model presented in Table 3), and (b) teachers in the two print-referencing conditions showed greater between-time point variability than teachers in the HDRR comparison condition (see Figure 3). Statistical comparisons among study conditions indicated that teachers in the HDPR and LDPR conditions exhibited greater frequencies of print referencing at the beginning of the year (see Table 2) and that this difference persisted through the end of the year (estimate = 23.98, $SE = 4.67$, $p < .001$ for HDPR vs. HDRR; estimate = 27.96, $SE = 3.33$, $p < .001$ for LDPR vs. HDRR). Effect sizes favoring the two print-referencing conditions ranged from $d = 1.03$ to $d = 1.56$. No differences in frequency of print references were found between the two print-referencing conditions (HDPR vs. LDPR: estimate = -4.35 , $SE = 3.12$, $p = .163$, $d = 0.16$ at the

beginning of the year; estimate = -3.97 , $SE = 4.60$, $p = .387$, $d = .24$ at the end of the year).

Post Hoc Analysis: Book Effects

Post hoc analyses were conducted to further examine the variability in teachers' print referencing across the year. We surmised that much of this variability was due to book effects, as (a) all teachers read the same books at the same time points and (b) the books utilized varied in the extent to which print was depicted in an interesting font or embedded within illustrations, thus perhaps affording differing amounts of print referencing (Justice & Lankford, 2002; Smolkin et al., 1988; Smolkin et al., 1992; Zucker et al., 2009). Our post hoc analyses thus attempted to account for the "print salience" of books as one important source of between-book, and hence between-time point, variability.

Specifically, we reanalyzed the data using teachers' frequency of print references conditional upon books' print salience. Print salience was measured using the Print Salience Metric (PSM; Zucker et al., 2009), which indicates the average number of print-salient features per book page. A book's PSM score is calculated by summing the instances of (a) print in illustrations (e.g., labels, environmental print, speech bubbles) and (b) typesetting changes in text (e.g., changes in font size, style, or color), and dividing this sum by the total number of pages in a book. Previous use of the PSM indicates that it can be calculated reliably, with 98% agreement between coders, and has predictive validity in terms of positive associations with teachers' frequency of print referencing (Zucker et al., 2009). PSM scores for the books utilized in the present study ranged from 0 to 5.10 ($M = 1.82$, $SD = 1.51$).

To generate a measure of teachers' print referencing frequency controlling for effects of books' print salience, PSM scores were entered into a cross-classified random effects model (teachers crossed with books; Piasta & Wagner, 2010; Raudenbush & Bryk, 2002) and used to predict teachers' FCC scores. The fitted scores were saved for use as the dependent measure when rerunning the freed-loading latent growth curve models previously described. Model fit indices indicated slightly better fit than the original growth curves, $\chi^2(128) = 593.892$ (comparative fit index = .840, Tucker-Lewis index = .831, root mean square error of approximation = .206, standardized root mean square residual = .069, loglikelihood value = -4243.411). The resultant growth curves replicated the original results and are depicted in Figure 4. As before, teachers in the HDPR and LDPR conditions exhibited greater frequencies of print referencing than teachers in the HDRR comparison condition (beginning of the year: estimate = 21.72, $SE = 3.79$, $p < .001$ for HDPR vs. HDRR, estimate = 26.19, $SE = 3.96$, $p < .001$ for LDPR vs. HDRR; end of the year: estimate = 22.27, $SE = 3.97$, $p < .001$ for HDPR vs. HDRR, estimate = 26.52, $SE = 4.15$, $p < .001$ for LDPR vs. HDRR). There were no reliable differences in print-referencing frequency

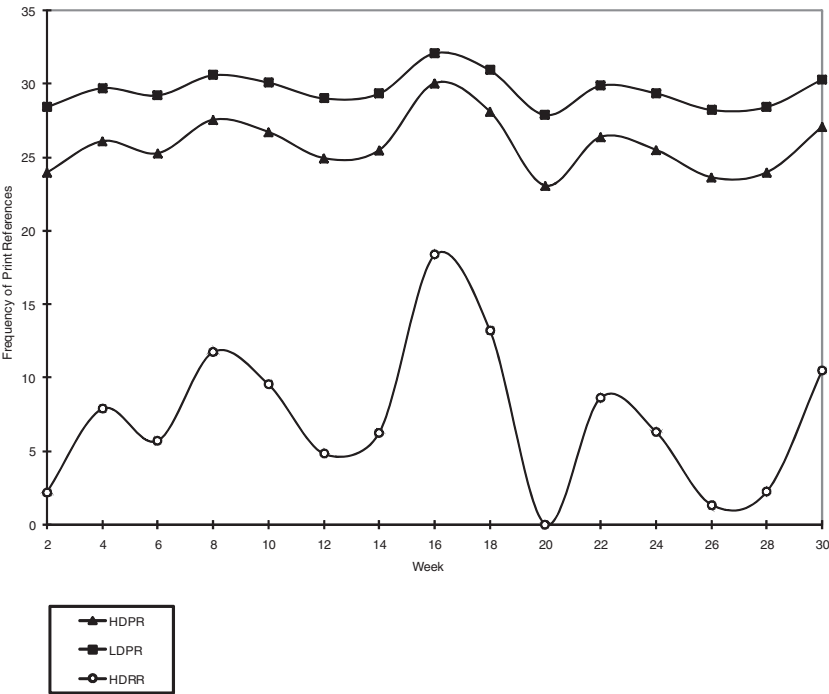


Figure 4. Latent growth curves for teachers’ print-referencing behaviors across the year conditional on books’ print salience. *Note.* HDPR = high-dose print referencing; LDPR = low-dose print referencing; HDRR = high-dose regular reading comparison.

between teachers in the two print-referencing conditions (estimate = 4.47, *SE* = 3.90, *p* = .252 at the beginning of the year; estimate = 4.25, *SE* = 4.09, *p* = .299 at the end of the year). Comparing Figure 3 and Figure 4, however, one may note that accounting for books’ print salience effectively reduced the variability in print referencing among books and time points for teachers in the HDPR and LDPR conditions (i.e., the curves appear “flatter”). Conversely, the variability in print referencing for teachers in the HDRR comparison condition was exaggerated.

DISCUSSION

The present study examined the effects of PD on preschool teachers’ reading behaviors during whole-class, shared read alouds. The PD examined in this study specifically targeted teachers’ use of print references. This particular reading style was targeted due to accumulating evidence that adults’ frequency of print references and children’s print knowledge are causally related (Justice &

Ezell, 2000, 2002; Justice, Kaderavek, et al., 2009; Justice et al., 2010; Justice, Skibbe, McGinty, Piasta, & Petrill, 2009; Lovelace & Stewart, 2007). The study yielded several important findings concerning the use of print referencing and PD in supporting high-quality classroom literacy practices.

The Impact of PD on Teachers' Print Referencing

The first major finding of the study concerns the effectiveness of PD in promoting teachers' use of print references. Study results showed the intended effect of PD designed to increase print referencing during whole-class, shared read alouds: Teachers who received this PD incorporated significantly more print references into their shared read alouds than teachers in the comparison condition. On average, teachers who received the print-referencing PD referenced print 33 times per read aloud, corresponding to 3.32 print-related comments or requests per minute. This rate is higher than that invoked by previous studies training parents and early childhood educators in print-referencing techniques (0.65–2.14 for parents in Justice & Ezell, 2000; 2.40 for early childhood educators in Girolametto et al., 2007) and similar to that attained when training graduate students in speech and hearing sciences (3.8 in Ezell & Justice, 2000). As all such studies resulted in reliable gains in children's print knowledge, we surmise that the effects enacted by PD in the present study are sufficient to produce meaningful gains in child outcomes (see Breit-Smith et al., 2009; Justice et al., 2010 for analysis of child effects).

Of importance, differences in the extent for print referencing between teachers in the intervention and comparison conditions were reliable at both the beginning and end of the academic year, with teachers in the intervention conditions consistently demonstrating higher rates of print referencing across the full 30 weeks. The content of print references also changed as a result of PD. Teachers who received print-referencing PD tended to focus children's attention on letters and words, whereas teachers in the comparison condition focused on book and print organization. This difference is noteworthy as the former represents print knowledge milestones that are directly linked to acquisition of the alphabetic principle or the understanding of links between written and spoken language (Justice & Ezell, 2004; Zucker et al., 2009).

Together, these results suggest that the PD model provided was successful in promoting sustained and meaningful change in teachers' reading style, whether teachers implemented intervention at relatively high (four times per week) or low rates (two times per week). Although there were no statistical differences in the print referencing of teachers who implemented read alouds four versus two times per week, descriptive data showed a slight advantage for those conducting fewer read alouds. Because the PD for HDPR and LDPR teachers was identical, we surmise that teachers who read four times per week may have referenced print slightly less frequently during any single

reading session due to the fact they had an additional three opportunities to accomplish their print-related instructional goals. Teachers implementing two read alouds per week, on the other hand, may have attempted greater amounts of print referencing to accomplish the same goals within fewer reading sessions.

The results just described are important for a number of reasons. Although we recognize that the focus in this study is a relative narrow aspect of classroom instruction, this study is informative for understanding the potential impacts of PD on teachers' practices. First, the results add to the growing literature indicating that teachers' classroom literacy practices are amenable to change through inservice PD efforts (e.g., Dickson & Bursuck, 1999; Flowers, Girolametto, Weitzman, & Greenberg, 2007; Jackson et al., 2006; Landry, Anthony, Swank, & Monseque-Bailey, 2009; Landry et al., 2006; Pianta, Mashburn, Downer, Hamre, & Justice, 2008). In particular, the current study demonstrates that PD can alter preschool teachers' implementation of the "active ingredient" or change mechanism causally linked to improved literacy outcomes (Breit-Smith et al., 2009; McGinty et al., 2010) and that such implementation can be maintained across an entire academic year. The sustainability of changes in teachers' print referencing is particularly promising and may have been bolstered by requiring teachers to submit biweekly implementation videos. In fact, the video submission requirement may have served as a reminder of the content and targets of PD as well as an opportunity for self-reflection regarding implementation. Future studies might consider the extent to which videos facilitate sustained change in teachers' classroom practices.

Second, results indicate that PD may affect change in both the amount and content of teachers' literacy instruction. Teachers not only learned to increase the frequency with which they referenced print during whole-class, shared read alouds but also shifted their teaching strategies to emphasize later-developing (and potentially more complex) print knowledge skills. The shift in the content of print referencing is important in matching instruction to children's literacy needs (Al Otaiba et al., 2008; Connor et al., 2006; Pressley, Rankin, & Yokoi, 1996). PD may have led teachers to provide greater scaffolding for those print knowledge skills considered challenging for preschool-aged children.

Third, the current results indicate that change in teachers' literacy instruction may be invoked by PD that is feasible and realistic for use across multiple settings (i.e., "scalable"; McDonald, Keesler, Kauffman, & Schneider, 2006). Special care was taken to ensure that PD utilized in the present study was practical for use in large numbers of preschool centers while also incorporating many important principles of effective PD (e.g., understanding of theory and practice, emphasis on content knowledge, links to improved student outcomes, feedback on classroom implementation; Dickinson & Caswell, 2007; Guskey, 2003). Recognizing the educational and financial costs associated with teachers' time spent outside of their classrooms, we strove to balance the intensity of

training with minimal classroom absences, requiring that teachers attend only one summer full-day workshop and one winter half-day refresher workshop across the academic year (11 hr total). This inservice model of PD was familiar to both the administration and teachers at participating preschool programs and easily integrated into their existing PD and academic schedules. Practical and financial feasibility was also enhanced by the use of video and written feedback on classroom implementation as neither PD providers nor teachers were required to travel for face-to-face meetings. Yet the feedback provided, in combination with the winter workshop, was sufficient to support continued high levels of implementation through the end of the academic year. PD was also cost-effective in that the new practices to be implemented involved the use of commercially available children's books rather than specialized curriculum materials. In the current study, sets of 30 books (approximately \$250 worth of materials) were provided to participating teachers, but the print-referencing techniques taught also could be enacted with books already available in teachers' classroom libraries. The latter highlights a final point concerning the feasibility of the PD for implementation in a variety of preschool settings. The context targeted by PD—whole-class, shared read alouds—is a commonly used activity in preschool classrooms. Thus, teachers may easily integrate the print referencing taught during PD into existing classroom practices.

Print Referencing in Typical Preschool Classrooms

The second major finding of the study concerns the print referencing typical of shared read alouds in preschool classrooms, as exemplified by teachers in the comparison condition. In the absence of PD encouraging print referencing, preschool teachers averaged approximately eight print references per shared read aloud or a rate of slightly less than one per minute of reading. The majority of these print references gave or requested information pertaining to book or print organization (e.g., "This is the title of the book" or "The author of this book is Lois Ehlert"). This result suggests that many preschool teachers of children at risk for academic difficulties do verbally reference print during the context of whole-class, shared read alouds but that such references occur at relatively low levels and are aimed at facilitating early-developing print knowledge milestones such as print directionality and book titles and authors (Zucker et al., 2009). Similarly low rates of print referencing have been observed for other untrained adults, including parents of typically and atypically developing children (Hammett Price, van Kleeck, & Huberty, 2009; Justice & Ezell, 2000; Justice, Skibbe, et al., 2009; van Kleeck, Gillam, Hamilton, & McGrath, 1997), graduate students in hearing and speech sciences (Ezell & Justice, 2000), and early childhood educators (Flowers et al., 2007; Girolametto et al., 2007). Notably, research has yet to identify a rate of print referencing that is adequate for supporting children's development; however, these rates of print

referencing are considerably lower than those used to promote children's print knowledge in empirical studies (e.g., Justice & Ezell, 2002; Justice et al., 2010).

Variability Among Teachers in Rates of Print Referencing

The third major finding of the study concerned the variability seen between teachers in all study conditions, including within the comparison condition. As previously discussed, this finding suggests that preschool teachers naturally vary in the extent to which they use print referencing during the whole-class, shared read alouds. Some teachers in the comparison condition referenced print at rates similar to teachers in the intervention conditions. Furthermore, some teachers who received print-referencing PD continued to reference print at relatively low rates. This finding has two interpretations. First, some teachers may simply not use print referencing as a teaching strategy during shared read alouds, regardless of whether they received PD targeting this behavior. This interpretation considers the variability across teachers in both intervention and comparison conditions as resulting from similar sources of individual differences. Recent results from Zucker et al. (2009), for instance, suggest that teachers' use of print referencing is related to their levels of education, teaching experience, and time spent reading (but not general amount of professional development or quality of read alouds). Second, some teachers may have continued to use low rates of print referencing because the PD provided was ineffective in changing this behavior. Other studies involving teacher training and implementation have demonstrated that teachers often vary in their uptake and implementation of trained strategies (see, e.g., Connor et al., 2009; Landry et al., 2006; Pence, Justice, & Wiggins, 2008). Both of these interpretations deserve further attention. Future studies might identify teacher characteristics predictive of print-referencing implementation, specifically, or uptake of PD in general. Future studies might also consider whether particular forms of PD are more or less effective for particular teachers. The latter might expand the Child \times Instruction Literature (Connor, Morrison, Fishman, Schatschneider, & Underwood, 2007; Foorman, Francis, Fletcher, Schatschneider, & Mehta, 1998; Juel & Minden-Cupp, 2000) to investigate Teacher \times PD interactions.

Variability Among Books in Rates of Print Referencing

The fourth major finding of the study concerns the fact that teachers varied greatly in their use of print referencing across time points (i.e., within-teacher variation). For example, notably higher rates of print referencing were seen during Week 16 and lower rates were seen during Week 12. Our post hoc analyses indicated that such differences were highly influenced by the extent to which particular books afforded print referencing, measured here in terms of print salience. The book read during Week 16 (*I Stink*; McMullan, 2002) had the

highest number of interesting print features ($PSM = 5.10$) and thus prompted greater amounts of print referencing. The book read during Week 12 (*We're Going On a Bear Hunt*; Rosen & Oxenbury, 1989) was far less print salient ($PSM = 0.47$) and thus less conducive to print referencing. This finding suggests that (a) utilizing books high in print salience during shared read alouds may naturally encourage teachers to provide greater amounts of print referencing, irrespective of PD on this topic, and (b) PD and preschool interventions aimed at facilitating children's print knowledge development ought to intentionally incorporate such print-salient books. The finding also highlights the need for further, careful consideration of the interplay between teachers' reading style and book characteristics, including characteristics beyond print salience such as book length, genre, and picture and story quality. This work is left for future research endeavors.

Limitations and Conclusion

A few additional points deserve mention. The external validity may be limited by the characteristics of our teacher sample. The majority of teachers was female; was White, non-Hispanic; and held preschool certification. All teachers taught in preschool classrooms serving children at risk for academic difficulties due to socioeconomic disadvantage. Moreover, all participating teachers volunteered to receive PD and implement a classroom shared read aloud program. These teachers may thus represent a particular population to which our findings apply; further replication is necessary to ensure that findings apply to other populations.

In sum, the findings of the present study support the potential of PD for successfully altering the reading style of preschool teachers during whole-class, shared read alouds. The meaningful, sustained changes seen in teachers' print referencing speak to the positive effects of PD in enhancing the quality of preschool classroom language and literacy environments, thus better enabling teachers to facilitate children's emergent literacy development.

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APPENDIX A

Dear (Teacher Name),

Thank you again for agreeing to participate in Project STAR. We appreciate your hard work and timely mailing of DVDs and reading logs. It is such a pleasure to have this wonderful information, and a privilege to view your storybook reading.

While watching your reading of *Rumble in the Jungle*, I noted your careful attention to the target Metalinguistic Concept of Letter. Your examples were quite clear; I especially enjoyed how you had the children think of other words that started with T like “tiger.” Your focus on the target Word Identification was equally rich, such as when you followed the caterpillar throughout the

pages with the word “munch.” The children responded so eagerly to all of your queries!

The children were clearly having a wonderful time during your storybook reading, and your encouragement of their participation was fun to watch. Taking Dawson’s lead when he said he had found a “little word” was a perfect way to talk about the letter S and the sound a snake makes. Also, your scaffolding was well tailored to the children’s needs, and certainly contributed to their very active attention to the reading.

Please know that we are always available should you have any questions or concerns (email xxx@virginia.edu, or phone xxx.xxx.xxxx). We wish you happy holidays and a wonderful New Year, and we look forward to seeing you in January.

Best regards,

(Research Staff Member Name)

APPENDIX B

Teacher # <u>2041</u> DVD # <u>4</u> Date <u>11/15/06</u> Coder <u>aet4q/mms4b</u> Duration of Session min <u>19</u> sec <u>0</u>
FIDELITY INDICATOR: Print target #1 <u>Word Identification</u> hit? yes X no <input type="checkbox"/> Print target #2 <u>Metalinguistic Concept of Letter</u> hit? yes X no <input type="checkbox"/>

4 PRINT DOMAINS: KEY WORDS AND PHRASES	PRINT-REFERENCING COMMENTS See manual for more comprehensive explanation of print domains	raw tally score
WORDS		
Word (s)Long, short, small, little, big they, those or that say(s), make(s)	Words (some words are short, others are long, letters make up words, words are distinct units of print, different than letters) 1. <i>This word is jungle.</i> 2. <i>Look right here at this word I'm pointing to.</i> 3. <i>This word is jungle.</i> 4. <i>You tell me what this word is.</i> 5. <i>All of these letters are making the words Rumble in the Jungle.</i> 6. <i>We're going to talk about some other things like the words up here in the title.</i> 7. <i>There's different letters in these words and letters make up words,</i> 8. <i>Three "e"s in those words but what do all these letters make?</i> 9. <i>It makes words, doesn't it?</i> 10. <i>Letters make words.</i> 11. <i>Letters make words.</i> 12. <i>This is l-i-o-n and these letters make up the word, "lion".</i> 13. <i>So, l-i-o-n make up what word?</i> 14. <i>Look here, boys and girls, here's a little teeny tiny word.</i> 15. <i>Had you seen that little teeny tiny word right there?</i> 16. <i>This little teeny tiny word says "munch".</i> 17. <i>What do you think this word says?</i> 18. <i>Do you think this word says snake" or "giraffe"?</i> 19. <i>Do you think this word says snake" or "giraffe"?</i> 20. <i>What would this word say then?</i> 21. <i>Where do you see a tiny word?</i>	IIIIII 21 IIIIII I

4 PRINT DOMAINS: KEY WORDS AND PHRASES	PRINT-REFERENCING COMMENTS See manual for more comprehensive explanation of print domains	raw tally score
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LETTERS

Letter(s)	Letters (letters come in 2 forms, names of different letters, the same letter can be used in many words)	IIIIII 24
Uppercase,		IIIIII
lowercase,		IIIIII-
capital, small, big	1. <i>Look at these letters.</i>	III
Any letter name	2. <i>Here's the letter "r" like your name begins with Randy.</i>	
Letter name + reference to word	3. <i>Randy's name begins with "R".</i>	
	4. <i>There's a lowercase "e".</i>	
	5. <i>So what do letters do?</i>	
	6. <i>What do letters make?</i>	
	7. <i>But what do all these letters make?</i>	
	8. <i>That is the very letter that begins R's name.</i>	
	9. <i>It has an uppercase "R" and some little "r"s and it goes R-r-r-r-r-r.</i>	
	10. <i>You have a lowercase "r" in your name.</i>	
	11. <i>Boys and girls, look here at these letters...</i>	
	12. <i>What do these letters say?</i>	
	13. <i>Lion, so these letters say, "lion".</i>	
	14. <i>You have an "o" in your name.</i>	
	15. <i>Look, here's the letter "z".</i>	
	16. <i>Put your finger up and let's make the letter "z" across, slant down, and then backward.</i>	
	17. <i>He sees some tiny letters.</i>	
	18. <i>Does anyone know what these letters are?</i>	
	19. <i>"S," very good, and you know what that snake says?</i>	
	20. <i>It makes a/s/sound.</i>	
	21. <i>Un huh, there's a letter, "c".</i>	
	22. <i>They begin with the letter "G".</i>	
	23. <i>Like Tyler's name begins with a "T".</i>	
	24. <i>Can you think of some more "t-t-t-t."</i>	
	(Continued on next page)	

4 PRINT DOMAINS: KEY WORDS AND PHRASES		PRINT-REFERENCING COMMENTS		raw tally	score
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BOOK AND PRINT ORGANIZA- TION					
Page, right, left, book, turn, start Author, writer, wrote, name Title, top, bottom, read, end, start, finish, genre	Book and Print Organization (The order in which the pages are read, the job of the author, reading occurs from top of the page to the bottom, the role of the title, reading in English occurs from left to right)	<i>1. Jungle; so read the title to me.</i> <i>2. Now we have our title page.</i> <i>3. We have the title again.</i> <i>4. I didn't tell the author.</i> <i>5. But today we're not going to talk about the author and the illustrator.</i> <i>6. OK, let's turn the page.</i> <i>7. Let's get real quiet and see which animal is on the next page.</i> <i>8. Let's see who's on the next page.</i> <i>9. Turn the page?</i> <i>10. I'm going to turn the page because you're scaring me.</i> <i>11. I wonder who's on the next page?</i> <i>12. Let's hurry and turn the page before. . .</i> <i>13. Well, let's look on the next page.</i>	IIIIII 13 IIIIII		
<hr/>					
PRINT MEANING					
Any reference to Any print and its function Called, said, says, read/s/ing, story, stories, book, books	Print Meaning (print function, words in the environment, discussion about the role and function of print and books for sharing information.)	<i>1. There's a little caterpillar there eating a leaf on that tree going "munch".</i> <i>2. The snake goes /sss/.</i> <i>3. Amanda's gonna tell me one more story about snakes and then we'll finish reading.</i>	III 3		