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Understanding print: Early reading development and the contributions of home literacy experiences

Betty Ann Levy [a,*], Zhiyu Gong [a], Sandra Hessels [a], Mary Ann Evans [b], Debra Jared [c]

[a] *Department of Psychology, McMaster University, Hamilton, Ont., Canada L8S 4K1*
[b] *Department of Psychology, University of Guelph, Guelph, Ont., Canada N1G 2W1*
[c] *Department of Psychology, University of Western Ontario, London, Ont., Canada N6A 5C2*

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Abstract

This study explored the development of children's early understanding of visual and orthographic aspects of print and how this is related to early reading acquisition. A total of 474 children, ages 48 to 83 months, completed standardized measures of phonological awareness and early reading skills. They also completed experimental tasks that tapped their understanding of what constitutes "readable" print. The parents of participants completed a questionnaire regarding their children's home literacy experiences. The data showed systematic development in children's understanding of print conventions and English orthography and spelling. Regression analyses indicated that print knowledge was related to early reading skill, even after accounting for variance due to age and phonological awareness. Furthermore, parents' ratings of the extent of their children's involvement in activities that led to practice in reading and writing most consistently predicted the development of emerging literacy skills, including understanding of the conventions of the English writing system. Little relation between print knowledge and the frequency of storybook reading by adults was observed.

* Corresponding author. Fax: +1 905 529 6225.
E-mail address: levy@mcmaster.ca (B.A. Levy).

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Introduction

Although most children begin to read only with formal instruction in elementary school, experiences during the preschool years are believed to set the stage for children's literacy development. Studies of emergent literacy have highlighted the importance of the early literacy environment and experiences (for a review, see Whitehurst & Lonigan, 1998) in developing children's knowledge and skills related to reading acquisition. In this study, we explored young children's understanding of print concepts and orthography. Our main interest was in tracing the developmental trajectories of several aspects of print knowledge, from visual/graphic aspects of print to early orthographic information. We then related development of these print concepts to the children's early reading skill. Finally, we explored aspects of the children's home literacy environment, relating these to the development of print concepts and early reading.

In the domain of early reading acquisition, the major focus has been on the development of early phonological sensitivity in young children. Bradley and Bryant (1983, 1985) found a strong relation between young children's ability to respond to sound units within words and their later reading acquisition. Rhyming ability measures, as well as syllable and phoneme deletion tasks, have become standard tools in detecting children who are at risk for reading problems. There is now fairly broad agreement that early sensitivity to the sound structure of spoken words is a strong predictor of reading success and that interventions that improve phonological sensitivity are related to reading achievement (e.g., Ball & Blachman, 1988; Foorman et al., 1997; Wagner & Torgesen, 1987).

However, to learn to read, a child must understand more than the phonological structure of the language and its grapheme–phoneme correspondences. Writing systems have specific conventions that govern the visual and orthographic aspects of print. For example, although English has only 26 letters that are combined to form words, there are orthographic constraints that determine what letter combinations can constitute words. There must be at least one vowel, and words normally contain both vowels and consonants; the exceptions are single-letter words such as *a* and *I*. Our spelling system not only is influenced by spelling to sound regularities but also encodes some morphological consistencies. Furthermore, there are orientation and spacing constraints for printed language. Letters are not printed backward or upside down, there are spaces between (not within) words, and in English one reads left to right along linearly arranged lines of letters. Before a child can begin to read, he or she must acquire considerable knowledge about the visual/orthographic aspects of the English writing system. The current study explored the development of these aspects of early literacy and some of the home literacy experiences that may influence their development.

The literature contains fewer quantitative studies that focus on the early development of visual/orthographic knowledge than those that focus on the development of phonological knowledge. Yet the former is an important aspect of emergent literacy that is linked to reading acquisition (Lomax & McGee, 1987). Clay (1993) emphasized that printing conventions (e.g., direction rules, spatial formatting, punctuation) and visual patterns (word and letter clusters) are essential elements in early reading development. She argued that these aspects of printed language, although processed automatically by fluent readers, are a source of confusion for beginning readers. For example, Lavine (1977), who studied 3- to 5-year-olds' understanding of what constitutes writing, found that 3-year-olds believed that signature-like scribbles were writing. By 5 years of age, scribbles were rejected as writing in preference to printed letters, words, and numbers. Similarly, Brenneman, Massey, Machado, and Gelman (1996) showed that the actions of 4-year-olds while drawing and writing were quite different from those of 5-year-olds. When children were asked to draw pictures, they often used continuous outlines and filled spaces with colors. The marks they made were put on the page in a random fashion. However, when they were asked to write names for objects, they often used discrete marks and arranged them in a linear fashion from left to right. This pattern for writing was more likely in older children than in younger children, indicating an increase in knowledge about the conventions of writing.

Levin and Bus (2003) reported a study of the development of drawing and writing skills in still younger Dutch and Israeli children (ages 28–53 months). They concluded that drawing and writing derive from a common notational basis, with children initially drawing print. At the earliest ages, children's writings were indistinguishable from their drawings; however, with development writings, but not drawings, began to include writing-like features such as segmentation into smaller units that were displayed linearly. In their study with children in the same age range, Bader and Hildebrand (1991) reported improved understanding of directionality. These studies point to development in the understanding of what constitutes acceptable writing in preschool children.

Although examining children's writing offers a window into their concepts about print, it is limited in that it does not directly tap what they believe is "readable" text. Many parents have encountered the awkward moment when their child brings his or her treasured scribbles and asks the parent to read them. These children clearly have not yet grasped what is readable and what is not. Bialystok (1995) asked 3- to 6-year-olds whether different displays, including squiggles, cursive writing, printed words, pictures, and shapes, were good for reading. She found that younger children were more likely than older children to accept nonalphabetic displays as being readable. Interestingly, all children were confused about whether pictures were readable. This may indicate that while listening to adults read, pictures and print are confused, with the children not knowing what part of the display the adults are actually reading.

DeGoes and Martlew (1983) provided further evidence for the continuous development of children's understanding of written words. In their study of 20 4- to 6-year-olds, half of the children accepted only strings of letters as being words, and 6 of these 10 children accepted only strings of letters of a certain length as being words.

DeGoes and Martlew suggested that symbol shape and string length are important criteria used by preschoolers in differentiating words from nonwords. Thus, one- and two-letter words were rejected. Landsmann and Karmiloff-Smith (1992) found that rejection of single letters as words increased with age and that 92% of 5- and 6-year-olds thought that single letters could not be words. Similarly, older children are more sensitive to the consonant–vowel structure of real words than are younger children. Pick, Unze, Brownell, Drozdal, and Hopmann (1978) reported development from ages 3 and 4 years to elementary school in children's grasp of the specific units that constitute words. They suggested that number of letters, directionality, and meaning are aspects of words that children come to understand over the preschool to early school years. Cassar and Treiman (1997) studied children's grasp of spelling constraints. They asked children to choose between nonwords containing consonant or vowel doublets. One choice placed the doublet in a location that was acceptable in English spelling, whereas in the alternative choice the doublet was in an illegal position. They found that as early as the first half of Grade 1, children showed evidence of knowledge about these spelling constraints.

Tolchinsky-Landsmann (2003) summarized much of this literature and pointed out that there is spontaneous development of children's writing knowledge before the beginning of formal instruction. She suggested that the first stage of writing development is undifferentiated "because children produce similar writing patterns regardless of the word or sentence they were asked to write" (p. 96). However, during the second stage, children construct criteria for writing that is readable, usually in terms of number and variety of letters. During the third stage, children relate writing to sound, often at the level of syllables. Finally, during the fourth stage, they develop an understanding of grapheme to phoneme correspondence. Her point, then, was that children begin to construct a system of representation that determines their writing and their criteria for what is readable and that this knowledge development begins prior to formal instruction on writing or reading. Despite all of this work, there is still no clear chronology that would answer a common question from parents: "What should my child know?" at different ages during the preschool and early school years. We know of no systematic study charting a large array of visual/orthographic concepts from preschool to when children are readers with a relatively large sample for each age. Therefore, the main purpose of the current study was to systematically measure some aspects of early knowledge about print from 4 to 7 years of age. Our first interest was in tracing a developmental chronology for different concepts about print. Our second interest was in relating development of these concepts to children's reading acquisition. Our final interest was in determining whether specific early home literacy activities were related to children's understanding of these print concepts.

To explore the systematic development of print concepts from 4 to 7 years of age, each child completed our print knowledge tasks. There were two versions of the task: a word version and a sentence version. For each version, the child was presented a series of cards, each containing two items (two "words" or two "sentences"). Each card contained a correctly printed item and an incorrect alternative with a single print convention violation. The print violation types were chosen from the literature to ensure a broad sweep across this developmental landscape. The choices were

empirically and intuitively guided rather than following from any specific theoretical view of the prerequisite skills that influence early reading. In our view, the theoretical positions provide broad categorizations of skills that do not inform well the nature of the task choices we had to make. Consequently, we attempted to sample print knowledge about figural and spatial conventions, lexical constraints, and accepted spelling conventions. Both single-item and multiple-word versions of the task were used to explore whether print concepts develop first for single words and only later generalize to sentences or whether the size of the print display is unrelated to understanding these writing conventions. In these tasks, the child was asked to choose the item on each card that "Mommy or the teacher would prefer to read," that is, to choose which one was better for reading. The data on this two-alternative, forced-choice discrimination task were used to chart the developmental trajectories for different aspects of visual and orthographic knowledge.

Our second interest was in the relation between the development of print knowledge and early reading acquisition. There is evidence suggesting a relation between early writing and spelling knowledge and early reading ability. For example, Cunningham and Stanovich (1990) found that for Grade 3 children, orthographic knowledge (e.g., understanding acceptable letter combinations, understanding acceptable letter positions in a word, understanding homophonic discrimination) predicted significant variance in their word recognition abilities after variance due to phonological awareness, memory, and nonverbal intelligence had been removed. Cunningham, Perry, and Stanovich (2001) reported similar results for beginning readers in Grade 1. Also, Shatil, Share, and Levine (2000) examined the relation between kindergarten writing and Grade 1 literacy abilities in a large sample of 317 Israeli children. They found that children's writing scores at the end of kindergarten predicted significant variance in decoding (7%), spelling (11%), and reading comprehension (8%) at the end of Grade 1.

Our print discrimination task is related to writing and spelling yet is not strictly either, so we examined the relation between our print task and reading ability using regression analyses. To do this, we tested each child's phonological awareness and reading ability using standardized measures. Using regression analyses, we then examined the prediction of reading ability from our print concept measures. Because phonological awareness has been shown to be a strong predictor of reading ability, we measured this skill so that its influence could be accounted for first in examining the relation observed between reading skill and our measures of knowledge about print. This allowed us to assess unique variance accounted for by knowledge about print after the major predictor of reading skill was removed. We acknowledge that this is a conservative estimate because orthography and phonology develop in tandem and probably in a mutually supportive fashion. The regressions that take out phonological sensitivity first give the shared variance to phonology and, therefore, underestimate the total contribution of orthography. However, our interest is in showing that there is still unique variance, as well as the shared variance, attributable to visual/orthographic knowledge in determining reading skill.

To pursue our final interest in how home experience influences print knowledge, we developed a Home Literacy Experiences Questionnaire that asked about the

literacy environment of the children. We were interested in the extent to which parents involved their children in various print-related activities and particularly in the importance of literacy activities that were child initiated or pursued independently, as opposed to the popular parent-initiated activity of shared book reading. Although the received wisdom is that reading to children will enhance their later reading acquisition (e.g., Ontario Ministry of Education, 2001), the research providing evidence for a direct connection between amount of storybook reading to children and their reading acquisition is contradictory. Scarborough and Dobrich (1994) concluded from a review of several decades of research that only a modest association exists between the frequency of parent–child reading and children's subsequent written language development. In contrast, from a meta-analysis of studies of the association between parent–child reading and reading development, Bus, Van Ijzendoorn, and Pellegrini (1995) concluded that shared reading has a significant impact on raising later literacy skills. However, it must be noted that some of the studies in this meta-analysis confounded home teaching of reading skills with storybook reading. Moreover, Aram and Biron (2004) found that from 3 to 5 years of age, joint writing interventions were more effective than joint reading interventions in improving children's performance on phonological awareness, word writing, orthographic awareness, and letter knowledge tasks. Thus, storybook reading may have less impact than expected on children's early reading acquisition.

Recent studies have examined the influences of home experience. Sénéchal, LeFevre, Thomas, and Daley (1998) studied 168 kindergarten and Grade 1 children. They measured the children's oral language skills (vocabulary, listening comprehension, and phonological awareness) and written language skills (print concepts, alphabet knowledge, spelling, and decoding). These measures of the children's language skills were then related to information from parent questionnaires assessing the frequency of the children's book experiences, to parental teaching of literacy, and to the extent of storybook reading assessed by a title and author recognition test by parents. Although storybook reading showed some prediction of the children's oral language skills, only parent reports of how frequently they taught their children to read and print words, on a 5-point scale, was predictive of the children's written language skills. In a similar vein, Evans, Shaw, and Bell (2000) found that storybook experience did not predict children's written literacy ability but that activities with letters accounted for variance in the children's language skills. In their 5-year longitudinal study, Sénéchal and LeFevre (2002) concluded, "The finding that exposure to storybooks failed to predict children's emergent literacy skills suggests that informal literacy experiences may not be sufficient to foster children's specific emergent literacy skills such as alphabet knowledge and early decoding" (p. 456). The need for maternal teaching was also echoed in the findings of Aram and Levin (2001, 2004) with lower socioeconomic status children in Israel. They concluded that the quality of maternal mediation influenced literacy development (spelling, reading, comprehension, and linguistic knowledge) through the early school years.

All of this literature suggests that not all home experiences affect children's literacy development in the same fashion. Interestingly, Meyer, Wardrop, Stahl, and Linn (1994) reported a negative relation between the amount of time kindergarten teachers

spent reading to children and the children's reading achievement. In Grade 1, there was no relation between frequency of teacher reading and child reading scores. Evidence from parent questionnaires indicated positive relations between the children's active engagement with print (e.g., reading to the parents) and their reading achievement. The authors suggested that there might be an unfortunate trade-off between passive language experiences and more effective active print engagement in the classroom. In the current study, we examined the relations among different aspects of early literacy experiences and children's understanding of the visual/orthographic aspects of print measured in this study. We focused particularly on the children's active involvement in early literacy activities, in contrast to passive listening to parents' story reading.

In summary, then, we measured children's understanding of a broadly selected set of print concepts that spanned the domain from visual/graphic aspects of print to correct spelling. We looked at the development of this knowledge from 4 to 7 years of age, using a sample of 474 children selected to ensure a minimum of 50 children in each 4-month interval across this age span. The purpose was to trace systematic developmental trajectories in children's understanding of aspects of the writing system. We then used regression analyses to examine the relation between this print development and early reading ability. Finally, we examined the home literacy activities as these related to knowledge of print concepts, with a focus on children's active participation in the literacy activity versus their passive participation, particularly in listening to stories read by their parents. Our interest here was in what experiences best lead children to learn about the writing system that underlies the language they are learning to read.

Method

Participants

A total of 474 children, ages 48 to 83 months, participated in the study. Three-year-olds were not included because a pilot study by Hessels and Levy (1999) indicated that this age group had little understanding of any of the concepts studied here. All but 14 participants were students in junior or senior kindergarten or Grade 1 classes of local schools in a midsized industrial city. The additional 14 children, who were available for testing during the summer months, consisted of 10 4-year-olds, 2 5-year-olds, and 2 6-year-olds. They were enrolled in regular classes in local public schools during the school year and were tested during summer programs at three local day care centers. Permission for participation was received from the school board, the participating schools and day care centers, and the children's parents or guardians. The 474 participants were selected so as to ensure a sample of at least 50 participants in each 4-month interval, from 4 years 0 months to 6 years 11 months. This sampling was done to ensure sufficient data to allow us to plot development across the age range in 4-month intervals. In the final sample, there were 50 participants in each of the intervals 48 to 51 months, 52 to 55 months,

56 to 59 months, 60 to 63 months, and 64 to 67 months as well as 66 participants aged 68 to 71 months, 54 aged 72 to 75 months, 52 aged 76 to 79 months, and 52 aged 80 to 83 months. Overall, 240 participants were female and 234 were male. Gender was approximately equal in all age bins except 72 to 75 months (23 females and 31 males) and 76 to 79 months (31 females and 21 males). Subsequent analyses on every measure indicated that there were no gender differences, so this factor is not discussed further.

Although the participating schools covered a broad socioeconomic class distribution, the volunteer families were more select. Analysis of demographic information from our Home Literacy Experiences Questionnaire indicated that 73% of the families spoke only English at home, 23% spoke English plus another language, and only 4% spoke mainly another language. The families were slightly more educated than the norm for the community, with 95% of mothers and 90% of fathers having completed Grade 12 or 13 (for the general community, 82.5% of adults ages 35–44 years had completed Grade 12 or 13 [Statistics Canada, 2001]). In addition, 72% of mothers and 64% of fathers had obtained a college diploma, university degree, or postgraduate degree compared with 57% for adults ages 35 to 44 years in the community. The sample of volunteer families in this study had a disproportionate number of families with incomes higher than $100,000 Can. (21%). However, a third of the sample had family incomes clustered around the community median ($69,000 Can.), and 22% had family incomes below this median.

The literacy program offered by the school board adheres to a whole language curriculum but with some alphabetic and phonemic awareness training. The program in junior kindergarten for 4-year-olds focuses on oral language and social skills. Children learn letter names through games and songs, and they learn to recognize their own and friends' written names by the end of the school year. In the senior kindergarten curriculum, the 5-year-olds are expected to develop oral language skills, letter knowledge, and phonemic awareness skills. They are taught to print the letters and their own names. By the end of Grade 1, the 6-year-olds are expected to read familiar words with picture support and to write simple words from alphabet and syllabic charts.

Test battery

Home Literacy Experiences Questionnaire

Along with the parental consent form, parents were required to return a Home Literacy Experiences Questionnaire. This questionnaire consisted of a variety of questions tapping characteristics of each family and the target child, including the language used within the home, highest level of education of the mother, highest level of education level of the father, and family income before taxes. These items provided the description of the sample given previously.

An additional 28 items asked parents to specify types and frequencies of home literacy activities. This included ratings of the frequency of reading seven different types of children's books to the child (e.g., alphabet books, storybooks, poems,

magazines, chapter books, classics, nonfiction) and of engaging in 21 literacy activities (e.g., learning letter sounds, reading signs, visiting public libraries, tracing/copying letters). These items formed the basis for analyses of the extent to which the parents involved their child in literacy activities. The questions were taken from a previous longitudinal study by one of the current authors (Shaw & Evans, 1999) where 130 parents had answered open-ended questions about the home literacy environment of children from kindergarten to Grade 2. Parents in the current study also rated, for each literacy activity in which their child was involved, the likelihood that this activity was initiated by the parents versus by the child. This provided a measure of the child's independent pursuit of literacy activities.

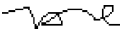
Standardized tests

Two standardized measures gauged each child's phonological sensitivity and reading achievement. Phonological sensitivity is a well-established correlate of early reading development (e.g., Bradley & Bryant, 1983, 1985). This measure was included so that it could be accounted for in examining the relationship between print knowledge and reading. Rosner's (1979) Test of Auditory Analysis Skills (TAAS) was used as a measure of phonological sensitivity. This test consists of 13 words that the child must attempt to say without a specific sound (syllable or phoneme deletions). To measure reading achievement, we used the reading subtest of the Wide Range Achievement Test (WRAT-3). In this test, the child attempts to name up to 15 capital letters and 42 words.

Experimental measures

The experimental test of visual/orthographic knowledge was a simple two-alternative, forced-choice discrimination task. There were two versions of the task: one where the two alternatives were single "words" and one where the two alternatives were short "sentences." Each version contained 130 flash cards with two alternatives per card: one correct representation and one that violated a single print convention in English. The print violations explored the understanding of 13 different print conventions. Tables 1 and 2 provide illustrations of the 13 types of violations for the word test and for the sentence test, respectively. For both word and sentence tasks, 10 cards tested each of the 13 types of print violations, and these instances were randomized in the total set of 130 cards. The 13 types of violations were selected to cover a range of knowledge, including form types (e.g., scribbles, pictures, letter-like characters vs. real letters), spatial formats (e.g., linear arrangement, spacing conventions), orientation conventions, and alphabetic knowledge about what constitutes a real word (e.g., multiplicity and variety of letters, all letters with no numbers, words containing vowels and consonants but not either exclusively, every word having a conventional spelling [pseudohomophones not acceptable]). The same 13 types of print violations were tested in both the word and sentence versions of the task so that performance could be compared for single and multiple-item displays.

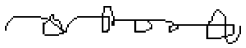
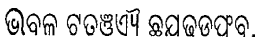
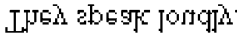
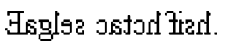
Table 1
Examples of the 13 violation types for the word discrimination task

Violation type	Correct representation	Incorrect representation
Word shape		
Scribbles	ounce	
Letter-like characters	swarm	ଊକଗଝଯ
Pictures	ghost	
Linearity	truck	t u k r c
Spacing	ninth	ni n th
Multiplicity	weave	W
Word elements		
Letter–number combination	glide	g8i3e
Variety	swamp	Sssss
Upside-down	miner	ɯɯɹǝ
Backward	screw	ɯɔɹǝs
Spelling		
Vowels	prior	prlbr
Consonants	mouse	louae
Pseudohomophone	purse	perce

For the word task, the correct items consisted of 65 high-frequency words (>100/million) and 65 low-frequency words (<49/million), according to a frequency count for children's literature, *The Teacher's Word Book of 30,000 Words* (Thorndike & Lorge, 1952), with 5 words of each frequency being used for tests of each of the 13 types of print violations. Words varied in length from 2 to 7 letters (mean 4.7), and length was equated across the 13 violation types. For the sentence task, the 130 correct items consisted of one three-word sentence, six four-word sentences, and three five-word sentences for tests of each of the 13 types of print violations. Half of the children in each age group completed the word test first and then the sentence test. The other half of the children completed the tasks in the reverse order.

For both word and sentence tasks, children were shown the flash cards one at a time and were told, "We are going to play a game. There are two things on the card. Can you tell me which one you think Mommy would like to read or which one you think is a better word/sentence to read? Point to it for me." The experimenter recorded the responses. Children worked at their own pace through each set of 130 cards. If a child indicated that he or she was bored or tired, the session was ended and testing was continued from the stopping point the next day. Most children completed the discrimination tasks within the first two sessions lasting approximately 20 min each.

Table 2
Examples of the 13 violation types for the sentence discrimination task

Violation type	Correct representation	Incorrect representation
Word shape		
Scribbles	Frogs eat pests.	
Letter-like characters	The wagon bumped.	
Pictures	Squirrels like carrots.	
Linearity	Grass is green.	G a s i g e n. r s s r e
Spacing	Farmers pick apples.	Fa rm ers p i c k app les.
Multiplicity	Flowers smell good.	F s g.
Word elements		
Letter–number combination	Jenny went shopping.	J2n8y 5ent sh9pp3ng.
Variety	Owls dislike rats.	Oooo dddd rrrr.
Upside-down	They speak loudly.	
Backward	Eagles catch fish.	
Spelling		
Vowels	Daniel collects coins.	Dgnycl cdllncts cqlns.
Consonants	Raccoons eat garbage.	Aaeeooui eai uaioaue.
Pseudohomophone	Mice dig tunnels.	Myse digg tunnles.

Procedure

Following the return of the questionnaire and consent form, each child was tested individually in a quiet area in the school or day care center for three sessions lasting 20 to 30 min each. The junior and senior kindergarten children were tested on alternate days to accommodate their alternate days attendance at school, and the Grade 1 children were tested on 3 successive days. Testing was done by a graduate student (the second author) or by one of three research assistants. The first two sessions consisted of the experimental tests of visual/orthographic knowledge, and the final session consisted of two standardized tests. The testing took place from January 2002 to January 2003. All age groups were tested throughout the year-long interval, with all grades at individual schools tested before moving to the next school. Thus, testing in each grade occurred across the entire year-long testing interval, so that "time of year" effects are random for each grade.

Results

The presentation of the results is organized to address the main questions of interest in this study. In the first section, the results of the print discrimination task

are analyzed to show the developmental trends across the age range from 4 to 7 years. The second section presents the data on the standardized measures and the regression analyses that examined the influence of print knowledge on early reading skill. The final section outlines the results of the Home Literacy Experiences Questionnaire by first examining the factor composition of the questionnaire, then determining how these components were influenced by age, and finally looking at the relation between the home literacy influences and the children's print knowledge and reading skill.

Developmental trends in the acquisition of print knowledge

We first examined the developmental trends in the experimental word and sentence tasks. Each violation type showed systematic development with age. For the youngest group, only the discrimination of scribbles and number–letter combination for the word test and scribbles and letter-like characters for the sentence test were above chance. For the children age 52 months or over, all types of discrimination were above chance except for the consonant, vowel, and pseudohomophone tasks. To capture any organization of clusters within the 13 types of print violations, we conducted a principal components analysis (varimax rotation with loadings <.40 dropped) on the scores for 4-, 5-, and 6-year-olds separately. That is, we analyzed the groups of 48- to 59-month-olds, 60- to 71-month-olds, and 72- to 83-month-olds separately for both the word and sentence tasks. Tables 3 and 4 present the factor loadings for the word and sentence tasks, respectively. For the 4-year-olds, the same three components emerged for both the word and sentence tasks. The first component contained six types of violations: linearity, multiplicity, spacing, pictures, scribbles, and letter-like characters. The only cross-loading was for linearity in the word task. We refer to this component as the Word Shape. The second component consisted of four types of print violations: variety, upside-down, backward, and number–letter combination. The only cross-loading was for variety in the word task. We refer to this component as the Word Elements. The third component consisted of three types of violations: vowels, consonants, and pseudohomophones. We refer to this component as Spelling.

The analyses for the 5- and 6-year-olds yielded two components (Tables 3 and 4). This might be because the scores for the Word Shape component were near the ceiling and so they contributed little variance. The cross-loadings involved variety, backward, upside-down, and number–letter combination. The developmental picture from these analyses is that for 4-year-olds, the three components are developing separately, whereas for the 5- and 6-year-olds, the Word Shape component is nearly learned and growth is now occurring largely in the Word Elements and Spelling components. Fig. 1 shows the developmental trajectories of the three components for both the word and sentence tasks. The word and sentence performance levels are remarkably similar, suggesting that once children acquire a type of knowledge, it can be applied to single- or multiple-item displays. Because of this similarity, performances on the word and sentence tasks were combined for subsequent analyses. Fig. 1 shows clearly that there is considerable development of knowledge about print

Table 3
Eigenvalues for components and component loadings for the 13 violation types of the word discrimination task

Component violation type	Eigenvalue	Component		
		1	2	3
4-year-olds				
1. Word shape	4.50			
Linearity		.75	.45	—
Multiplicity		.77	—	—
Spacing		.77	—	—
Picture		.82	—	—
Scribbling		.85	—	—
Letter-like characters		.82	—	—
2. Word elements	2.65			
Variety		.52	.62	—
Upside-down		—	.68	—
Backward		—	.81	—
Number–letter combination		—	.72	—
3. Spelling	1.22			
Vowel		—	—	.70
Consonant		—	—	.51
Pseudohomophone		—	—	.64
5-year-olds				
1. Word shape and elements	7.15			
Linearity		.90	—	
Multiplicity		.90	—	
Spacing		.91	—	
Picture		.79	—	
Scribbling		.90	—	
Letter-like characters		.88	—	
Variety		.89	—	
Upside-down		.83	—	
Backward		.65	—	
Number–letter combination		.76	—	
2. Spelling	1.68			
Vowel		—	.71	
Consonant		—	.61	
Pseudohomophone		—	.73	
6-year-olds				
1. Word shape and elements	6.25			
Linearity		.86	—	
Multiplicity		.86	—	
Spacing		.83	—	
Picture		.72	—	
Scribbling		.83	—	
Letter-like characters		.88	—	
Variety		.86	—	
Upside-down		.75	.48	
Backward		.48	.66	
Number–letter combination		.75	.47	

(*continued on next page*)

Table 3 (*continued*)

Component violation type	Eigenvalue	Component		
		1	2	3
2. Spelling	2.67			
Vowel		—	.70	
Consonant		—	.80	
Pseudohomophone		—	.62	

Note. Loadings of less than .40 are represented by a dash (—). For 4-year-olds, total percentage of variance accounted for 64.37% (Component 1, 34.64%; Component 2, 20.38%; Component 3, 9.35%). For 5-year-olds, total percentage of variance accounted for 67.95% (Component 1, 55.00%; Component 2, 12.95%). For 6-year-olds, total percentage of variance accounted for 68.68% (Component 1, 48.11%; Component 2, 20.57%).

from 48 to 83 months of age. The three print components we have abstracted from the data suggest that this knowledge development is systematic, with basic graphic information being acquired fastest, followed by or in conjunction with abstraction of orientation and "wordness" information. Naturally, a full understanding of spelling is not completed even by the end of the sixth year.

Because there were some age intervals where the children were in different grades even though they were the same age (particularly in the final 4-month intervals between 4 and 5 years of age and then 5 and 6 years of age), we reexamined the data where this confound did not occur. For this reanalysis, we used only 426 children, with all children of the same age also being in the same grade. Thus, for each 4-month interval from 48 to 63 months, all children were in junior kindergarten; for age intervals from 64 to 75 months, all children were in senior kindergarten; and for age intervals from 76 to 83 months, all children were in Grade 1. The developmental trajectories for this sample are virtually identical to those shown in Fig. 1. Reanalyses using this sample yielded no change in basic findings. This suggests that the age profiles presented in Fig. 1 are not affected by those few children at each age interval who happened to have been in a different grade. This might be because the early literacy programs used in the schools focused on oral language rather than written language.

Relation between print knowledge and early reading skill

Table 5 contains the mean performance (raw scores because standard scores were not available for the younger ages on some measures) on the two standardized tests (TAAS and WRAT-3) given to each child. For the WRAT-3 scores, the two final columns in the table break the overall WRAT score into its components: letter naming and word naming. The point to be taken from these components is that the 4-year-olds read mainly letters, with nearly no word reading. The 5-year-olds read only a word or two, so that the only "real" reading by these children occurs in the 6-year-old sample. This becomes important for our later discussion about the relation between our print task and reading development. Table 5 shows that there was clear development in both phonological sensitivity and reading scores over the ages studied here. Table 6 indicates that the early skill measures are intercorrelated with each

Table 4
Eigenvalues for components and component loadings for the 13 violation types of the sentence discrimination task

Component violation type	Eigenvalue	Component		
		1	2	3
4-year-olds				
1. Word shape	4.52			
Linearity		.86	—	—
Multiplicity		.84	—	—
Spacing		.82	—	—
Picture		.81	—	—
Scribbling		.88	—	—
Letter-like characters		.85	—	—
2. Word Elements	2.40			
Variety		—	.82	—
Upside-down		—	.62	—
Backward		—	.68	—
Number–letter combination		—	.71	—
3. Spelling	1.23			
Vowel		—	—	.50
Consonant		—	—	.64
Pseudohomophone		—	—	.69
5-year-olds				
1. Word Shape and Elements	6.18			
Linearity		.91	—	
Multiplicity		.92	—	
Spacing		.85	—	
Picture		.82	—	
Scribbling		.91	—	
Letter-like characters		.86	—	
Variety		.70	.49	
Upside-down		.60	.60	
Backward		.48	.60	
Number–letter combination		.68	.53	
2. Spelling	2.42			
Vowel		—	.63	
Consonant		—	.51	
Pseudohomophone		—	.65	
6-year-olds				
1. Word Shape and Elements	6.02			
Linearity		.90	—	
Multiplicity		.88	—	
Spacing		.85	—	
Picture		.54	—	
Scribbling		.84	—	
Letter-like characters		.84	—	
Variety		.71	—	
Upside-down		.69	.42	
Backward		.53	.64	
Number–letter combination		.82	—	

(*continued on next page*)

Table 4 (*continued*)

Component violation type	Eigenvalue	Component		
		1	2	3
2. Spelling	3.13			
Vowel		—	.87	
Consonant		—	.84	
Pseudohomophone		—	.81	

Note. Loadings of less than .40 are represented by a dash (—). For 4-year-olds, total percentage of variance accounted for 62.68% (Component 1, 34.79%; Component 2, 18.45%; Component 3, 9.44%). For 5-year-olds, total percentage of variance accounted for 66.20% (Component 1, 47.55%; Component 2, 18.64%). For 6-year-olds, total percentage of variance accounted for 70.33% (Component 1, 46.29%; Component 2, 24.04%).

other and with the three print components of the experimental word and sentence tasks.

Because both age and phonological sensitivity are strong predictors of reading development, we used ordered regression analyses to ask whether performance on the word/sentence task predicted variance in the WRAT-3 reading test after variance due to age and phonological sensitivity was removed. Ordered regression analyses were performed separately for 4-year-olds (first three age intervals), 5-year-olds (next

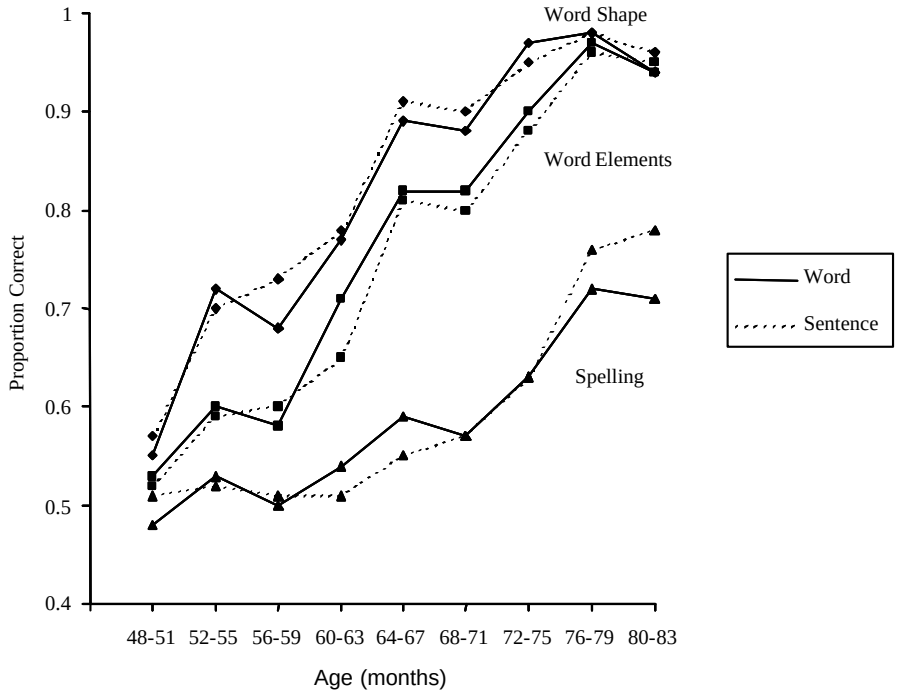


Fig. 1. Proportions correct for the three print components as a function of age for the word and sentence tasks.

Table 5
Means and standard deviations for TAAS and WRAT-3 in each age interval

Age interval (months)	TAAS	WRAT-3 (total)	Letters	Words
48–51 ($n = 50$)	1.22 (1.49)	6.26 (5.65)	6.22 (5.81)	0.04 (0.20)
52–55 ($n = 50$)	1.72 (2.19)	8.92 (5.90)	8.68 (5.62)	0.24 (0.82)
56–59 ($n = 50$)	2.00 (1.75)	11.22 (4.63)	11.00 (4.39)	0.22 (0.68)
60–63 ($n = 50$)	2.34 (1.59)	12.12 (4.27)	11.78 (3.99)	0.34 (0.63)
64–67 ($n = 50$)	3.46 (2.28)	15.46 (3.36)	14.08 (2.34)	1.38 (1.88)
68–71 ($n = 66$)	3.92 (3.06)	15.24 (5.27)	13.20 (3.34)	2.05 (3.09)
72–75 ($n = 54$)	5.17 (3.66)	17.93 (4.81)	14.37 (2.26)	3.56 (3.76)
76–79 ($n = 52$)	6.87 (3.85)	21.46 (4.98)	14.87 (0.49)	6.60 (4.85)
80–83 ($n = 52$)	7.88 (4.22)	22.52 (4.89)	14.87 (0.34)	7.65 (4.79)

Note. Standard deviations are in parentheses.

Table 6
Intercorrelations of emergent literacy variables for 4-, 5-, and 6-year-olds with age (months) as a factor

	1	2	3	4	5
4-year-olds					
1. Age					
2. TAAS	.18*				
3.WRAT	.38***	.52***			
4. Word Shape	.27***	.31***	.30***		
5. Word Elements	.23**	.47***	.40***	.64***	
6. Spelling	.03	.20*	.10	.04	.12
5-year-olds					
1. Age					
2. TAAS	.29***				
3.WRAT	.29***	.57***			
4. Word Shape	.21**	.25***	.26***		
5. Word Elements	.27***	.35***	.39***	.81***	
6. Spelling	.19*	.36***	.39***	.28***	.44***
6-year-olds					
1. Age					
2. TAAS	.27***				
3.WRAT	.40***	.58***			
4. Word Shape	−.02	.07	.15		
5. Word Elements	.19*	.26***	.41***	.79***	
6. Spelling	.37***	.51***	.73***	.36***	.57***

Note. ns = 150, 166, and 158 for 4-, 5-, and 6-year-olds, respectively.
* $p < .05$.
** $p < .01$.
*** $p < .001$.

three age intervals), and 6-year-olds (final three age intervals). For each regression, age was entered as the first predictor, then performance on the TAAS was entered as the second predictor, and finally performance on one of the print components (combining scores for the word and sentences tasks) was read in as the third step in the regression. The Spelling component for 4-year-olds was not used because performance was at chance, and the Word Shape component for 6-year-olds was not used

because performance was at ceiling. These ordered regression analyses provided a stringent test of any additional unique variance accounted for by print knowledge beyond that shared with age and phonological sensitivity.

Table 7 contains the regression outcomes for the 4-, 5-, and 6-year-olds. For the 4-year-olds, only the Word Elements component accounted for a small (2%) but reliable amount of unique variance after accounting for age and phonological sensitivity. Even for these young children, the graphic and spatial information (Word Shape component) did not predict reading. Rather, an understanding of word elements (e.g., letter orientation, variety of letters) predicted performance on the WRAT-3 reading test (largely letter reading) after accounting for age and phonological sensitivity. The middle panel of Table 7 shows the regression outcomes for the 5-year-olds. Here both the Word Elements and Spelling components accounted for additional unique variance in reading scores (3 and 6% of variance) after accounting for age and phonological sensitivity, and again Word Shape did not account for unique variance. By 5 years of age, then, children's knowledge about the letter constituents in the English writing system and more detailed knowledge about acceptable spelling contributed to reading achievement over and above the contributions of age and phonological sensitivity. Finally, the lower panel of Table 7 displays the regression results for the 6-year-olds. Examination of the data indicated that seven children's scores were extreme outliers (very poor performance), so these children were eliminated from the data set. For 6-year-olds, both the Word Elements and Spelling components contributed unique variance (5 and 19%, respectively) to reading achievement after accounting for age and phonological sensitivity.

Table 7
Summary of regressions predicting reading (WRAT) from the print components after accounting for age and TAAS

Step	Predictor	R^2	$p<$	β	r
4-year-olds					
1	Age	.14	.001	.38	.38
2	TAAS	.21	.001	.46	.52
3	Word Shape	.01	*ns*	.09	.30
3	Word Elements	.02	.05	.15	.40
5-year-olds					
1	Age	.09	.001	.29	.29
2	TAAS	.26	.001	.53	.57
3	Word Shape	.01	*ns*	.11	.26
3	Word Elements	.03	.01	.20	.39
3	Spelling	.06	.001	.26	.45
6-year-olds					
1	Age	.16	.001	.40	.40
2	TAAS	.30	.001	.57	.63
3	Word Elements	.05	.001	.22	.39
3	Spelling	.19	.001	.52	.72

Note. After outliers were removed, the sample size for 5-year-olds was 164 for the Spelling component. The sample size for 6-year-olds was 155 for both the Word Elements and Spelling components.

The developmental relation between reading and print knowledge suggested by these regressions indicates that reading is *not* mediated by learning about graphic information in the word shapes. Rather, by 4 years of age, children begin to focus on the internal constituents of words. This focus on print during the fourth year appears to improve the acquisition of letter knowledge as measured by letter reading on the WRAT (which makes up most of the scores for 4-year-olds). The 5- and 6-year-olds further analyze the letter constituents and come to understand that there are acceptable combinations of letters. The Spelling component predicts most of the print variance related to reading. These data, then, show important developmental links between the acquisition of word element and spelling knowledge from print and the acquisition of letter names that leads to improved reading skill.

Dimensions of the Home Literacy Experiences Questionnaire

The data described previously suggest that it is important that children's early literacy experiences include activities that lead them to explore details of the print itself. To investigate potential sources of these experiences, we next examined the information provided by the parents on our Home Literacy Experiences Questionnaire. These data consisted of parents' evaluations of how often their children were involved in various literacy activities and, for the activities in which they were involved, the frequency with which that involvement was child initiated. Means and standard deviations for each of the items, including ratings of both extent child of involvement and degree of child initiation/independence of involvement, are shown in Table 8. Reduction of data from these two sets of questions was as follows.

Frequency of involvement in literacy activities

A principal components analysis with varimax rotation was performed on the 364 responses to the 28 literacy activities. These 364 responses consisted of questionnaires in which all 28 literacy activity questions were answered (partial responses were not included). The demographics of this subsample did not differ from that of the larger group, with the exception that slightly more mothers had received a college or university degree (76% vs. 72% for the entire sample). This analysis resulted in seven principal components, accounting for 58% of the variance. The seventh component consisted of the single item "watching educational TV such as Sesame Street." This single item component was dropped, and the analyses were repeated using the remaining 27 literacy items. It resulted in six components with eigenvalues greater than 1 that together accounted for 55% of the variance. Only 4 of the items cross-loaded onto a second component to a fair extent (i.e., component loading >.40). All components consisted of items for which all of the loadings were at least fair, and at least 2 of the items were very good to excellent (i.e., $\geqslant .60$). In addition, communality indexes for the items ranged from .32 to .78. Table 9 presents the means and standard deviations for the items arranged by component. Table 10 presents the intercorrelations of the components by age group.

Table 8
Descriptive statistics for home literacy experience items in principal components analysis

Component and item	Involved in[a]		Initiative/independence[b]	
	M	*SD*	*M*	*SD*
I. Practicing reading and writing				
Spelling words	3.80	1.79	3.16	1.30
Reading out loud	3.66	2.01	3.14	1.38
Writing a note or little story	2.71	1.71	2.86	1.49
Practicing letter names/individual words	4.12	1.55	3.49	1.23
Reading signs/labels	4.03	1.55	3.55	1.22
Printing his/her own name	5.07	1.23	4.07	1.16
Learning letter sounds/word parts	4.46	1.35	3.26	1.11
Doing word games (e.g., crossword, word find)[c]	2.26	1.19	2.62	1.41
Playing computer games involving reading[c]	3.72	1.47	3.74	1.20
II. Beginning print/book activities				
Using children's picture dictionary	2.11	1.34	2.42	1.32
Playing with magnetic letters/letter cards	2.69	1.42	3.02	1.33
Using alphabet books	3.44	1.37	3.25	1.16
Visiting public library	2.62	1.10	2.48	1.10
Listening to storybook tapes	2.33	1.34	2.72	1.48
III. Phonics/Phonological awareness activities				
Read books with poems/stories that rhyme to child	3.67	1.17	—	—
Read ABC/alphabet/letter sound book to child	3.45	1.28	—	—
Listening to rhyming words/rhyming stories/poems	3.88	1.39	3.37	1.14
IV. Casual activities with books/print				
Listening to books you read	4.92	1.40	3.61	1.15
Tracing or copying letters/words[I]	4.37	1.32	3.60	1.24
Looking at magazines/books	4.51	1.41	3.93	1.09
Watching you print notes	3.63	1.31	3.41	1.28
V. Reading child advanced text				
Read long classic children's books to child	2.33	1.32	—	—
Read chapter books to child	2.14	1.33	—	—
Read children's magazines to child	1.88	1.07	—	—
Educational games (e.g., Spill & Spell, Boggle)	2.74	1.38	2.80	1.28
VI. Traditional shared book reading				
Read short illustrated storybooks to child	4.06	1.30	—	—
Read illustrated children's nonfiction books to child	3.08	1.40	—	—
Single-item component				
Watching educational TV (e.g., Sesame Street)	4.40	1.43	3.90	1.14

Note. Roman numeral superscript indicates the component when the corresponding item for child initiative/independence loaded onto a different factor from that for child involvement.

[a] Ratings for involvement were as follows: 1, never; 2, rarely (1–3 times per month); 3, from time to time (7–15 times during past 4 months or 2–3 times per month); 4, often (20–30 times during past 4 months or 1–2 times per week); 5, frequent (40–60 times during past 4 months or 3–4 times per week); 6, nearly every day (>80 times during past 4 months).

[b] Ratings for independence were as follows: 1, always initiated/led by parent, child never pursues on own; 2, primarily initiated/led by parent; 3, initiated by child and parent equally; 4, primarily initiated and led by child; 5, rarely initiated/led by parent, child nearly always pursues on own.

[c] Initiative/Independence item formed a separate component.

Table 9
Descriptive statistics for principal component scores of home experiences by age level

	Age 4		Age 5		Age 6	
	M	*SD*	*M*	*SD*	*M*	*SD*
Activities involved in						
Practicing reading and writing	−.43[a]	.63	−.04[b]	.67	.38[c]	.55
Beginning print/book activities	−.00	.66	−.02	.65	−.29	.61
Phonics/Phonological awareness	.18[a,b]	.75	−.04[b,c]	.74	−.11[c]	.79
Casual activities with books/print	−.01	.65	.03	.70	−.18	.68
Being read advanced text	−.20[a,b]	.66	.02[b,c]	.67	.12[c]	.63
Traditional book reading	−.09	.86	−.08	.83	−.05	.85
Activities initiated/independently pursued						
Practicing reading and writing	−.47[a]	.80	.14[b]	.63	.25[b]	.68
Beginning activities with letters and print	−.26	.69	−.09	.73	−.07	.71
Casual activities with books/print	−.16	.76	−.05	.73	−.10	.64
Playing games with reading	−.46[a,b]	.87	−.15[b,c]	.83	.16[c]	.82

Note. No statistically significant difference was found for means sharing superscripts.

Table 10
Intercorrelations of child age and home experiences in which child is involved

	1	2	3	4	5	6
4-year-olds						
1. Age						
2. Reading and writing	.30***					
3. Beginning print/book	−.03	.44***				
4. Phonics/Phonological awareness	−.12	.23*	.42***			
5. Casual activities	−.01	.48***	.35***	.40***		
6. Being read advanced text	−.14	.24**	.49***	.18*	.21*	
7. Traditional book reading	−.15	.09	.29**	.53***	.23*	.32***
5-year-olds						
1. Age						
2. Reading and writing	.24*					
3. Beginning print/book	.14	.62***				
4. Phonics/Phonological awareness	.09	.49***	.53***			
5. Casual activities	.14	.68***	.50***	.50***		
6. Being read advanced text	.08	.40***	.57***	.42***	.38***	
7. Traditional book reading	.06	.21*	.22**	.42***	.32***	.40***
6-year-olds						
1. Age						
2. Reading and writing	.15					
3. Beginning print/book	.00	.49***				
4. Phonics/Phonological awareness	−.07	.48***	.45***			
5. Casual activities	.08	.56***	.44***	.42***		
6. Being read advanced text	−.01	.37***	.46***	.25**	.29***	
7. Traditional book reading	.05	.45***	.27***	.37***	.33***	.18*

* $p < .05$.
** $p < .01$.
*** $p < .001$.

Component 1, whose 9 items accounted for 24.11% of the variance, reflected activities in which the children were actively involved in printing, reading, spelling, and doing as opposed to watching or listening. Hence, it was named Practicing Reading and Writing. Internal consistency, as assessed by Cronbach's alpha, was .86. It is important to note that the items on this component and the materials or activities within them span a range of difficulty levels. Component 2, Beginning Print/Book Activities, consisted of a mixture of five activities that allow children to examine letters and print, such as looking at picture dictionaries, using alphabet books, and playing with letters, as well as library activities. Internal consistency was .65. Component 3, Phonic/Phonological Awareness Activities, consisted of materials and activities drawing attention to the sounds of language along with alphabet books and letters that represent various sounds. Internal consistency was .66 for the 3 items. Component 4 consisted of more casual activities with print such as listening to parents read, watching parents print, and looking at magazines and books. Cronbach's alpha was .60 for the 4 items. Finally, Components 5 and 6 differentiated between reading books to children with text at a more advanced level and traditional book reading. Cronbach's alphas were .59 and .54 for these components with 4 and 2 items, respectively.

Child-initiated pursuit of literacy activities

Because parents rated frequency of child initiation of activities only for those activities in which their children were involved, the number of participants for whom complete data were available was reduced to 223 for this analysis. A principal components analysis was completed on the same 21 activities. Watching educational TV and visiting the library each singly formed the last two components and were dropped. The resulting four factors cumulatively accounted for 61% of the variance. Item commonalities ranged from .45 to .72. Internal consistencies, as assessed by Cronbach's alpha, were .88, .72, .61, and .50 for the four components, with the last one being for the component having only 2 items.

The components are very similar to those described previously with two exceptions. Because items on the frequency with which parents read different types of books were not included in this analysis, components reflecting listening to rhyming books and short children's storybooks could not emerge. Instead, the extent to which parents versus children initiated listening to storybooks and rhyming words/stories/poems both loaded onto a component with 4 items involving children's listening to and observing others reading and writing and reflected casual activities with print. In addition, games requiring reading, such as crosswords and computer games, emerged as a separate component rather than loading with items involving practicing reading and writing. All components consisted of items for which all of the loadings were at least fair, and at least 2 of the items were very good to excellent. Only 1 item cross-loaded; reading signs and labels loaded .43 both on practicing reading and writing and on everyday activities with print.

Age differences in home literacy experiences

To examine whether component scores differed among the three age groups, an analysis of variance (ANOVA) was performed on each component score, setting alpha at .005 as a Bonferroni correction. Being involved in activities where reading and writing were practiced increased significantly with each age group, $F(2, 365) = 54.19$, $p < .001$, with 6-year-olds being more involved than 5- and 4-year-olds and with 5-year-olds being more involved than 4-year-olds. Similarly, the degree to which these activities were engaged in independently or led by the children differed by age level, $F(2, 219) = 19.42$, $p < .001$. The 6-year-olds and 5-year-olds did not differ, but both groups were rated more highly than 4-year-olds. A group difference was also observed for being involved in phonological awareness activities, $F(2, 365) = 4.78$, $p < .01$. Scores were higher for 4-year-olds than for 6-year-olds. The extent to which children were involved with advanced text, such as chapter books and games involving reading, also differed, $F(2, 365) = 7.34$, $p < .001$, such that 6-year-olds experienced this more than did 4-year-olds. This was paralleled by a difference between these same two age groups in the extent to which the children were rated as independently pursuing or initiating games involving reading, $F(2, 365) = 9.78$, $p < .001$.

Relation of home experiences to literacy skills

To examine the relation of home literacy experiences in which children were involved to the children's visual/orthographic knowledge (measured by our word/sentence discrimination task), to phonological sensitivity (measured by the TAAS), and to letter/word identification (measured by the reading subtest of the WRAT-3), each of these variables was regressed onto the six components reflecting involvement. Parallel regressions were conducted for each age group. A preliminary examination within each age group revealed that mother's education, father's education, and family income were not significantly correlated with any of the children's emergent literacy scores, so these variables were not included in the regressions. Rather, age was entered as the first step, followed by scores on the six involvement components, to assess the contribution of these home activities to children's print knowledge (Word Shape, Word Elements, and Spelling), TAAS performance, and WRAT performance. A regression was not conducted at a given age group if scores were at ceiling or floor (i.e., Spelling for 4-year-olds and Word Shape for 6-year-olds). Only cases with complete data for creating all of the involvement components were included in the analyses. Therefore, the sample sizes were 101, 123, and 141 for the 4-, 5-, and 6-year-old groups, respectively. Any outliers in a given regression were deleted from all of the regressions, leaving samples sizes of 100, 118, and 122, respectively. The resulting regressions are shown in Tables 11–13 for the corresponding three age groups.

For the 4-year-old group, neither age nor the extent of involvement in home activities significantly predicted scores on the TAAS. In contrast, letter knowledge, as assessed by the WRAT, and print knowledge on the Word Shape and Word Ele-

Table 11
Summary of emergent literacy variables for 4-year-olds regressed on involvement in home activities

Dependent	Step	Predictor	R^2	$p<$	β	r
TAAS	1	Age	.03	*ns*	.09	.16
	2	Involved in activities	.11	*ns*		
Word Shape	1	Age	.08	.01	.30**	.29**
	2	Involved in components	.17	.01		
		Practicing reading and writing			−.01	.21*
		Beginning print/book activities			.39**	.33***
		Phonics/Phonological awareness			.19	.23**
		Casual activities with print			−.07	.09
		Being read advanced text			−.16	−.02
		Traditional book reading			−.06	.04
Word Elements	1	Age	.08	.01	.32**	.28**
	2	Involved in components	.11	.01		
		Practicing reading and writing			−.09	.13*
		Beginning print/book activities			.30*	.23**
		Phonics/Phonological awareness			−.12	.09
		Casual activities with print			.05	.10
		Being read advanced text			−.12	.04
		Traditional book reading			.26*	.21*
WRAT	1	Age	.19	.001	.28**	.44***
	2	Involved in components	.15	.01		
		Practicing reading and writing			.44***	.45***
		Beginning print/book activities			−.03	.05
		Casual activities with print			−.01	.14
		Traditional book reading			.12	−.01

* $p < .05$.
** $p < .01$.
*** $p < .001$.

ments component were predicted by both. After accounting for age, involvement in home experiences accounted for 17% of the variance on the Word Shape component, 11% of the variance in the Word Elements component, and 15% of the variance in WRAT scores. Examination of the zero-order correlations, partial correlations, and beta weights showed that beginning activities with print were associated with scores for Word Shape and Word Elements. Practicing reading and writing was associated with letter naming on the WRAT.

For the 5-year-old group, age as the first step contributed to all of the dependent variables. Home activities contributed additional variance in the regressions predicting both TAAS scores and WRAT scores (18 and 19%, respectively). In each case, activities in which the children were involved with reading and writing both had a significant positive correlation and received a positive beta weight in the regression. This variable also likely shared variance with casual activities with books, which was positively correlated with both TAAS and WRAT scores but did not receive significant beta weights. Although being

Table 12
Summary of emergent literacy variables for 5-year-olds regressed on involvement in home activities

Dependent	Step	Predictor	R^2	$p<$	β	r
TAAS	1	Age	.09	.005	.28***	.26
	2	Involved in components	.18	.001		
		Practicing reading and writing			.27**	.29***
		Beginning print/book activities			−.21*	.01
		Phonics/Phonological awareness			.18	.24**
		Casual activities with print			.15	.25**
		Being read advanced text			−.26*	−.07
		Traditional book reading			.12	.15
Word Shape	1	Age	.08	.01	.26**	.25
	2	Involved in components	.03	*ns*		
Word Elements	1	Age	.11	.001	.29**	.33***
	2	Involved in components	.03	*ns*		
Spelling	1	Age	.04	.05	.20*	.17
	2	Involved in components	.04	*ns*		
WRAT	1	Age	.05	.05	.15	.22**
	2	Involved in components	.19	.001		
		Practicing reading and writing			.51***	.41***
		Beginning print/book activities			−.15	.12
		Phonics/Phonological awareness			−.06	.16*
		Casual activities with print			.02	.27**
		Being read advanced text			−.12	.06
		Traditional book reading			.16	.17*

* $p < .05$.
** $p < .01$.
*** $p < .001$.

read advanced text and beginning activities in print received significant negative beta weights in the regression for the TAAS, the zero-order correlations were virtually zero, indicating that these variables were of little consequence for phonological awareness.

For the oldest age group (6-year-olds), age continued to predict scores on each dependent variable. Home activities significantly predicted an additional 15% of the variance in scores for the Spelling component and an additional 13% of the variance in WRAT scores. In both cases, activities in which the children were involved in practicing reading and writing had significantly positive zero-order correlations and beta weights.

The overall picture that emerges from these regressions is that being read books, whether advanced text or more traditional children's books, was uncorrelated with the literacy variables, but activities in which the children were directly involved with printing, reading, and writing, and to a lesser extent phonics/phonological sensitivity activities, were related to print knowledge and the ability to manipulate sounds in spoken words.

Table 13
Summary of emergent literacy variables for 6-year-olds regressed on involvement in home activities

Dependent	Step	Predictor	R^2	$p<$	β	r
TAAS	1	Age	.04	.05	.18*	.21*
	2	Involved in components	.07	*ns*		
Word Elements	1	Age	.21	.001	.41***	.45***
	2	Involved in activities	.05	*ns*		
Spelling	1	Age	.11	.001	.26**	.33**
	2	Involved in components	.15	.001		
		Practicing reading and writing			.50***	.30***
		Beginning print/book activities			−.14	−.03
		Phonics/Phonological awareness			−.23*	−.13
		Casual activities with print			−.07	.05
		Being read advanced text			.05	.07
		Traditional book reading			−.10	.00
WRAT	1	Age	.08	.001	.22**	.29***
	2	Involved in components	.13	.01		
		Practicing reading/writing			.47***	.29***
		Beginning print/book activities			−.10	.00
		Phonics/Phonological awareness			−.19	−.09
		Casual activities with print			−.06	.07
		Being read advanced text			.02	.06
		Traditional book reading			−.09	.01

* $p < .05$.
** $p < .01$.
*** $p < .001$.

However, it might be the case that children's involvement in literacy activities is a reflection of their skill level and interest, that is, that more skilled children received higher ratings of involvement from their parents. Thus, a second set of regressions was undertaken where the extent to which children initiated or pursued the activities independently was entered after age, followed by the extent of their involvement, to determine whether child initiative wholly mediated the relationship. The predictor variables were the involvement components that received significant beta weights in the regressions above and their corresponding independence components. A summary of these regressions appears in Table 14. It shows that the ratings of independence/child initiative only partially mediated the relation between involvement in home activities and children's literacy scores, with the sole exception being for the TAAS at 5 years of age. In all of the other regressions, ratings of frequency with which the children were involved in reading and writing at home predicted additional variance.

Thus, overall it appears that parental encouragement toward, provision of, and guidance in literacy activities are important over and above their children's contributions in initiating or independently pursuing those activities.

Table 14
Summary by age of emergent literacy variables regressed on child age, independence, and involvement in literacy activities

Dependent	Step	Predictor	R^2	$p<$	Adjusted R^2	R^2
4-year-olds						
Word	1	Age	.24	.001	.23	.24
Shape	2	Independence in beginning print/book activities	.04	*ns*	.25	.28
	3	Involvement in beginning print/book activities	.07	.05	.31	.34
Word	1	Age	.08	.05	.06	.08
Elements	2	Involvement in beginning print/book activities and casual activities with books/print	.02	*ns*	.05	.10
	3	Involvement in beginning print/book activities and traditional book reading	.12	.05	.14	.22
WRAT	1	Age	.10	.01	.09	.10
	2	Independence in reading and writing activities	.10	.005	.18	.20
	3	Involvement in reading and writing activities	.07	.01	.24	.27
5-year-olds						
TAAS	1	Age	.12	.001	.11	.12
	2	Independence in reading and writing activities	.07	.01	.17	.19
	3	Involvement in reading and writing activities	.03	*ns*	.19	.21
WRAT	1	Age	.15	.001	.14	.15
	2	Independence in reading and writing	.09	.001	.22	.29
	3	Involvement in reading and writing	.05	.01	.27	.29
6-year-olds						
Spelling	1	Age	.15	.001	.14	.15
	2	Independence in reading and writing	.10	.001	.24	.25
	3	Involvement in reading and Writing	.03	.05	.26	.28
WRAT	1	Age	.13	.13	.13	.00
	2	Independence in reading and writing	.09	.001	.22	.23
	3	Involvement in reading and writing	.03	.05	.25	.26

Discussion

The study reported here addressed several questions. Are there systematic early developmental trajectories for children's understanding of print concepts? Is this development related to reading acquisition? Are there home literacy experiences that relate to this development? The data show clear development of print concepts from 48 to 83 months of age. This development begins with an understanding of figural and spatial aspects of writing (word shape). Next, or in conjunction with the first development, comes development of more abstract notions of word constituents, including letter orientation, and finally comes an understanding of more detailed aspects of acceptable spelling patterns. This is a rough characterization of the three print components derived from the principal component analyses and bears similarity to the stages

of writing development proposed by Tolchinsky-Landsmann (2003). What is clear is that development of this print knowledge is rapid as children begin to focus on print during their fourth year of life and that it begins prior to formal instruction and before the children begin word reading. Although the findings are consistent with those of earlier studies on emergent literacy, they provide a fuller chronology of the developmental window across the preschool to early school years. The three components identify the type of knowledge that is acquired during each age interval. These data, then, provide a baseline for "normal" growth in children's early understanding of the visual/orthographic aspects of printed English that can be used to guide parents and teachers in focusing the children's attention during literacy activities.

The relation between this early print knowledge and other early emerging skills (phonological awareness and reading) is shown by the intercorrelations among measures. Although visual/orthographic and phonological skills undoubtedly become intertwined in a mutually supportive fashion during development, the regression analyses show that the visual/orthographic skills are also related to reading development over and above the relation through phonology. Interestingly, even for the youngest children, this contribution is not related to understanding the figural aspects of print (the Word Shape component); rather, it is carried by the more abstract aspects of letter orientation, word constituents, and spelling (Word Elements and Spelling components). These findings point to the importance of early print exposure to allow children to learn how language is coded in the written display.

The developmental trajectories and the relation with reading is consistent with much of the literature discussed in the Introduction. Consistent with Levin and Bus (2003), we found that by 4 years of age, young children demonstrated clear understanding that writing followed conventions that differ from drawing. Well before formal instruction, young children show an understanding of some of the abstract requirements of the English writing system, consistent with the findings of Cassar and Treiman (1997). Our regression analyses suggest that prior to reading words, 4-year-olds begin to understand word constituents and letter orientation (word elements). This knowledge is related to their letter reading ability as measured on the WRAT reading test, when word reading is minimal. We suggest that this orientation to examine and learn letters begins the development of orthographic knowledge. After children focus on the sequencing of printed signals (letters), they begin to learn about the spelling patterns used in English words. For 5-year-olds, and even more for 6-year-olds, the spelling component of print knowledge develops and is related to word reading that becomes a larger component of the WRAT score. Clearly, there is a reciprocal relation between print understanding and reading. The more children read, the more they will learn about print and spelling conventions. Our point, however, is that prior to knowing how to read words, young children must closely examine the print and develop an understanding of written letters and how they encode words in the English writing system. This learning begins informally before instruction through encounters with print during the preschool years.

Finally, the study addressed the early experiences that relate to children's understanding of written English. Sénéchal and colleagues (1998; see also Sénéchal & LeFevre, 2002) and Evans and colleagues (2000) showed that storybook reading

relates to oral language development but not to written language development. Instead, parental coaching in printing, letter names and sounds, and reading is critical to the development of written language concepts. The current study offers clear support to these ideas. It was literacy activities in which the children actively participated with and focused on print (e.g., using letters, using alphabet books and picture dictionaries, printing, reading out loud, learning letter names) that best related to all of the emerging literacy skills, including the development of visual/orthographic skills. Also supporting Evans and colleagues (2000), Sénéchal and LeFevre (2002), and Aram and Levin (2001, 2004), we found here that maternal support and guidance of literacy activities was related to children's reading achievement. A significant contribution of the current work is in showing that the relation holds even after partialling out the extent of children's initiative and independence in these activities. The message to take home is that early learning about print and print–sound relations is not a passive process. Rather, learning is maximized by focusing children's attention on the aspects of the writing system that need to be acquired, consistent with the findings of Meyer and colleagues (1994) for classroom reading. Storybook listening at home has little impact on children's understanding of print. In fact, two recent studies of preschoolers' eye movements when read storybooks showed that they rarely look at the print (Evans & Saint Aubin, in press; Justice, Skibbe, Canning, & Lankford, in press).

Learning about the English writing system is a form of early learning that requires adults to engage young children with the print even before they can read it. A recent longitudinal study from preschool to Grade 4 (Storch & Whitehurst, 2002) suggested that there are two paths linking early literacy skills to later reading skills: one through oral language that relates to later reading comprehension and one through emergent code development that relates to reading accuracy and comprehension. It is this latter route that may best capture the emergence of visual/orthographic knowledge, consistent with the model proposed by Sénéchal and LeFevre (2002).

In summary, this study demonstrated the shifting nature of orthographic understanding in nine age groups from 4 to 7 years of age. It provides a chronology of development from understanding graphic/spatial aspects of print to understanding word constituents and finally accepted spelling conventions. The study showed that this understanding is related to achievement on standardized measures of early reading skill even after accounting for variance due to age and phonological sensitivity. Finally, the analyses of home literacy activities and experiences show an important role for adult guidance to focus young children on the print itself during literacy activities. Getting children involved with the print is more effective than passive listening to adult reading in facilitating the development of the written literacy skills of children.

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