Home Environment, Teacher Language, and Literacy Development Across the First Grade Year

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Abstract

Existing research has established both parent behavior and teacher language to be important mechanisms in memory development during the early elementary years. Preliminary research on math achievement during this time has suggested that these relationships extend into achievement domains. The purpose of this investigation was to test if these patterns extend into literacy development. Literacy outcomes at the beginning of the first grade year and growth across the year were explored as a function of home literacy environment and teacher mnemonic style. Children who scored higher on the Family Literacy Environment subscale performed better on literacy tasks at both the beginning and end of the first grade. However, children in classrooms with high mnemonic teachers did not show different levels of growth in literacy outcomes when compared to children with low mnemonic teachers. These patterns suggest that a richer home literacy environment does predict better literacy performance at the beginning and throughout the first grade, while teacher memory talk does not appear to be related to literacy outcomes across the year. The results of this study suggest that home environment is important in fostering literacy development in early childhood, though further research is needed to understand the specific mechanisms that should be employed to facilitate literacy development in the classroom.

Home Environment, Teacher Language, and Literacy Development Across the First Grade Year

The early elementary years are a vital period in cognitive development. During this time, children experience significant growth in the ways in which they process and store information. Although the cognitive growth across these years can certainly be attributed in part to maturation, it has also been shown to be highly social in nature in that perceptual skills, memory, logical thinking, and other cognitive processes are highly influenced by both social interactions in the home and classroom contexts. A wide body of research has explored the mechanisms through which this increased sophistication occurs (e.g., Coffman, Ornstein, McCall, & Curran, 2008; Moely, Hart, Leal, & Santulli, 1992; Fivush & Nelson, 2004; Fivush, Reese, & Haden 2006; Kosmodis, Zafari, & Politimou, 2011; Morrison, Smith, & Dow-Ehrensberger, 1995; Morrison & Connor, 2002; Christian, Morrison, Frazier, & Massetti, 2000). This study focused on the parallels in the development of memory and literacy, both of which have been shown to be strongly related to parent-child interactions and teacher instruction, and the role of home and classroom environments play in their development over the first grade year.

The Socialization of Memory

The kindergarten and first grade years have been revealed to be especially important in guiding the development of children's memory skills, both at home and at school. Before exposure to formal schooling, children's memory development is shaped by interactions with parents, such as mother-child conversation during and after events that have been experienced jointly (Fivush et al., 2006; Haden, Ornstein, Eckerman, & Didow, 2001; Nelson & Fivush, 2004). Once children enter the formal schooling environment, teacher instruction continues to

shape the development of memory skills and strategies (Coffman et al., 2008; Moely, et al., 1992; Wagner, 1978).

Memory Development and the Home. The majority of literature on home factors draws from Vygotsky's sociocultural theory and the assumption that children develop skills primarily through interactions with parents or other more developmentally competent individuals in their environment. The language content of parent-child interactions has been found to be especially important in the development of children's memory.

Haden et al. (2001) conducted a longitudinal investigation of mother-child conversations during events such as specially constructed "adventures" (e.g., a pretend camping activity) and the ways in which the conversational content related to children's later recall for those events. Researchers analyzed mother-child interactions during these events when the children were 30-, 36-, and 42-months of age, focusing on for whether specific components of the events were jointly discussed, discussed only by the mother, or not discussed at all. Children were later evaluated for memory of the events using open-ended recall, and were also assessed at 42 months in terms of the general memory strategies they used on an object memory task. The researchers observed that children's success in open-ended recall of details from these events was strongly associated with joint talk with their mothers during the event, suggesting that mother-child conversation during the event was a factor in focusing the children's attention and enhancing their understanding and storing of information related to the activity.

To further examine the relationship between mother-child conversation and child recall for an event, Boland, Haden, and Ornstein (2003) developed an experimental methodology in which mothers were trained to use specific conversation techniques - w*h*-questions, associations, follow-ins, and positive evaluations – during a constructed camping activity with their children,

who were 3-4 years of age at evaluation. Children were also evaluated for general language skills and recall of details for two prior novel events selected by the mother. Results from this experiment showed that children whose mothers had been trained in the use of these components of an elaborative conversational style subsequently exhibited better recall for the camping event, thus confirming the hypothesis that the mothers were able to facilitate their children's understanding and retention of event details through the trained conversational techniques. Analyses also showed that children with higher language skills performed better on recall of event details.

Research has consistently affirmed the idea that parent-child interactions are crucial for structuring children's understanding and memory. This can be attributed to a variety of reasons. In cases of more specific event-relevant recall, parent-child conversational techniques have the ability to focus the attention of children to better comprehend and retain information as an event is occurring (Haden et al. 2001). However, linkages have also been found between maternal reminiscing, or talking about past events, and developmental outcomes. Nelson and Fivush (2006) have linked maternal reminiscing style, defined by the use of "many questions and statements to add information to the ongoing narrative", to the development of children's autobiographical memory, language, and narrative skills across the preschool years. Using Vygotsky's sociocultural theory to explain these linkages, the researchers suggest that by exposing children to strategies for discussing and remembering past events, parents provide a model for children to organize and understand their own episodic memories.

Memory Development and the Classroom. Before children are exposed to formal schooling, their parents or caregivers serve as their primary "instructors" in the development of cognitive skills, as is clear in literature regarding parent-child interaction and memory

development. Once children are exposed to a formal classroom environment, however, in what ways do teachers effect the further development of memory? What changes in memory development during this time period can be attributed to teaching methods versus maturation?

Early research on the subject demonstrated the unique role of the classroom in the development of cognitive abilities, as opposed to simple aging (Scribner & Cole, 1978; Wagner, 1978). Wagner's (1978) work in Morocco compared different memory processes between children who did and did not have the opportunity to attend formal school, in both urban and rural areas. This research showed specifically that whereas some aspects of memory (e.g., the short-term store and other "hardware" components of the system) seemed to be universal and developed as a function of age, others (e.g., "control processes," including the use of strategies) were dependent on exposure to schooling. This early research established that although some cognitive growth does occur naturally with age, exposure to schooling is crucial to development of cognitive processes such as skilled remembering.

Moely et al. (1992) further confirmed the importance of exposure to schooling for development of more advanced cognitive strategies and sought to examine in more detail the timing and nature of teacher instruction specifically intended to encourage cognitive activity and development. The researchers conducted classroom observations and coded teacher instruction for the presence of specific teaching behaviors in intervals evaluated every 30 seconds. In these observations, Moely and her colleagues found that instruction directly intended to teach children about the use of mnemonic techniques was observed fairly infrequently (e.g., in only 9% of all observed intervals), in contrast to other types in instruction, such as providing content specific information or requesting correct answers from children. They also observed wide variability across teachers and grades in the frequency with which information about remembering was

presented. In fact, teachers provided the most strategy suggestions for students in 2nd and 3rd grade classrooms, whereas they provided fewer for both younger and older children. According to the authors, this period in schooling occurs at a point when children are unlikely to nominate strategies independently, but are nonetheless highly receptive to memory strategy training.

A more recent and widely used tool for examining the effect of schooling on cognitive development is the "cutoff" method. A cutoff date refers to a school system's set date by which a child must be a certain age to enter into school. The "cutoff" method enables researchers to compare children who have either just missed or just made their school system's "cutoff" date (e.g., "old kindergartners versus "young" first graders), meaning that the children are all of similar age but are receiving different types of schooling (Christian et al., 2000). By comparing these groups, researchers can make inferences about whether factors such as achievement are more closely related to exposure to formal schooling versus biological age. Using this methodology, Morrison et al. (1995) found that the development of explicit memory skills and strategies was primarily a function of exposure to formal schooling in first grade, and that children of the same age in kindergarten did not demonstrate having developed the same cognitive processes, confirming the crucial role of schooling in cognitive development. Burrage et al. (2008), also using a cutoff design, found similar results in children as young as kindergarten, confirming that working memory and executive functioning are more developed in children of the same age who attended pre-kindergarten versus those who did not.

This research has well established the importance of formal schooling in cognitive development and memory. Given Moely's (1992) evidence that teachers infrequently employ specific strategy instruction, what are the factors that contribute to this development? Longitudinal research in recent years has been important for more closely examining the specific

mechanisms and timing of changes in memory development (Ornstein, Grammer, & Coffman, 2010). Coffman et al. (2008) focused in on the specific mechanisms of memory development in the first grade. The students in this study were followed beginning in the first grade and assessed at different time points over the course of the year. Additionally, teachers were observed in order to evaluate the language that they used when providing instruction in math and language arts. Teacher instruction was coded in 30-second intervals, and a total of 60 minutes was coded for each teacher in each subject matter domain.

In terms of classroom instruction, the Coffman et al.'s (2008) findings revealed considerable variability in teachers' use of "memory-relevant" language, such as providing suggestions, asking metacognitive questions, or pairing instructional and cognitive information with explicit memory requests. Memory-related content was measured using the *Taxonomy for Teacher Behaviors*, categorizing types of instruction into four broad categories: instructional, cognitive structuring, memory requests, and metacognitive information (Coffman et al., 2008; Ornstein et al., 2010). Examples of specific codes within these categories include general information giving, book reading, attention regulation, semantic and episodic questions, strategy suggestions, and metacognitive questions. The "mnemonic style" of the teachers was assessed on the basis of the frequency of five specific codes: (1) *strategy suggestions* and (2) *metacognitive questions*, as well as the co-occurrence of memory requests with (3) *instructional activities*, (4) *cognitive structuring activities*, that increase the depth to which information is processed, and (5) *metacognitive information*. Teacher scores on these 5 codes were standardized to get a *T* score for each measure, which were then averaged into a single mnemonic orientation score for each teacher. A median split was then performed on those scores in order to classify these teachers as "high-mnemonic" or "low-mnemonic."

Researchers then examined patterns of recall and strategy use as a function of mnemonic style. By the spring of the children's first grade year, Coffman et al. (2008) observed that variation across teachers in the mnemonic content of their language during instruction was associated with differences in students' memory skills. Children in "high-mnemonic" classrooms displayed more use of memory strategies such as sorting and clustering while engaged in memory tasks than did their peers in low mnemonic classrooms. Further, children taught by teachers labeled "high mnemonic" performed slightly better in terms of recall than did those with teachers labeled "low mnemonic."

Cross-sectional and longitudinal classroom-based research has made it very apparent that teacher language is instrumental in shaping children's memory skills and strategies. Not only have linkages between teacher language and children's memory skills been established in the first grade, but the influences of teacher mnemonic language have been observed in later years as well (Ornstein et al. 2010; Coffman et al. 2008). "Cutoff" research by Morrison et al. (1995) found significant differences in memory growth over a school year in children who were in the first grade versus children of similar age who were in kindergarten, suggesting something about the first grade year that is especially important for the growth of memory skills. Baker-Ward, Ornstein, & Holden (1984) also stressed the first-grade year as the point at which children's explicit strategy use becomes associated with improved memory performance

Parent and Teacher Influences on Literacy Development

As with memory development, the role of parents and teachers as motivators of literacy growth is undeniable. Both at home and in the classroom, children's literacy skills are shaped by the instruction they receive from these adults (Martini & Sénéchal, 2012; McGeown, Johnston, & Medford, 2012; Skibbe, Connor, Morrison, & Jewkes, 2011; Morrison & Connor, 2002).

Literacy Development in the Home. Literacy development in early childhood is highly dependent on "instruction" derived from interactions with parents. Success in in early reading depends on many factors, such as letter knowledge, ability to comprehend and manipulate phonemes, and the mapping of sounds and symbols (Caravolas et al. 2012). Through what mechanisms do children develop these individual skills?

In a correlational study of environmental factors in the home and children's literacy, Martini and Sénéchal (2012) stressed the importance of parents as instructors in their child's literacy development. Informal parent teaching activities, such as shared book reading, as well as formal teaching behaviors, such as explicit pointing and labeling of letters and words, were demonstrated to be strongly related to children's literacy outcomes. These relationships affirm the role of the parent as a child's instructor in the early developmental years, asserting that parental choices – such as the types of activities in which to engage their children and how often to do so – are crucial to consider in the context of child literacy development.

Although this correlational work suggests a strong relation between parent instruction and child literacy, the possibility of bidirectionality must be acknowledged; for example, a child with higher interest in literacy might elicit more frequent reading or instruction from his or her parents. However, with experimental methodology, McGeown et al. (2012) provided evidence to affirm the causal linkage between parents as important instructors and children's developing literacy skills. In this study, researchers confirmed that the types of strategies children were instructed to use highly influenced the cognitive skills they used later in early reading, as well as overall their reading ability. It is indisputable that even before exposure to formal schooling, parenting and the home environment shape the way children learn to read.

Literacy in the Classroom. Once children enter the formal schooling environment, their literacy development continues to be shaped by the instruction they receive. Research seeking to distinguish the separate influences of chronological age vs. exposure to schooling shows that although some developmental processes, such as self-regulation and vocabulary, are dependent on chronological age, children of the same age who had received an extra year of schooling show more advanced letter knowledge and decoding skills (Skibbe et al. 2011). Just as memory development in these years appears to be strongly related to the content of teacher instruction, studies suggest that development of literacy skills is highly affected by emphasis of skill-specific instruction in the classroom setting (McGeown et al. 2012; Skibbe et al., 2011). Furthermore, research utilizing cutoff methodology to examine specific influences of classroom instruction on literacy skills has demonstrated that instruction time is predictive of growth in vocabulary and decoding skills, especially for children who initially performed lower than their peers in these areas (Morrison & Connor, 2002). This research confirms the importance of teacher instruction, but also implies that teaching strategies may differ in efficacy for students of different initial skill levels.

Linking Memory and Achievement

Linking Teacher Talk and Memory. The linkages between teacher memory talk and children's memory development are well established. Furthermore, it is evident that development of both memory and literacy are highly related to the home and classroom contexts, and the timing of the emergence of these cognitive skills is similar (Christian et al., 2000; Morrison et al., 1995; Morrison et al., 2002). In terms of academic achievement, content-specific teacher talk has been shown to play a role in young children's knowledge in academic areas. For example, Klibanoff, Levine, Huttenlocher, Vasilyeva, and Hedges (2006) examined the amount

of math-specific language used by preschool teachers and the links between this content and child math knowledge at the end of the school year. The researchers found that there was great variability among teachers in the amount of math talk they provided, and that differences in levels of math talk were in fact predictive of child math knowledge at the end of the year.

Only very recently have researchers begun to explore the connections between teacher memory talk and child achievement outcomes in content-specific areas. Grammer, Coffman, Sidney, & Ornstein (under review) explored the math outcomes of second graders in classes whose teachers were identified as being "high-mnemonic" or "low-mnemonic" on the basis of the language they used when teaching mathematics. Though the two groups of students showed no differences in math ability at the beginning of the second grade year, students with "high-mnemonic" teachers performed significantly better on math assessments by the end of that year.

Hudson (2012) explored children's math outcomes in the kindergarten year as a function of both parental influence (specifically, maternal metamemory talk during a mother-child reminiscing task) and teacher mnemonic style. In this study, Hudson observed that maternal memory talk predicted children's mathematics skill levels at the beginning of the kindergarten year, such that higher levels of memory talk were associated with higher levels of math skills. She also found that the content of teacher talk (previously demonstrated to facilitate the emergence of memory skills) was not related to mathematics outcomes for children at the beginning of the kindergarten year, but that it was associated with achievement at the end of kindergarten. Interestingly, Hudson (2012) also found that the effects of maternal and teacher conversational style at the end of the academic year were additive: Kindergartners with both a high mnemonic mother and a high mnemonic teacher performed better than their peers in the other groups, but the mathematics outcomes for children with either a high mnemonic mother or

a high mnemonic teacher were better than those with low mnemonic mothers and teachers. Overall, the study demonstrated that children's growth in mathematics skills across the kindergarten year varied as a function of parent and teacher influences individually as well as a function of the interplay of both factors, affirming the importance of both environments individually and together.

Linking Teacher Memory Talk and Literacy. Although some work has explored links between memory and literacy, most research has focused on the role of language in memory development. Language is instrumental in early childhood memory growth, specifically in the development of autobiographical memory, because it is a tool for interpreting, organizing, and expressing memories (Fivush & Nelson, 2004). Furthermore, it is not until children have language that they can participate in the parent-child dialogues previously established to be beneficial to remembering events. Links have also been established between literacy and working memory. Kosmidis, Zafiri, and Politimou (2011) explored this relation, asserting the role of working memory in vocabulary and literacy acquisition. In comparisons between illiterate, self-educated literate, and formal-educated literate populations, researchers concluded that although some deficits in working memory could be attributed to illiteracy, formal schooling enhanced memory processes in literate individuals, again emphasizing the important role of formal schooling in memory development.

The present study was designed to further explore the relation between the home environment and teacher instruction and the development of literacy across the first grade year. Although the current literature demonstrates the importance of both parent and teacher instruction on literacy development, very little research has examined the potential influence of teachers' memory talk on the development of literacy. Given the undeniably important role of

teacher talk in memory development, as well as its apparent role in math achievement, it is likely that the mnemonic content of teacher instruction is predictive of literacy development, as well. This study was designed to explore the hypothesis that the mnemonic content of teachers' instruction is in fact related to the literacy achievement in children during the first grade year. Furthermore, in examining factors related to both memory and literacy development, we hope to examine the interplay of both environments in shaping children's development. Specifically, we examined whether home environment moderates the relationship between teacher talk and child outcomes, hypothesizing that teacher talk would have a stronger association with memory outcomes for children from lower home literacy environments than it would for children from high home literacy environments.

Method

Participants

This particular study is part of a larger longitudinal project in which children were followed through their kindergarten and first grade years. Student and teacher participants were recruited from four elementary schools in North Carolina (two in Chapel Hill and two in Durham). The teacher sample was made up of 17 teachers, all of whom were female. Three of the teachers were African-American, and 14 were Caucasian.

The total student sample used included 130 first-graders, 74 of whom had participated in the study during their kindergarten year and 56 who were recruited at the beginning of the first grade year. Sixty-five children were students in the Chapel Hill-Carrboro City Schools, and 65 attended the Durham Public Schools. In this sample, 61 children were female and 69 were male. In terms of ethnicity, 43% of the students were Caucasian, 21% were African American, 16%

were Hispanic/Latino, 8% were Asian or Pacific Islander, and 12% identified as mixed ethnicity. Mean age was 6.49 years.

For the purpose of this study, only the 56 participants who entered the study at the start of the first grade year were used. Of these students, 29 children were male and 27 were female. 46% were Caucasian, 15% were African American, 18% were Hispanic/Latino, 10% were Asian or Pacific Islander, and 10% identified as mixed ethnicity. These students were spread across the classrooms of the 17 teachers, with an average of 3.5 students per class in our sample (*SD* = 1.5).

Procedure

Classroom Observations. To collect data on the content of teacher language, naturalistic observations were conducted the classrooms of participating teachers. Each teacher was filmed while instructing the class in lessons in mathematics and language arts. For the purpose of this study, only language arts instruction was used. Researchers filmed teachers during multiple visits over the course of the year to collect 60 minutes of instruction per teacher in each of the two domains of instruction. The research assistant who made each observation visit also recorded information about the lesson content, teacher and child behavior, as well as materials in the classroom context. A research assistant later coded the tapes for content of the teacher's language using the *Taxonomy of Teacher Behaviors* (Coffman et al., 2008).

Child Assessments. Over the first grade year, child assessments were conducted at three time points: in the fall, winter, and spring. During the assessments, which lasted from 45 to 75 minutes, participants were given a variety of tasks to measure memory performance and strategy use, as well as self-regulation and achievement. Assessments were generally conducted before or after school. They were videotaped and later coded by two research assistants. For this study,

we focused on two subscales of the Woodcock Johnson III Tests of Achievement administered, one administered only at Time 1 and one administered at both Time 1 and Time 3.

Measures

Family Literacy Environment. To assess the quality of the literacy environment in the home, parents were given Griffin and Morrison's (1997) Home Literacy Environment questionnaire. The questionnaire, composed of 8 items, asked parents to report information about a variety of factors, including the amount of time their child spends watching TV per week, the newspaper and magazine subscriptions in the home, the time that the parents spend reading to themselves, and the time they spend reading to the child. The questionnaire was scored as a sum of all responses.

Teacher Language Content. Teacher instruction and mnemonic content was evaluated using the *Taxonomy of Teacher Behaviors* developed by Coffman et al. (2008). Teacher language was coded for the presence and frequency of specific types of language, in intervals of 30 seconds.

As can be seen in Table 1, teacher language was classified into four broad categories: instructional activities, cognitive structuring activities, memory requests, and metacognitive information. Codes for *instructional activities* included: *book reading* from a book or other written source; *general information giving,* such as the presentation of new factual information; *specific task instruction,* including directions for completing a particular activity; and *prospective summary*, such as descriptions of upcoming lessons or events.

Cognitive structuring codes were given for *massed repetition*, i.e., direction to perform an activity in unison*; identifying features,* including the generation of features for a specific semantic or conceptual category; *categorization,* or the sorting of items into two or more

categories; *personal experiences (home),* such as requests for children to associate a prior experience outside school with the current classroom activity; *personal experiences (school),* including requests for the children to associate a prior classroom experience with the current activity; *drawing inferences,* such as asking students to predict an outcome, or the intentions of a character; *visual imagery,* including asking students to create visual mental images; *attention regulation (instructional goals),* such as the provision of directions for focusing attention or following along with the activity; and *attention regulation (behavioral goals)*, including attempts at regulating or changing student behavior.

Codes given for memory requests included *semantic* requests, for already learned information; *episodic* requests, for the retrieval of memories of specific past events; *procedural* requests, for the retrieval of a series of ordered tasks to achieve a specific goal; *prospective* requests, including the assignment of non-instructional tasks to be completed for a future purpose; and *anticipated* requests, such as asking students to remember academic or procedural information for the purpose of future learning or studying. When these requests were explicitly stated (using language like "remember", "don't forget", or "put it in your brain"), these codes were paired with an *expressed* code.

Teacher language was coded for metacognitive information when the teacher provided or solicited metacognitive information. These codes included *strategy suggestions*, such as the recommendation of a specific method with which to remember or process information; *metacognitive questioning*, including asking a student to provide a strategy or explain the rationale for a utilized strategy; *metacognitive rationale*, as when the teacher provided a rationale for a particular strategy; *suppression,* including a recommendation that a child refrain from using

an unhelpful or inappropriate method; and *replacement*, or the recommendation of a an alternate, more effective strategy.

Codes were also given for *non-instructional/non memory relevant* language to capture instances in which the teacher was not engaged in instructionally relevant activity, there was a verbal interruption, or a period of no verbal instruction spanned an entire interval.

The coder of the language that teachers use during the course of instruction was initially trained in use of the *Taxonomy of Teacher Behaviors* by exposure to 8 training videos in the laboratory. The coder had to reach 100% reliability with these video clips before beginning to code the instruction of the teachers in this study. The coder then had to attain 80% reliability with a master coder on 25% of the teacher videos from the present sample (4.25 hours) before continuing to code independently.

Child Literacy Outcomes. Child literacy outcomes were measured by two Woodcock Johnson III subscales - Letter-Word Identification and Reading Fluency (Woodcock, McGrew, & Mather, 2001).

The Letter-Word Identification task measures the child's word-decoding skills. The child is presented with single letters and words and asked to correctly identify them. The words must be pronounced correctly. The task includes 76 items, which increase in difficulty as the task is administered. A basal level is established if the participant answers 6 items in a row correctly, and a ceiling is reached when the participant misses 6 items in a row.

For the timed Reading Fluency task, participants must read a series of sentences and circle either "yes" or "no" based on whether the sentence is true. The task is made up of 98 sentences, and the participant is given 3 minutes to complete as many sentences as possible. The task measures reading speed and semantic processing speed.

Results

Descriptive Statistics of the First-Grade Sample

Because some students participated in the study during their kindergarten year, they had already been administered some of the tasks and training in memory strategy. To eliminate the possible influence of testing effects, only those participants who were recruited at the beginning of the first grade year were included in the analyses for the purpose of this study. One teacher did not have any children who entered the study in the first grade, so that teacher was excluded. Four students who participated in the study at Time 1 were not assessed at Time 3, so data for those students was excluded.

To observe the development of children's literacy skills across the first grade year, two Woodcock Johnson III subscales were used. The Reading Fluency task, administered only at Time 1, was used as a measure of literacy skills upon entry into the first grade. At Time 1, students scored an average of 35.06 (*SD* = 8.40). The Letter-Word identification task, administered at Time 1 and Time 3, allowed us to observe the growth in literacy skills over the course of the first grade year. Children showed some growth on this task over the course of the year, as can be seen in Figure 1. As can be seen in the figure, the participants' average score at Time 1 was 35.37 (*SD* = 8.17), while the average score at Time 3 was 40.19 (*SD* = 7.96).

Descriptive Statistics of Home Environment

Finally, the Home Literacy subscale was used as a measure of the richness of home environments as pertaining to literary development. The survey included 8 items addressing factors such as books in the home and time parents spend reading with children. Questions were all rated on a Likert scale, and scores on all items were summed to create a general HLE score. The subscale provided a variety of information about the home environment of the participants.

Parents reported reading to their child an average of 8.3 times per week, though length of time was not specified. A total of 43% of families reported that their child owns 80 books or more, whereas only 16% of the families reported that their child owns fewer than 20 books. Moreover, 94% of the families reported owning a library card, though only 66% reported using it at least once a month.

The individual items from the subscale were not used in analyses, but we rather focused on the sum measure of overall Home Literacy Environment. Scores for this measure ranged from 4 to 22, with a mean of 13.5 (*SD* = 4.2).

Descriptive Statistics of Teacher Instruction

The *Taxonomy of Teacher Behaviors* was used to classify the content of teacher instruction across 120 30-second intervals of teacher-led language arts lessons in each of 17 first-grade classrooms (see Table 1). Instruction was summarized in four broad categories: (1) *instructional activities*, (2) *cognitive structuring activities*, (3) *memory requests*, and (4) provision or solicitation of *metacognitive information*.

Unsurprisingly, teachers devoted the most content to providing simple instruction, as 95.7% of all intervals contained some kind of instructional language. More specifically, 86.4% of intervals contained instances of *general information giving*, while 32.1% contained *specific task instruction. Memory requests* constituted the second most prevalent type of instruction, with 63.8% of intervals containing some language asking students to use memory. The most common type of memory request was a *semantic question*, present in 57.3% of intervals. *Cognitive structuring* also constituted a large part of teacher instruction (44.5% of intervals), the most common types being *connection to personal experiences – school* (13.7%) and *attention regulation – instruction goal* (18.7%). Teachers devoted the least amount of instruction to

metacognitive information, which was found in only 9.0% of all intervals. Specifically, 5.2% of instruction intervals contained *strategy suggestions*, while even fewer contained *metacognitive questions* (2.5%) or *metacognitive reasoning* (2.9%). Overall frequency of each individual code can be found in Table 2.

Three component codes were also created in order to examine the co-occurrence of specific codes in the same interval: 1) *memory requests* and *instructional activities*, 2) *memory requests* and *cognitive structuring,* and 3) *memory requests* and *metacognitive information*. As can be seen, the use of *memory requests* with *instructional activities* occurred frequently, with a range of 49.2% to 60.5% of intervals. *Memory requests* and *cognitive structuring* co-occurred less frequently, with a range of 15.8% to 29.9% of intervals. The co-occurrence of *memory requests* with *metacognitive information* was highly infrequent, occurring in a range of 1.7% to 5.7% of intervals.

In order to categorize teachers on the basis of mnemonic orientation, we created a median split of "high" mnemonic teachers and "low" mnemonic teachers. To do this we combined the teachers' use of 5 codes: strategy suggestions, metacognitive questions, and the three co-occurrence codes. Teacher's scores for each code were standardized to get a *T* score for each measure. The *T* scores for the individual measures were then averaged into one mnemonic orientation score for each teacher. As mentioned previously, the number of students per teacher in our sample was quite small, meaning that student outcomes when considered in the context of individual classrooms were susceptible to a large amount of variability. Therefore, a median split was created with mnemonic orientation scores to divide teachers into either "high" or "low" mnemonic orientation groups and examine student outcomes as a function of these groups. The

mean of *T* scores for the mnemonic orientation measure was 50 (*SD* = 5), with a range of 41 to 59.

Linking Home Environment and Literacy Outcomes

To investigate the link between home literacy environment and children's literacy performance at the beginning of the first grade, we performed correlations between HLE score and the Reading Fluency task taken at Time 1. HLE score and Reading Fluency score were significantly, positively correlated ($r = .43$, $p = .008$), indicating that children with richer home literacy environments performed significantly better on the Reading Fluency measure upon first grade entry than did children with less literacy-rich home environments. We then created a median split for the HLE measures to further compare differences between children in terms of "high" and "low" home literacy environments. As can be seen in Figure 2, children in the high HLE group scored an average of 19.91 (*SD* = 13.0) on the Reading Fluency task, while children in the low HLE group scored an average of 14.25 (*SD* = 10.7). A one-tailed independent samples *t*-test found this difference to be significant, $t(52) = -1.65$, $p = .05$. These differences are consistent with the correlation observed above, suggesting that children from richer home environments perform better on the Reading Fluency task at first grade entry than do children from less rich home environments.

Letter Word scores were also used to examine the relation between home environment and literacy outcomes. There was a slight, positive relationship between HLE and LWI scores at Time 1, but they were not significantly correlated, $r = .27$, $p = .10$. Though the correlation is not quite significant, the trend observed is consistent with a positive relationship between home environment and literacy outcomes at the beginning of the first grade year suggested by outcomes on the Reading Fluency task. Again, we then separated scores into "high" and "low"

HLE to compare differences between the groups. As displayed in Figure 3, on the Letter Word Identification task, "high" HLE children had a mean score of 35.77 (*SD* = 7.90) and low HLE children had a mean score of 34.55 (*SD* = 8.83). A one-tailed independent samples *t*-test found differences between these groups to be marginally significant as well, $t(51) = -1.39$, $p = .09$.

To examine the relationship of home environment and literacy growth across the first grade year, we performed a correlation between HLE scores and LW difference scores from Time 1 to Time 3. HLE and LW growth across the year were not significantly correlated, $r = .04$, $p = .83$. As can be seen in Figure 4, when examined as a function of "high" versus "low" HLE groups, "high" HLE children had a mean difference score of 5.68 (*SD* = 3.12) and low HLE children had a mean difference score of 4.20 (*SD* = 4.22). A one-tailed independent samples *t*-test found differences between these groups to be marginally significant, $t(50) = -1.39$, $p = .09$. This suggests that a rich home literacy environment may not only predict higher literacy performance at the beginning of the first grade year, but more growth across the course of the year as well.

Linking Teacher Mnemonic Orientation and Literacy Outcomes

To examine growth in literacy skills over the course of the first grade year as a function of teacher mnemonic orientation, we examined pre- and post-test scores for the Letter Word Identification task between high mnemonic and low mnemonic classrooms. As displayed in Figure 5, at Time 1 students in low mnemonic classrooms had an average score of 36.16 (*SD* = 8.69) and students in high mnemonic classrooms had an average score of 34 (*SD* = 7.23). At Time 3, students in low mnemonic classrooms had an average score of 41.70 (*SD* = 8.45) and students in high mnemonic classrooms had an average score of 38.67 (*SD* = 6.61). As can be

seen in Figure 5, the lines are almost parallel and are quite close to each other, suggesting no notable differences between the groups at either time point.

To further analyze growth in Letter Word scores across the year, a difference score was created for the Letter-Word Identification task by subtracting participants' scores at Time 1 from their scores at Time 3. These difference scores were then analyzed as a function of teacher mnemonic orientation, which can be seen in Figure 6. As seen in the figure, children in high mnemonic classrooms had a mean difference score of 4.67 (SD = 2.96), whereas children in low mnemonic classrooms had a mean difference score of 4.97 (SD = 4.45), again suggesting that growth across the year did not differ between children with low mnemonic teachers versus children with high mnemonic teachers. Consistent with inspection of Figures 5 and 6, differences between the two groups were not significant, t (49) = .27, p = .79.

Interplay of Home and Classroom and Literacy Outcomes

Finally, we sought to examine children's literacy performance as a function of the interplay between home environment and teacher talk. To do this a composite score was created for each child using both HLE group and teacher mnemonic group. Children were split into 4 groups: (1) high HLE and low mnemonic teacher, (2) high HLE and low mnemonic teacher, (3) low HLE and high mnemonic teacher, and (4) low HLE and low mnemonic teacher. Letter Word difference scores were then examined to measure growth across the year as a function of this interplay. As can be seen in Figure 7, children with both a high HLE and high mnemonic teacher increased an average of 5.75 across the year (SD = 3.2). Students with a high HLE and low mnemonic teacher had an average difference score of 5.64 (SD = 3.2). Students with a low HLE and high mnemonic teacher improved an average of 4.07 (SD = 2.5), and students with a low HLE and low mnemonic teacher improved an average of 4.33 (SD = 5.5). A one-way

ANOVA did not reveal any significant differences between these groups, $F(51) = 1.93$, $p = .17$. Though there were no significant differences between the groups, inspection of Figure 7 suggests that children with in the high HLE group performed generally better than children in the low HLE group for both measures, regardless of teacher mnemonic orientation.

Discussion

The purpose of this study was to examine literacy outcomes in the first grade as a function of both teacher language and home environment. We expected the home literacy environment to predict greater literacy performance at first grade entry. Furthermore, previous research has well established an association between both parent conversation and teacher memory-relevant talk and the development of memory (Coffman et al., 2008; Ornstein et al, 2010). Preliminary research on math outcomes suggests that these relations may extend into achievement domains, as well (Hudson, 2012). Given these linkages, we hypothesized that teacher mnemonic level in the classroom would predict greater growth in literacy skills over the course of the first grade year. Lastly, we hoped to examine the joint effect of both the home and classroom environment, hypothesizing that home environment would act as a moderator in the relationship between teacher language and literacy growth across the first year.

This investigation did find evidence of home effects consistent with what we hypothesized. The significant relation between Home Literacy scores and child performance on the Reading Fluency task at the beginning of the first grade confirms the expected linkage between Home Literacy Environment and literacy. Though the relation observed was not as strong we expected it would be, it does affirm our hypothesis children with richer home literacy environments perform better on literacy tasks at the beginning of the first grade year. This is consistent with previous research establishing the association between parent behaviors and

interest in literacy and the child's literacy development. Trends on the Letter Words task also suggested that children from richer home literacy environments experience more literacy growth over the course of the first grade year. It is not surprising that factors such as parent interest in reading, time spent reading with children, and books in the home are positively related to child literacy outcomes, as these factors make up the primary environment to which children are exposed in the early years of development.

In the classroom context, previous research has suggested that children in classrooms with high mnemonic teachers show increased recall and more frequent strategy use when engaged in memory tasks than do children with low mnemonic teachers (Coffman et al., 2008). Hudson (2012) observed a similar trend in math outcomes as a function of teacher mnemonic orientation. However, in examining literacy growth across the first grade, we found no evidence to suggest a linkage between teacher memory talk and literacy outcomes. Literacy scores between children with high mnemonic teachers and low mnemonic teachers were essentially the same at both the beginning and end of the year, with the low mnemonic group actually performing slightly better. Growth across the first grade year was essentially identical for children with low mnemonic teachers and children with high mnemonic teachers.

It is interesting that we would find no effects of teacher mnemonic orientation in literacy outcomes when such effects were found in math domains. To understand this it may be necessary consider the differences in (1) the frequency of memory-relevant language in math instruction versus language arts instruction, and (2) the relevance of memory-relevant language to success in each domain. In previous studies of teacher memory talk as well as this study, we find memory-rich language to be used more frequently in math instruction than in language arts instruction, even when considering the same teacher. This makes sense given the nature of math

instruction, which is in large part focused on teaching general strategies to be employed in the future to solve specific problems (counting, adding, subtracting, etc.) Language arts instruction, in contrast, encompasses a wider range of activities, such as teachers reading to students, brainstorming writing material, etc. Though the types of memory-relevant talk we use to score teachers as "high mnemonic" is still present in language arts instruction, it may be less frequent than in math instruction simply because it is less relevant to the activities and future goals of language arts instruction. This could also be reflected in the link between memory-relevant talk and domain-specific outcomes. It is intuitive that more memory-rich talk predicts higher memory performance and strategy use. It also makes sense that this relationship would extend to math performance, given the proportion of math instruction focused on learning strategies to be implanted repeatedly in certain types of problems. However, given the variety of material included in language arts lessons, this type of language simply may be less relevant in the context of language arts instruction how it effects child outcomes.

This investigation also aimed to examine the joint effect of home environment and teacher language. As our findings did not support a relation between teacher mnemonic orientation and literacy, we were unable to further evaluate home environment as a moderator for such a relationship. However, examining literacy outcomes as a function of combined home and teacher effects reiterates earlier evidence suggesting that home matters regardless of teacher mnemonic orientation. Between children grouped by both home environment and teacher mnemonic level, we observed slightly higher scores for children with high HLE scores over children with low HLE scores, whether their teacher was high or low mnemonic. Though differences between the groups were not significant, the trends suggest that richer home

environment predicts slightly higher literary performance regardless teacher mnemonic orientation.

One limitation we faced in this investigation was the strength of the measures used to assess literacy skills. The Letter-Word Identification measure was unfortunately the only measure for which we had data at both the beginning and end of the first grade year. This was therefore the only measure available with which to evaluate growth in literacy over the course of the first grade year, as well as to examine joint effects of home environment and teacher language. This measure is limited in scope in that it only measures word decoding, and does not measure any comprehension or more complex literacy skills. The Reading Fluency task, which does assess reading comprehension and semantic decision making, is an example of a task that may more accurately measure the literacy skills we aimed to evaluate (but again, we unfortunately only collected data for this at Time 1). The fact Reading Fluency scores were more strongly correlated with Home Literacy Environment scores than were Letter-Word scores provides further support for this suggestion. If literacy outcomes were evaluated more complexly or thoroughly, it is possible that we might start to see patterns more consistent with those seen in previous research on the linkage between teacher mnemonic language and other outcomes.

Another limitation to this study was the size of our sample. Dividing the student sample across 17 classrooms lead to a small sample size per individual classroom. Additionally, there was a good deal of variability in sample sizes between classrooms. The fact that sample sizes for individual classrooms were so small could be a contributing factor to the variability in student outcomes within individual classrooms. We attempted to address this by creating a median split with our teacher measure, thereby looking at students simply in groups as students with "high-

mnemonic" or "low-mnemonic" teachers; however, larger, more equally distributed sample would have lessened the potential influence variability between individual student outcomes. Furthermore, larger samples within classrooms would have made it more feasible to examine student outcomes as a function of teacher mnemonic orientation on a continuum, which may have revealed patterns more consistent with our hypotheses.

A third and important limitation of this study was our failure to account for demographic differences within our sample. Though we were unable to account demographic school effects in our analyses, preliminary examination of the sample suggests notable differences in student outcomes between the four schools from which we gathered our data. These differences could be attributed to a mix of factors including the location of the schools and SES of the student populations at those schools. It is possible that some of these factors were at play in the outcomes observed in this study. Again, a larger sample size could be useful in reducing the effects of other variables, as could be the case here. However, it may also be useful to take these factors into account in any further investigations of classroom environments and student achievement.

Although we did not find the relationship we expected between teacher mnemonic orientation and literacy in the first-grade, there are still practical implications to be noted. Previous research linking teacher memory talk with memory development and math outcomes suggests that teacher language is important in facilitating cognitive development during the early elementary years. This is encouraging in that it suggests that teachers can be trained in the use of specific types of language in the classroom in order to more positively influence children's cognitive development during these early childhood years. If there is truly no relation between teacher memory talk and literacy outcomes during these years, as our results suggest, we must ask then what the specific factors in the classroom do matter to children's literacy development.

This is especially important when considered in the context of the home effects we do see in literacy development. We can see that there is a positive relationship between home environment and child outcomes. This is encouraging for children who do come from rich literacy environments, but suggests that children who come from less rich home environments are disadvantaged despite the school context to which they are exposed. If teacher mnemonic orientation is not the mechanism that facilitates development of literacy skills in these early years, what is? If researchers can identify the specific mechanisms that contribute to the literacy development in the classroom, this can be put to practical use in helping students from disadvantaged home environments to still be able to achieve academic success.

Future research should therefore focus more accurately identifying the factors that matter to literacy development in early childhood. Our evidence suggests that home is important, but what factors in the classroom can be addressed to increase potential for students despite their home backgrounds? Future models should take into account factors such as demographics on both the student and school level, and should attempt to observe literacy outcomes more thoroughly in order to understand the complex mix of factors at play in children's cognitive development during the early elementary years. Once these relationships are more deeply understood, this knowledge can be put to practical use in facilitating literacy development during the early elementary years.

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Figures & Tables

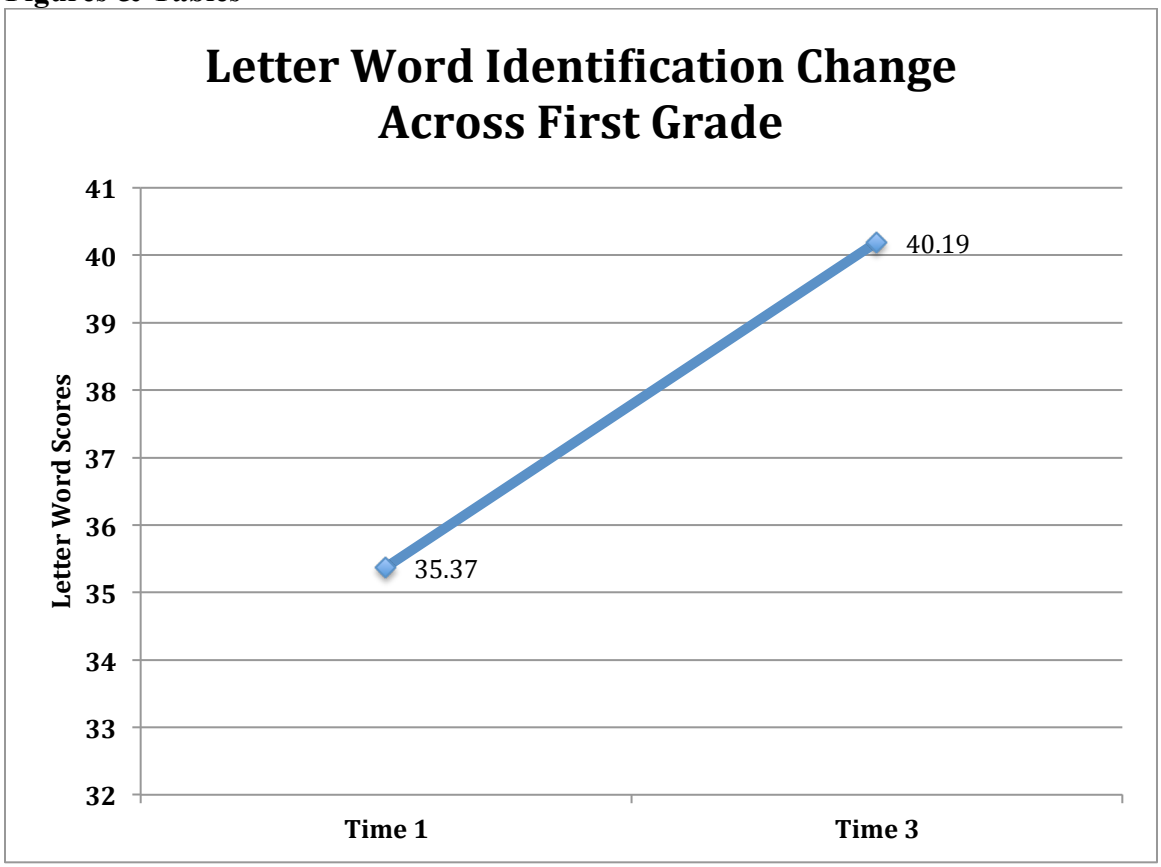

Figure 1. Children's performance on the Letter Word Identification task at the beginning and end of the first grade.

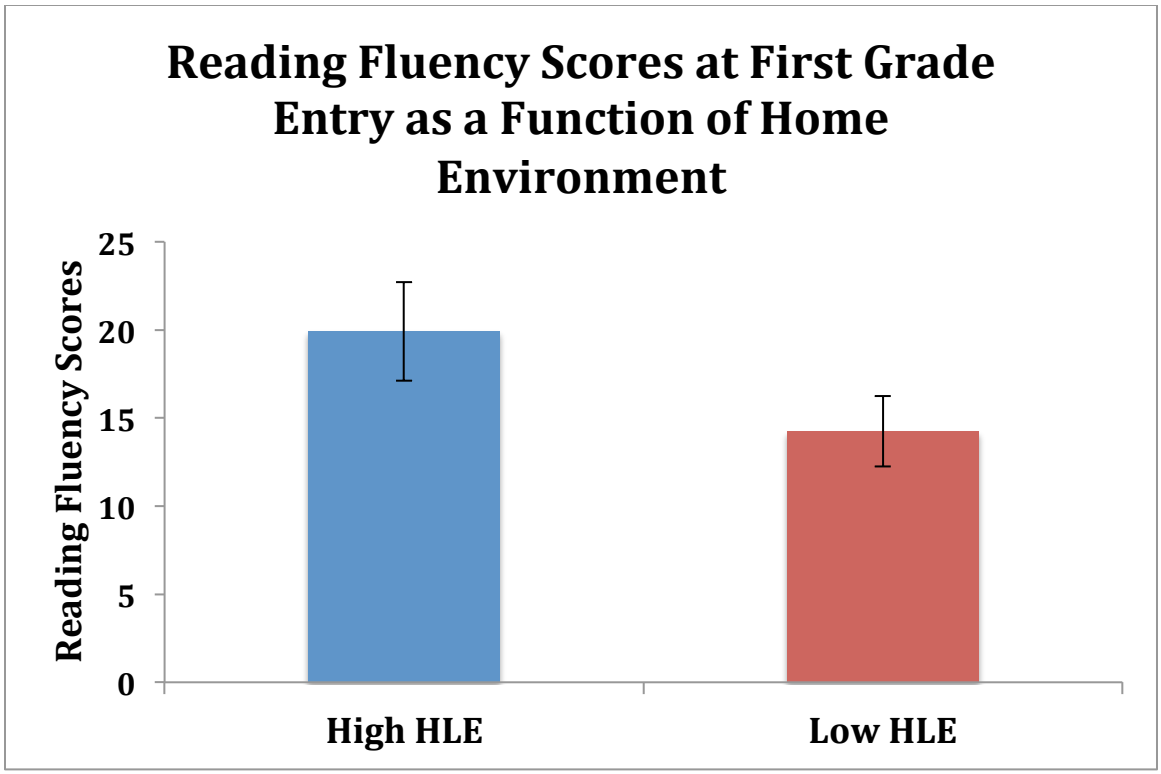

Figure 2. Children's performance on the Reading Fluency task at the beginning of the first grade as a function of home environment.

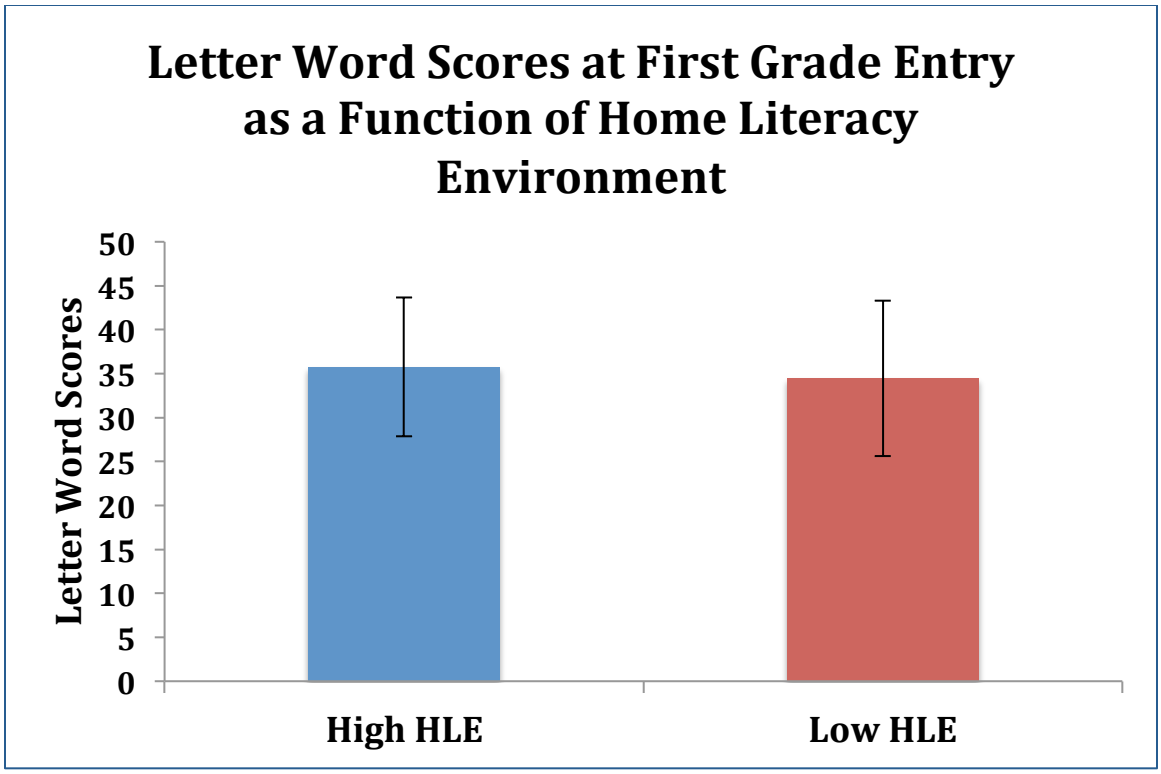

Figure 3. Children's performance on the Letter Word Identification task at the beginning of the first grade as a function of home environment.

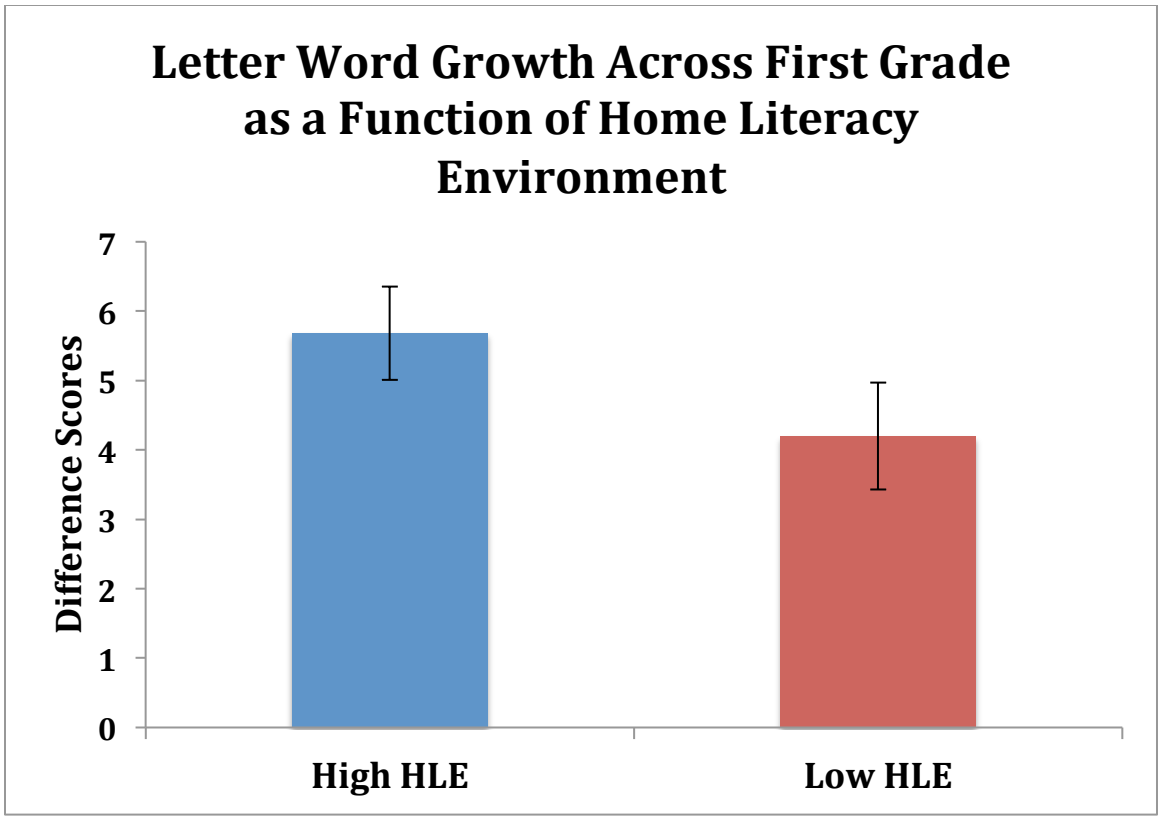

Figure 4. Children's growth on the Letter Word Identification task as a function of home environment.

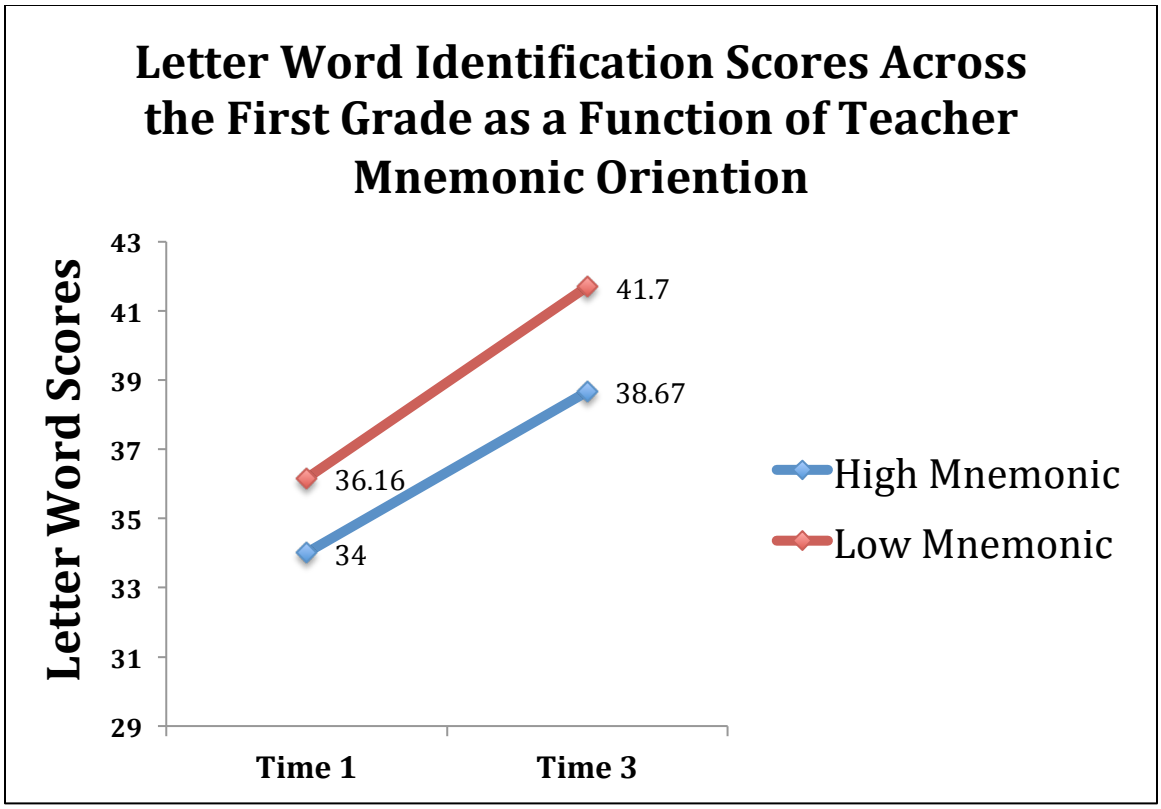

Figure 5. Children's performance on the Letter Word Identification task at the beginning and end of the first grade as a function of teacher mnemonic orientation.

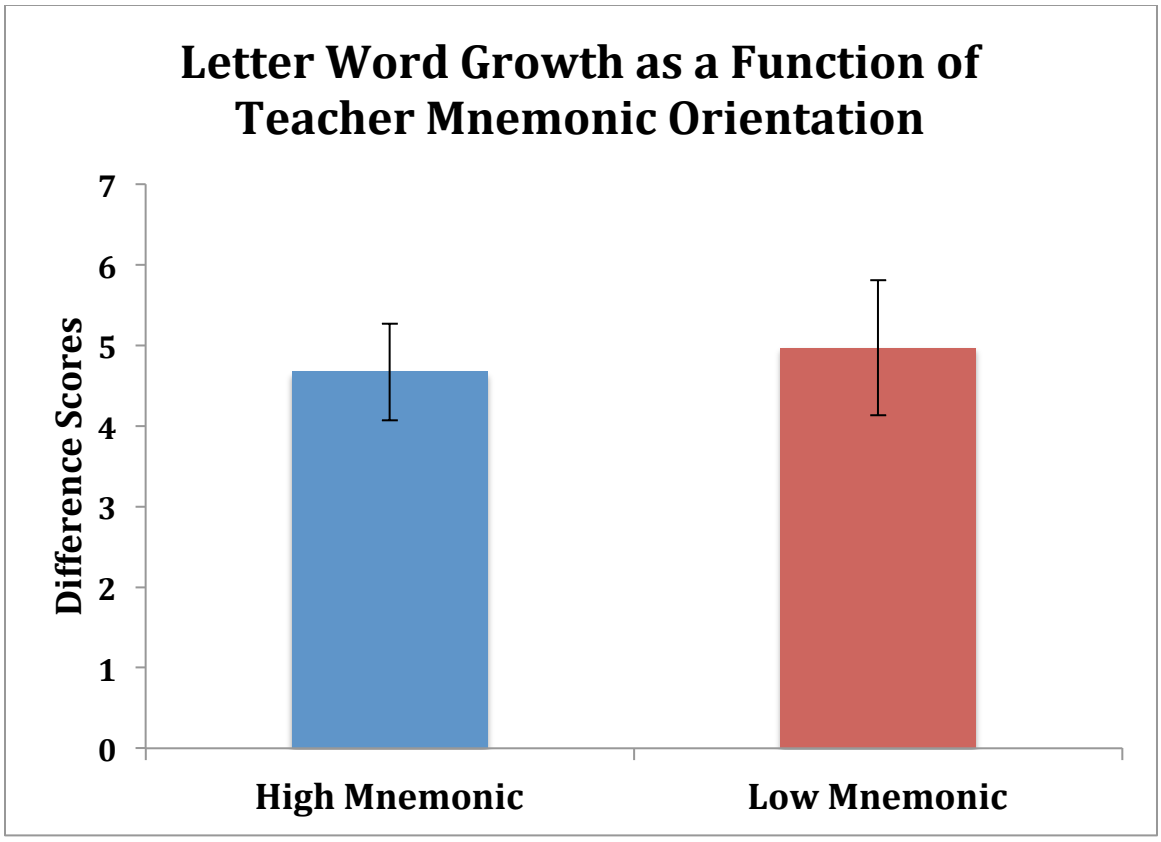

Figure 6. Children's growth on the Letter Word Identification task across the first grade as a function of teacher mnemonic orientation.

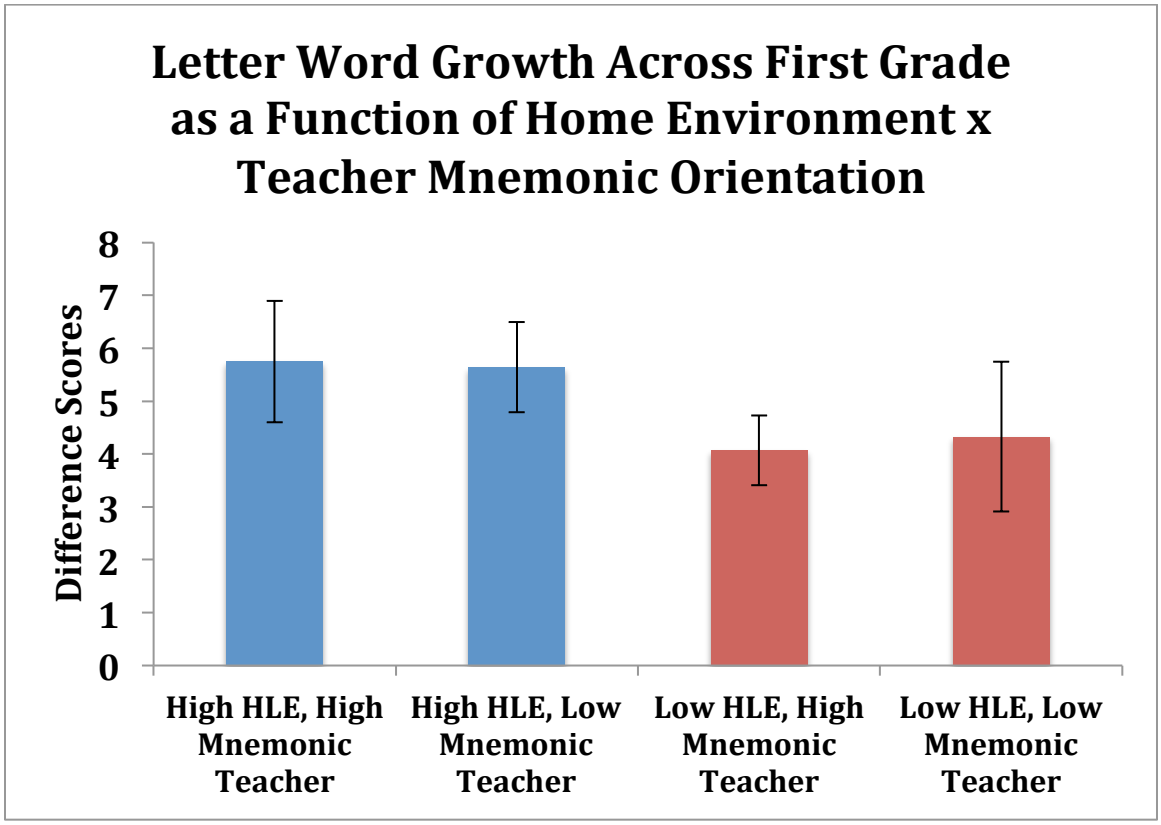

Figure 7. Children's growth on the Letter Word Identification task as a function of the interplay between home environment and teacher mnemonic orientation.

Table 1

Classroom Observation Code Definitions

Category	Definition
Non-instruction	The teacher is not engaged in a memory or instructional activity
Instructional activities	
Book reading	Reading aloud to the group
General information giving	Presentation of factual information
Prospective summary	Description of upcoming events
Specific task information	Instructions for performing a particular task
Cognitive structuring	
Attention regulation:	Directing or focusing student's attention
Behavioral goal	to reprimand or guide behavior
Instructional goal	to instruct or guide attention to do a task
Massed repetition	Performance of an activity in unison
Identifying features	Generating features of a category i.e.: parts of a bug
Categorization	Verbally or physically putting class material into categories
Identifying relationships	Comparison of at least 2 items, emphasizing similarities and differences
Connections to personal experiences:	Associating a prior experience to a current classroom activity
Home	outside of school
School	in school
Drawing inferences	Predicting an outcome or intentions or desires of another
Visual imagery	Creating visual mental images that relates to the material
Memory requests	
Episodic	Retrieval of a specific past event in or out of the classroom
Semantic	Retrieval of an already learned fact, idea, or object
Procedural	How to perform a series of activities with a behavioral goal
Prospective	Non-instructional task to be completed in the future
Anticipated	Expectation for child to remember information w/o a given strategy
Metacognitive instruction	
Metacognitive rationale	Provides rationale for strategy use or for organizing or self-regulation
Metacognitive questioning	Asks child to provide potential strategy or rationale for strategy choice
Suggestion	Recommends a method for remembering information
Suppression	Asks student to refrain from using an unhelpful or inappropriate method
Replacement	Recommends an alternative strategy

Table 2

Overall Percent Occurrence of Teacher Behaviors

Taxonomy Codes	Overall % Occurrence	Range across teachers
Non-Instructional/Non-Memory Relevant	3.2%	0.0% - 10.0%
Instructional Activities – Category Total	95.7%	90.8% - 99.2%
Book Reading	13.9%	1.7% - 38.3%
General Information Giving	86.4%	75.8% - 95.8%
Prospective Summary	10.6%	1.7% - 22.5%
Specific Task Information	32.1%	11.7% - 53.7%
Cognitive Structuring – Category Total	44.5%	22.5% - 68.6%
Attention Regulation- Behavioral Goal	20.1%	10.2% - 36.7%
Attention Regulation- Instructional Goal	18.7%	4.2% - 38.8%
Massed Repetition	9.3%	0.0% - 41.5%
Identifying Features	1.3%	0.0% - 6.7%
Categorization	4.0%	0.0% - 23.3%
Identifying Relationships	6.7%	0.0% - 13.3%
Connections- Personal Experiences at Home	1.9%	0.0% - 5.8%
Connections- Personal Experiences at School	13.7%	8.3% - 21.7%
Drawing Inferences	2.0%	0.0% - 8.3%
Visual Imagery	0.3%	0.0% - 5.0%
Memory Requests – Category Total	63.8%	50.4% - 85.0%
Episodic	3.6%	0.0% - 7.5%
Semantic	57.3%	40.8% - 80.8%
Procedural	1.3%	0.0% - 9.2%
Prospective	1.1%	0.0% - 3.3%
Anticipated	7.4%	0.8% - 18.3%
Metacognitive Instruction – Category Total	9.0%	1.7% - 18.3%
Metacognitive Rationale	2.9%	0.0% - 8.3%
Metacognitive Questioning	2.5%	0.8% - 5.0%
Suggestion	5.2%	0.0% - 14.2%
Suppression	0.1%	0.0% - 0.8%
Replacement	0.1%	0.0% - 0.8%
***Co-occurrence of Memory Requests with**:*		
Instructional Activities	61.4%	49.2% - 84.2%
Metacognitive Information	5.5%	1.7% - 12.5%
Cognitive Structuring Activities	30.2%	15.8% - 53.4%