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# Environmental and Developmental Indicators in Early Childhood: Relations to Second-Grade Reading Comprehension

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ENVIRONMENTAL AND DEVELOPMENTAL INDICATORS IN EARLY  
CHILDHOOD: RELATIONS TO SECOND-GRADE  
READING COMPREHENSION

by

Gina A. Cook

A dissertation submitted in partial fulfillment  
of the requirements for the degree

of

DOCTOR OF PHILOSOPHY

in

Family and Human Development

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2010

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**ABSTRACT**

Environmental and Developmental Indicators in Early Childhood:  
Relations to Second-Grade Reading Comprehension

by

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Utah State University, 2010

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Reading success has been linked to high school completion, future job success, and future generations of children who can read. Unfortunately, children who are unable to read on grade level by the end of first grade are at a great disadvantage and unlikely to catch up later. Without the ability to read and comprehend text, all aspects of schooling become progressively more difficult and the challenge of poor reading ability can be so difficult to overcome that many poor readers will not complete high school. For these reasons, it is important to identify early experiences in a child's family environment that predict the early skills that are necessary for later reading and reading comprehension. The child's family environment includes the quality of both the general home setting and specific kinds of parent-child interactions. The skills necessary for reading success include vocabulary, phonological skills, and other early literacy skills, but broader cognitive and regulatory skills may also be necessary.

Because children from low-income families are at higher risk for reading problems, this study examines extant data on early environments, early development, and second-grade reading from a sample of 117 children from low-income families who participated in a longitudinal study from the child's infancy to second grade. Early family environments and children's early cognitive and other skills that are measured at 36 months and just prior to kindergarten entry at 54 months, were analyzed in relation to their second-grade vocabulary, reading ability, and reading comprehension. The results of this analysis of extant longitudinal data help identify early predictors of reading success for children at risk for reading problems.

(171 pages)

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## GLOSSARY OF TERMS

*Attention regulation*—the ability to direct and focus cognitive activity on specific stimuli also includes the ability to delay gratification through such processes as distraction and reframing (Gross, 1998).

*Background knowledge*—a child’s prior knowledge of the subject presented in a text, general knowledge of the world, knowledge of language, and an understanding of how print is used to convey meaning (Carrell, 1983).

*Decoding/phonological processing*—the ability to apply knowledge of letter-sound relationships, including knowledge of letter patterns, to correctly pronounce written words (Goldenberg, 2002).

*Early environmental supports*—the early childhood home environment that includes parenting behaviors and home literacy activities indicated by number of books in the home, library visits, and print exposure (Sénéchal, LeFevre, Hudson, & Lawson, 1996).

*Early intervention*—A process of assessment and treatment provided to children ages 5 and under to facilitate cognitive and emotional development and to prevent developmental delay (American Heritage Medical Dictionary, 2007).

*Early literacy skills*—the process of becoming a reader and writer, commonly referred to in the preschool years but includes language, prereading and prewriting activities from birth until the child is reading (Dickinson & DeTemple, 1998).

*Emotion regulation*—emotion self management, “the extrinsic and intrinsic processes responsible for monitoring, evaluating, and modifying emotional reactions...to accomplish ones goals” (Thompson, 1994, p. 27). “The processes by which individuals influence which emotions they have, when they have them, and how they experience and express these emotions” (Gross, 1998, p. 275).

*Fluency*—the ability to read with speed, accuracy, and proper expression (Pressley, Gaskins, & Fingeret, 2006).

*Home environment*—the quality and quantity of stimulation and support available to children in their home (Caldwell & Bradley, 1984).

*Language skills*—the ability to use and understand many different words and to communicate needs and ideas.

*Letter knowledge/alphabetic knowledge*—knowledge of the alphabet letters and the ability to distinguish the sounds within words (Ehri, 2004).

*Literacy*— “The ability to read, write, spell, listen, and speak” (Moats, 2000, p. 3).

*Parenting behaviors*—the conduct a parent exhibits in their daily interactions with their child and includes their level of affection, expectations, and developmental support (Landry & Smith, 2006).

*Phonological skills*—skills necessary to segment units of sounds made up of phonemes, identifying and manipulating units of oral language—parts such as words, syllables, and onsets and rimes (Goswami & Bryant, 1990).

*Phoneme* — “the smallest unit of sound that can change the meaning of a word” (Goswami & Bryant, 1990, p. 2).

*Phonemic awareness*—the ability to discriminate between the individual sounds (phonemes) that make up a word. “The child’s awareness of sounds” (Goswami & Bryant, 1990, p. 2).

*Prek* —an abbreviated term for prekindergarten, an early childhood setting that focuses on a child’s social, emotional, physical, and cognitive development.

*Print knowledge*—an understanding of environmental print and the concepts of print such as where to begin a book or a page in a book and what direction to read (Dickinson & DeTemple, 1998).

*Reading ability*—“A complex system of deriving meaning from print...includes the skills and knowledge to understand how phonemes, or speech sounds, are connected to print; the ability to decode unfamiliar words; and the ability to read fluently” (National Institute for Literacy; [www.nifl.gov](http://www.nifl.gov)).

*Reading comprehension*—understanding and interpretation of what is read, requiring a child to (a) decode what they read; (b) make connections between what they read and what they know; and (c) think deeply about what they read (Snow & Sweet, 2003).

*Risk*—environmental and psychosocial factors that are negatively related to the development of competent cognitive and social functioning in young children (Barocas, Seifer, & Sameroff, 1985).

*School readiness*—cognitive, physical, social, and emotional development needed for school success, including the skills and competencies required for a child to be ready to learn (Knitzer & Lefkowitz, 2005).

*Self-regulation*—an internal process of bringing oneself into compliance with the expectations inherent to the situation (Deci & Ryan, 1985), requiring the ability to regulate one’s emotions, interactions, and attention, delay gratification, and tolerate

change in the environment (Gross, 1998). It encompasses both emotion regulation and attention regulation.

*Vocabulary*—the sum of words understood by or used by a person (Laufer & Nation, 1995).



## **CHAPTER I**

### **STATEMENT OF THE PROBLEM**

The importance of reading in children's academic success has been recognized, and reading is the ultimate goal of the early school years. Children who are unable to read and comprehend what they are reading by the middle of their elementary school years face many challenges academically, are less likely to succeed in school, and more likely to drop out of school (National Research Council [NRC], 1998). Reading is so important to a child's future that Dr. G. Reid Lyon stated in a speech to the subcommittee on Education Reform that "failure to learn to read places children's futures and lives at risk for highly deleterious outcomes. It is for these reasons that the NICHD considers reading failure a national public health problem" (Hearing on Measuring Success: Using Assessments and Accountability, 2001).

Once a child has the ability to read and comprehend what they are reading, they are then able to do well in other subjects and tasks required to be successful in school (Cunningham & Stanovich, 1998). Reading comprehension problems, often evident by second or third grade (NRC, 1998), lead to more general academic problems later. Often, reading comprehension problems are not attended to until later in the elementary school years (McCardle, Scarborough, & Catts, 2001), by which time students are already experiencing potentially avoidable difficulties and failures. Solving reading comprehension problems early or preventing them altogether will prevent serious losses in academic achievement. The prerequisites to reading and reading comprehension, therefore, must be understood and the early supports and skills necessary for future

reading success must be identified.

Not all children in America come to school “ready to learn” (National Education Goals Panel, 1998). All children need basic academic and social skills to be successful in school, yet many low-income children lack these skills at school entry (Lee & Burkam, 2002). Children come to school with differing levels of the cognitive and social skills that have been linked to school adjustment and later academic success (Ladd, 1990; Rimm-Kaufman, Pianta, & Cox, 2000). The National Education Goal Panel has suggested an increased focus on early intervention before school age so that “all children in America will start school ready to learn,” but what does it mean to be “ready to learn”? For many years school readiness was defined in a number of differing and seemingly unrelated ways including skills such as being able to sit still, knowing letters and numbers, being able to communicate, but also physical characteristics such as being physically healthy, and personality characteristics such as being curious (Lewit & Baker, 1995). However, which of these are the most important for a child when they enter school in order for them to succeed? While it has been suggested that the focus of school readiness be shifted to early childhood, what skills should the focus be on?

One of the skill sets identified as important for school success is early literacy skill. Early literacy skills have been identified as perhaps the most important skills a child can have upon entering school in order to be academically successful and to be able to learn to read (Cunningham & Stanovich, 1997; Stanovich, 1986), and the ability to decode and comprehend what one reads is considered one of the best indicators of future success in school and life (NRC, 1998). What other skills and experiences does a child

need to have before entering school to ensure success, and how is success defined?

Early literacy skills are those skills that help a child understand print: “what it is, how it works, and why it is used” (Gunn, Simmons, & Kameenui, 1995, p. 5). Early literacy is traditionally defined as a set of developmental prerequisites for reading and writing that include language skills, letter knowledge, knowledge of print conventions, understanding and producing narratives, and pretending to read (Sulzby, 1989; Sulzby & Teale, 1991). In other words, early literacy is the process of becoming a reader and writer and includes language, prereading, and prewriting activities from birth until the child is reading. More recently, Whitehurst and Lonigan (1998) have reemphasized the importance of these outside-in skills in the preschool years but have also suggested a new model of early literacy that includes aspects of the home literacy environment and parent-child interactions. They ask how these early predecoding skills are related to the family environment as well as to later reading comprehension and success in school. In her seminal work on early reading, Durkin (1966) found that children who read early are more likely to have parents who read to them, have parents who talk about letters and sounds with them, and have access to numerous and varied reading materials. These early readers also maintained their advantage over their peers in later reading achievement. Justice and Ezell (2000, 2002, 2004) and Justice and Pullen (2003) also emphasized the importance of print referencing as a strategy that can be implemented in the home and has been shown to increase early literacy skills. The implication of this model is that early reading ability may be influenced by parent-child interactions and the home environment, which then mediates the influence of early experiences on later reading

comprehension. The goal of this study was to explore the contributions of early experiences leading to reading ability (e.g., letter recognition, phonological awareness) versus those leading to language skills (e.g., vocabulary) to second-grade outcomes (e.g., reading, listening comprehension, reading comprehension). Specifically, identifying the parenting and home environment experiences that are most influential along with the age points that make the biggest impact on later reading and comprehension is the first part of this goal. Second is confirming the relationship of early literacy skills, vocabulary, and reading ability on second-grade reading and comprehension.

### **Low-Income Children and Reading Comprehension**

*Children who have grown up poor, in a single parent family, will enter the first grade hopelessly behind their peers. They do not catch up.*

Moynihan (1986)

Moynihan's statement may seem harsh, but it is true for many children living in poverty. More than a third of fourth graders in America are unable to read fluently, but among low-income children, this is an even bigger problem, with 56% unable to read proficiently (National Assessment of Educational Progress [NAEP], 2004). There are specific skills and support that are necessary for learning to read and, in turn, succeeding in school. These skills and support include early literacy skills, a sufficient vocabulary, the ability to pay attention, and support from home and for those children coming to school without these skills they will be more likely to have problems learning to read. In a 1991 study of teachers' beliefs about children's readiness for school, teachers reported that 35% of children in the U.S. were not ready for school based on five dimensions of

school readiness (e.g., being able to sit still, knowledge of letters and numbers, being able to communicate, being physically healthy, and being curious) with lack of proficiency in language as their biggest concern (Boyer, 1991). Similarly, a more recent study of profiles of school readiness in the Early Childhood Longitudinal Study—Kindergarten (ECLS-K) on similar dimensions as those used in the previously mentioned study found that 35-45% of children were not ready for school (Hair, Halle, Terry-Humen, Lavelle, & Calkins, 2006). In a national study of approximately 3,600 kindergarten teachers, 46% reported that over half of the children in their classes not only lack academic skills but also have difficulty following directions and working independently, both skills that teachers have identified as being necessary for academic achievement (Rimm-Kaufman et al., 2000).

For children living in poverty, this is a problem that can continue from generation to generation, with parents who are poor readers raising children who end up being poor readers (DeFries & Alarcon, 1996; NRC, 1998; Scarborough, 2001). Among low-income and minority children, the incidence of reading problems increased from approximately 45% to over 50% in just 3 years in the early part of this century (Grigg, Daane, Jin, & Campbell, 2003). Children from low-income families, compared to those in families with more resources, have fewer home literacy experiences and come to school with less knowledge and fewer literacy skills (Goldenberg, 2002). The home environment and childcare experiences play a role in low-income children's ability to read indirectly through language (Poe, Burchinal, & Roberts, 2004). Reading abilities are related to

family income and resources, culture, beliefs, and literacy practices (Wasik, Dobbins, & Herrmann, 2001).

### **Purpose of the Study**

The purpose of this study was to help increase the focus of reading research in early childhood by examining the early home environment, early cognitive development, and other specific child and family factors in relation to school-age literacy and reading comprehension. Specifically, this study has the potential to reveal which specific aspect of the early environment and early development predict later reading ability and reading comprehension in a low-income sample. This study built upon the seminal work of Dickinson and Tabors (2001) by extending the examination of early environmental influences on literacy from kindergarten to the second grade. The unique nature of this longitudinal study of children from age 3 through the second grade gives us the opportunity to explore early development and relationships in the preschool years in relation to later reading and school success during the elementary school years (Figure 1). More specifically, this study examined the question: what skills are necessary when a child starts kindergarten in order to become successful at reading and reading comprehension?

### **Research Questions**

1. What *early environmental supports* predict later reading, given varying levels of risk for academic problems? Children from low-income families are at risk for academic problems due to poverty but vary in the number of additional risk factors they

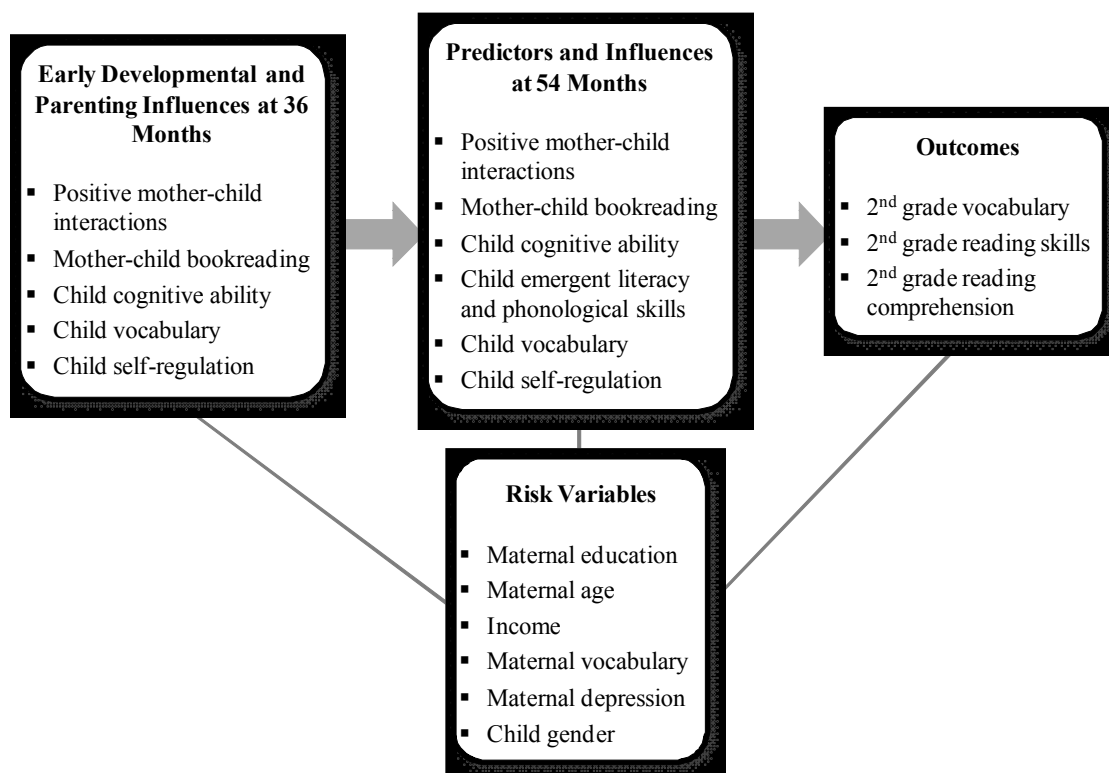


Figure 1. Reading and reading comprehension logic model.

face, so the specific research objectives address aspects of early experience and development that affect later second-grade outcomes over and above the cumulative risk factors.

- a. Which aspects of *early environmental supports* (i.e., quality of home environment, number of books available, frequency of family reading, and quality of parent supportiveness) measured at 36 and 54 months are related to second-grade vocabulary, reading ability, and reading comprehension?
- b. What combination of early *environmental supports* best predict second-grade vocabulary, reading ability, and reading comprehension?
- c. Does timing matter, that is, do *environmental supports* at 54 months, because

of their temporal proximity to second-grade outcomes mediate any impact of environmental supports at 36 months on second-grade reading?

2. What *early developmental skills* predict later reading, given varying levels of risk for academic problems?

a. Which early developmental skills (i.e., vocabulary, cognitive skills, self-regulatory skills, and early literacy skills) measured at 36 and 54 months are related to second-grade vocabulary, reading ability, and reading comprehension?

b. What combination of early developmental skills best predict second-grade vocabulary, reading ability, and reading comprehension?

c. Does timing matter, that is, do child developmental skills at 54 months because of their proximity to second-grade outcomes mediate any impact of their developmental skills at 36 months on second-grade reading?

3. How do *early environmental supports* and *developmental skills* combine to influence second-grade vocabulary, reading ability, and reading comprehension in the context of risk for academic problems?

a. What combination of *early environmental supports* and *early developmental skills* best predict second-grade vocabulary, reading ability, and reading comprehension?

b. Do *early environmental supports* and *early developmental indicators* affect second-grade outcomes differently?

c. How are the three second-grade outcomes (vocabulary, reading ability,



reading comprehension) related to each other? Are they consistently or differentially predicted by similar environmental supports, developmental skills, and their combination?

4. Can a final model improve prediction and identify important early factors that early intervention can address? If second-grade outcomes of vocabulary, reading ability, and reading comprehension are consistently predicted by the same set of supports and developmental skills, will the model in question 3 change if these variables are treated as one outcome factor?

## **CHAPTER II**

### **LITERATURE REVIEW**

This chapter provides a review of theories of reading and reading comprehension and research on the potential influences of early environment and development on later reading and reading comprehension abilities. Specifically, research linking each of these potential sources of early influences on later reading will be examined. Important components of reading success as identified by the theories include cognitive development and memory, expressive language, self-regulation, rapid naming, decoding, phonemic awareness, and letter knowledge. Research on the prerequisite skills for reading comprehension includes studies of listening comprehension, vocabulary, and background knowledge. Finally, the following variables will be discussed as cumulative indicators of risk for academic problems: poverty, gender, maternal age, education, vocabulary, and maternal depression.

#### **Theory**

Reading comprehension research during the past two decades has led to an expansion of theories, models, and concepts about reading comprehension (e.g., Anderson & Pearson, 1984; Kintsch, 1998, 2000; Kintsch & Kintsch, 2005; Schmalhofer, McDaniel, & Keefe, 2002; Tracey & Morrow, 2006; van den Broek, Lorch, Linderholm, & Gustafson, 2001). While the definition of reading comprehension has been thoroughly discussed in the literature, the assessment and instruction of reading comprehension remains ambiguous. While some theorists believe that comprehending what one reads is

purely text driven, others believe that it is a combination of the reader, the text, and the activity that comprise reading comprehension (RAND, 2002; Snow & Sweet, 2003). Finally, a new set of theories credits the quality of the child's early environment to later reading success. Because there is not one single theory that takes into account the combination of environmental and developmental contributions to later school reading performance four theories will be discussed: (a) *Kintsch's* construction-integration model and comprehension theory, (b) *van den Broek's* landscape model, (c) *Vygotsky's* socio-historical theory of cognitive development, and (d) family literacy theory.

These four contributing theories fall under three broader types of theories: constructivism theories, social learning theories, and developmental theories. The first two theories fall under the constructivism category, which emphasizes the individual's part in actively constructing knowledge through integration of new knowledge with existing knowledge (Tracey & Morrow, 2006). The third theory is a social learning theory, and its emphasis is on the importance of social interactions as influences on literacy learning (Tracey & Morrow, 2006). Finally, the last theory that will be discussed is a developmental theory and is actually a newly evolving theory integrating concepts from other developmental theories. This set of theories explains literacy learning as a longitudinal process, but although unique in this way, it does not discount the importance of either the constructivist or social learning points of view (Tracey & Morrow, 2006). Kintsch's construction-integration model (1988, 1998) and comprehension theory (2000, 2005) will be discussed, followed by van den Broek's "landscape" view of reading (van den Broek et al., 2001; van den Broek, Risen, Fletcher, & Thurlow, 1996), and

Vygotsky's socio-historical theory of cognitive development (Vygotsky, 1986). Finally, an integrated and evolving theory called family literacy theory, which is a set of ideas and views held by many reading researchers (Tracey & Morrow, 2006) was applied to the development of reading comprehension.

### **Construction-Integration Model and Comprehension Theory**

Van Dijk and Kintsch's (1983) comprehension model is a model of reading comprehension that describes the reading process from decoding to constructing meaning. Kintsch has continued to work on this model to develop both a construction integration model (1988, 1998) and a theory of reading comprehension (Kintsch, 2000, 2005). In this model, it is understood that the reader builds mental representations of the text. These representations include a verbatim representation, a semantic representation, and a situational representation; it is through this construction of mental representations that the connections at each level are linked to each other to form a mental model or understanding of the text (Kintsch, 1998). The construction part of this model involves forming and connecting propositions with background knowledge while the integration part involves creation of the text model. The building of this model is the "comprehension process." The integration phase of this process takes place in working memory, and although long-term memory is not used for this part of the model, it is needed to store the necessary background knowledge required during the construction phase (Kintsch, 1988, 1998).

Kintsch's models have developed into a theory of comprehension that has two

main subjects that have been more fully developed from the previous models, first, is the complexity of the mental representations or models that are formed during reading and second, the inference processes that are required to form these mental models. Mental models are complex because they are formed at each level of reading comprehension and each piece of the model is dependent upon the development of the preceding level. The first stage of comprehension is the *decoding process*; it is during this stage that the reader forms a mental representation consisting of propositions or units of ideas. The second stage of comprehension is the construction of the *textbase* when a mental model is formed by linking propositions at the microstructural level and then connecting the relations among the various sections of text at the macrostructural level. The final stage of comprehension occurs when the reader constructs a *situational model*; this model is formed when the reader integrates background knowledge and experience with the text. Understanding has been achieved when there is coherence within and between the levels of the model. It is not until this point, when inferences are required, that the reader is truly able to construct meaning or really understand the text (Kintsch & Kintsch, 2005).

Inferences are necessary to form situational models. In order to form a model the reader must have prior knowledge about the subject either from experience or from information presented earlier in the text and then use this information to understand the meaning. Prior knowledge about the linguistic structure of the sentence is also used to infer meaning. The reader must be able to go beyond the information provided by the text, retrieve the information, and then integrate it with the new information. Inferences can be either automatic or controlled. When an inference is automatic it comes easily, as

usually occurs when the subject is familiar. At other times, inferences are controlled, as in the case when the reader must work deliberately to infer meaning and fill in gaps. The difficulty for teachers is understanding how to get the reader to engage in this deliberate or controlled inferential processing that is a necessary part of the comprehension process (Kintsch & Kintsch, 2005). Skills emphasized in this theory include background knowledge, inferential and cognitive skills, memory and attentional skills, and early literacy and decoding skills.

While Kintsch does not specifically discuss the importance of early social experiences and cognitive skills to later reading comprehension abilities, it is suggested in the final stage of comprehension. In this stage, also known as the situational model stage, the reader is using prior experiences and background knowledge to construct meaning from the text. This study examines the influence of child cognitive development and competence on later vocabulary, reading ability, and reading comprehension. Kintsch's work has been used by other reading comprehension researchers as a starting point for developing similar models and theories. One such model is van den Broek's Landscape model (van den Broek et al., 1996) described below.

### **Landscape Model**

Recent research suggests that reading comprehension does not develop in an orderly stage-like fashion as suggested by Kintsch, but rather in a cyclical and active process (van den Broek, Virtue, Everson, Tzeng, & Sung, 2002). van den Broek's Landscape model (van den Broek et al., 1996, 2002; van den Broek & Kremer, 2000) is an elaboration of previous models with an emphasis on the cyclical nature of reading

comprehension. It has been described as a set of complex cognitive processes that includes allocation of attention, access of background knowledge, inference-generation, reader modulation, and information representation in memory (van den Broek et al., 2002).

In van den Broek's landscape model, he described reading as a "landscape of inferences and fluctuating activations," and suggested that it "poses quite a challenge: Readers attempt to maintain coherence as they proceed through the text, but they must do so within the limited constraints of limited attentional resources" (van den Broek et al., 1996, p. 166). Two types of coherence are identified in this model—anaphoric clarity and causal explanation. Anaphoric clarity is the coherence a reader achieves once they are able to identify the referents for objects, persons, and so forth; this is similar to the microstructural understanding previously discussed in Kintsch's model. Causal explanation is the coherence a reader achieves when they are satisfied that the sentence or paragraph they are reading has been explained adequately. This process starts over at each new statement, idea, or paragraph making it a cyclical process. The difficulty then is maintaining coherence from one cycle to the next while still maintaining attention and storing information from the previous cycle in short-term memory. This theory is similar to Kintsch's theory but differs in that it emphasizes the importance of attentional skills, memory, and motivation, and specifies the cyclical nature of reading comprehension (van den Broek et al., 1996).

Van den Broek's theory takes the previous theories a step further in suggesting that it is not only background knowledge and inferential abilities that contribute to the

ability to comprehend what one reads, but that other skills such as attention and motivation are important in this cyclical process. While van den Broek's theory is more comprehensive than Kintsch's theory, it still lacks an important aspect of children's learning, the context in which early learning occurs. In Vygotsky's socio-historical theory it is suggested that motivation is both socially and culturally determined thus emphasizing the importance of the family context to later literacy and reading comprehension skills.

### **Socio-Historical Theory of Cognitive Development**

Vygotsky's theory was based on the assumption that children learn as a result of social interactions with others. Reading has been described as a social act; it involves interpreting and understanding the communicator's intent or message. It is more likely that this task will be completed successfully if both parties have similar linguistic resources, cultural expectations, and shared background knowledge. Vygotsky suggested that meaning is constructed within a particular sociocultural context and that children learn as a result of social interactions dependent upon both the people around them and the cultural tools provided to support their thinking. Vygotskian theory provides a useful framework for considering sources of influence on children's reading comprehension (Vygotsky, 1986). Vygotsky's theory accounts for the development of language and vocabulary in the context of supportive social interactions with parents, teachers, and other adults. From this perspective, language development involves the connection of thought with speech and communication and develops in an interactive context, it is



through these experiences that children build a foundation for vocabulary learning and background knowledge that later helps them comprehend the text they read (Tracey & Morrow, 2006). Evolutionary psychology (Geary & Bjorklund, 2000) suggested that although literacy is built on a foundation of language skills, language is a biologically primary ability acquired readily and universally because of evolutionary pressures for human communication, while literacy is an “unnatural” secondary ability, culturally determined and requiring external motivation for mastery. Vygotsky would suggest that when children experience the use of literacy in social situations they can internalize the usefulness of this cultural tool and are thereby motivated to independently use it (Tracey & Morrow, 2006). One goal of this study is to examine the home environment and its relation to later vocabulary, reading ability, and reading comprehension. The home environment provides the child with multiple, daily social interactions in which the child is able to learn. The family is a major component of the home environment and the parent’s influence on their child’s language and literacy development in the context of the home is a key assumption of this study.

### **Family Literacy Theory**

Family literacy theory is an evolving theory that has come together as a series of ideas developed by several researchers as they have studied the homes of children who learn to read without direct instruction (Tracey & Morrow, 2006). According to Cairney (2003, p. 85), “literacy is not a single unitary skill; rather, it is a social practice, which takes many forms, each with specific purposes and specific contexts in which they are used.” Emergent literacy theory was a precursor to family literacy theory and both

propose that the home environment is central. These theories also assert that literacy is a continuous and ongoing process that begins at birth. While the two theories are similar, emergent literacy theory emphasizes children's development of preliteracy skills such as listening, speaking, reading, and writing (Morrow, 2005), while family literacy theory emphasizes the critical role of parents to their child's literacy success (Tracey & Morrow, 2006). "The family's literacy values and practices will shape the course of the child's literacy development in terms of the opportunities, recognition, interaction and models available to them" (Hannon, 1995, p. 104).

Family literacy researchers have concluded that an environment rich in literacy materials and experiences is more important to a child's early successful literacy development than even the best preschool and kindergarten classrooms (Bus, van IJzendoorn, & Pellegrini, 1995; Dickinson & Tabors, 2001; Hart & Risley, 1995; Jordan, Snow, & Porche, 2000; Scarborough & Dobrich, 1994). In these homes, children have access to books and other literacy materials, have reading models, are read to frequently, have parents that are interested and involved in their development and education, and live in homes that are full of supportive and interactive experiences that encourage emergent literacy skills (Tracey & Morrow, 2006). This theory emphasizes the importance of at-home experiences and the critical role of parents on their children's reading success. While the importance of parent involvement during the school years has long been emphasized, the family literacy theoretical framework has become widely known only recently. As literacy theories are evolving, the implications of parental involvement are becoming increasingly central to models of literacy acquisition (c.f., Whitehurst &

Lonigan, 1998).

### **Summary and Integration of Theories**

These theories of reading comprehension emphasize important skills that would be useful for a child to have upon entering school so they become successful readers. These skills include cognitive, regulatory, and linguistic skills which all begin developing in infancy (e.g., knowledge of concepts, the ability to infer, language skills, attentional skills, memory skills) and early literacy skills which begin to appear as children approach school age (e.g., vocabulary, phonemic awareness, letter knowledge, background knowledge). Many of these skills can be enhanced through the use of socio-emotional supports (e.g., a wide variety of experiences, supportive social interactions, access to books and literacy materials, reading models). While each of the theories is unique, they have many similarities and complimentary concepts. Most of these theories suggest that background knowledge and inferencing skills are important to the development of reading comprehension. While each theory has a different emphasis on how these skills are developed they all support these concepts and the importance of experiences. The longitudinal nature of literacy learning is emphasized in family literacy theory along with the cognitive, linguistic, and early literacy skills suggested in the other theories. This study will examine each of these potential predictors of reading across 5 years of development in order to determine which experiences and skills are most necessary at what ages in order for children to become literate, comprehend what they read, and ultimately succeed in school.

## Reading Ability

*Students who do not develop reading fluency, regardless of how bright they are, are likely to remain poor readers throughout their lives.*

National Reading Panel, 2000, p. 326

For children to comprehend what they are reading they must first be able to read words from printed text. Decoding, also known as phonological processing or translating text to spoken language, is dependent (in English as in many other languages) on the alphabetic principle, the understanding that letters represent sounds, and phonemic awareness, the understanding that words are comprised of segments of sounds (Goldenberg, 2002). Decoding is the ability to segment units of sounds made up of phonemes, identifying and manipulating units of oral language such as words, syllables, and onsets and rimes (Goswami & Bryant, 1990).

Decoding limitations have been found to be at the center of most reading problems (Lyon, 2002; NRC, 1998). Phonological awareness, letter-sound knowledge, and word recognition are reading subskills that have been found to be reciprocally related to reading, in other words, growth in one facilitates growth in the others (Perfetti, Beck, Bell, & Hughes, 1987). Children who lack phonemic awareness and other related skills such as letter knowledge have difficulties decoding, and word recognition is, therefore, slow and labored.

### **Phonemic Awareness and Letter Knowledge**

Phonemic awareness and letter knowledge are precursors to phonological

processing/decoding and are essential to learning to read and write in languages that use an alphabetic system (Ehri, 2004). Phonemic awareness is the ability to discriminate between the individual sounds, or phonemes, that make up a word (Goswami & Bryant, 1990).

In order to develop phonemic awareness and to gain phonological processing skills one must first have knowledge of the letters and sounds that make up words, therefore letter knowledge is a required skill in an alphabetic system such as English (Ehri, 2004). Children who are unable to discriminate between letters of the alphabet cannot learn letter-sound relationships. Letter knowledge helps children learn to read by preparing them to be able to become aware of phonemes and to understand the relation between letters and sounds. A longitudinal study of the developmental steps of learning to read found that phoneme awareness develops in phases and interacts with the child's ability to finger-point read (concept of word in text knowledge; Morris, Bloodgood, Lomax, & Perney, 2003). Research has found that the best school entry predictors of second-grade reading are phonemic awareness and letter knowledge (Share, Jorm, Maclean, & Matthews, 1984). In a study of precursors of literacy delay in children with a genetic risk for dyslexia, letter knowledge at 45 months was the strongest predictor of reading level and reading comprehension 2 years later although vocabulary and expressive language were also related (Gallagher, Frith, & Snowling, 2000). Without the ability to read words accurately and fluently, comprehending the meaning of words is extremely difficult. Reading fluency is important because "it provides a bridge between word recognition and comprehension" (Briggs, 2003).

## **Fluency**

Fluency, automatic rapid and accurate reading, frees up more cognitive resources for comprehension (de Jong & der Leij, 2002; Lyon, 2002). Fluency requires extensive practice in reading and decoding text (de Jong & der Leij, 2002; Snow, Scarborough, & Burns, 1999). Despite the importance placed on reading fluency and the attention to improving fluency, fluency interventions do not help all children with reading comprehension difficulties. Fluency is better thought of as a moderator or filter. Slow readers use too much processing capacity leaving less for comprehension tasks such as inference and integration (Hannon & Daneman, 2001; Perfetti, 1985). When fluency is low, reading comprehension is limited, but when fluency is adequate or higher, reading comprehension then can be affected by child cognitive and foundational skills such as background knowledge, listening comprehension, and vocabulary (RAND, 2002).

## **Reading Comprehension**

*The more that you read, the more things you will know. The more you learn, the more places you'll go.*

Dr. Seuss (1978). "I Can Read With My Eyes Shut!"

Reading comprehension is the process of extracting and constructing meaning through interaction and involvement with written language (Snow, 2002). Reading comprehension has also been defined as understanding the meaning, relevance, and implications of text (van den Broek et al., 2001). A reader comprehends when he/she "constructs a coherent mental 'picture' of the text. How? The reader identifies meaningful relations between parts of the text" (van den Broek et al., 2005, p. 110).

The debate among reading researchers has long been whether being able to decode is enough for children to eventually be able to construct meaning from text or if there is more required to constructing meaning than just recognizing the words. The RAND reading group concludes that both extracting (e.g., decoding text) and constructing meaning (e.g., comprehending) from text are necessary processes for successful reading comprehension and that both are dependent upon the skills of the reader (RAND, 2002). Some of the skills that have been identified as necessary for a student for successful reading comprehension include attention, memory, inferencing, motivation, vocabulary knowledge, background knowledge, and comprehension strategies (Snow & Sweet, 2003). These skills are not all necessarily skills that are essential to decoding text. Comprehending text requires different and additional abilities than those required for decoding text. Simply put, both word recognition and language comprehension combined allows the reader to understand the concepts and ideas provided by the text (Vellutino, 2003). Some of the questions that this study hopes to answer are: (a) What does early literacy really mean for this group of children? and (b) What skills and environmental factors are necessary when a child starts kindergarten in order to become a successful reader and comprehender in second grade?

Foundational skills required for reading comprehension, such as listening comprehension, background knowledge, and vocabulary, begin to develop long before children can decode text. Distinct types of reading comprehension problems may stem from particular deficits in the early years. Children's comprehension of text, like their comprehension of speech, requires adequate language development as an essential

foundation (Catts, Fey, Tomblin, & Zhang, 2002; Catts, Fey, Zhang, & Tomblin, 1999), and early language development depends on support from the early language environment (Snow, Porche, Tabors, & Harris, 2007). To achieve the goal of school success for all children, it is important to understand what early cognitive skills are important for later literacy and reading comprehension and how the development of those skills is affected by parent-child interaction.

Although adequate reading comprehension in third grade is no guarantee that a child will not have reading problems later (RAND, 2002), reading comprehension difficulties in third grade typically do persist into later grades and extend to other academic areas beyond language arts. Often, reading comprehension problems are not attended to until later in the elementary school years (McCardle et al., 2001), by which time, children are already experiencing potentially avoidable school difficulties and failures. Solving reading comprehension problems early or preventing them altogether could prevent serious losses in academic achievement if identified early.

Enriched early environments promote vocabulary, knowledge, and oral comprehension even before children acquire reading fluency, and may thereby prevent both reading comprehension problems and subsequent academic failure. It is critical therefore, to identify children early who are at risk for reading comprehension difficulties, before the gap between rich and poor early language environments becomes more difficult to bridge. Understanding early indicators of risk for later reading comprehension difficulties will allow early identification of environmental supports, in homes and early education programs, which reduce the risk. For low-income children,



especially those in rural or semi-rural areas, early environmental supports that are critical for development in language and other domains may be limited.

Reading comprehension, constructing meaning from text, is the ultimate goal of reading, but before meaning can be acquired from text, reading requires connecting print to language and decoding words accurately and quickly. The RAND Reading Study Group concluded that comprehension is the most important area of study in the research on reading,

We have made enormous progress over the last 25 years in understanding how to teach aspects of reading. We know about the role of phonological awareness in cracking the alphabetic code, the value of explicit instruction in sound-letter relationships, and the importance of reading practice in producing fluency.... The fruits of that progress will be lost unless we also attend to issues of comprehension. Comprehension is, after all, the point of reading. (Sweet & Snow, 2003, p. xii, as cited in RAND, 2001)

The RAND Reading Study Group defined reading comprehension as “the process of simultaneously extracting and constructing meaning through interaction and involvement with written language” (RAND, 2002), but to reach this goal, decoding and fluency skills must first be acquired and then vocabulary, listening comprehension skills, and background knowledge become important.

*Listening comprehension*, understanding of spoken or oral language, becomes highly correlated with reading comprehension after children can decode words (NRC, 1998). Listening and reading comprehension depend on a base of general knowledge and word knowledge or vocabulary. Increasing a child’s vocabulary and listening comprehension skills can therefore improve reading comprehension (Beck & McKeown, 2002). At least in middle class homes, early home literacy experiences, vocabulary,

listening comprehension skills, and language skills are related directly to reading comprehension in the school years (Sénéchal & LeFevre, 2002).

*Vocabulary skills* are an important part of both reading and reading comprehension, children's vocabulary at the beginning of first grade predicts both their reading ability at the end of that school year (Sénéchal & Cornell, 1993) and their comprehension abilities in high school (Cunningham & Stanovich, 1998). Reading ability and vocabulary size are related (Stanovich, Cunningham, & Feeman, 1984), in that word recognition is slowed when a child is trying to read a word that is not in their vocabulary, and slowed word recognition makes comprehension more difficult. The NELP, supported by extensive research studies with diverse populations, has identified early language skills as some of the strongest predictors of school-age reading comprehension (Schatschneider, Fletcher, Francis, Carlson, & Foorman, 2004). Early cognitive and language development provide the foundation for later reading ability. Vocabulary size along with depth of vocabulary knowledge is highly correlated with reading comprehension (Qian, 1999). Recent research has pointed out the importance of not only breadth of vocabulary, but also depth of vocabulary as an important contributor to reading comprehension (Nation & Snowling, 2000). The NRC suggested that increasing children's oral language skills and vocabulary could prevent a majority of reading problems (Snow, Burns, & Griffin, 1998). Children, who have better cognitive skills and larger vocabularies in their early years, are better readers in second grade (Roggman, Newland, Slocum, Cook, & Boyce, 2000) and children with larger vocabularies and oral language skills have higher reading scores (Whitehurst & Lonigan, 2001). These early

domains of development provide the basic components needed for later decoding print and understanding written information. When a child reads a text with more than 2% of the words unknown to them, their reading comprehension is stalled (Carver & Leibert, 1995). Everyday experiences and rich interactions with the world help children gain more opportunities for learning in these areas (Juel, 2006).

*Background knowledge* has been identified by the NRP (2000) as a second-tier skill in reading comprehension, but it is a skill that is greatly influenced by parent-child interactions. Language and early literacy experiences are very important to enhance a child's vocabulary and build their background knowledge and parents play an important role in language development (Smith, Landry, & Swank, 2000). Children who receive a rich language input are more likely to develop vocabulary and semantic knowledge that enable them to understand what objects are, how they work, and what goes together (Hart & Risley, 1995; Weizman & Snow, 2001). "Reading improves if you acquire knowledge so that you may be in a position to acquire more knowledge to improve your reading." In Kintsch's (2000, 2005) theory of reading comprehension the final stage of comprehension occurs when the reader integrates background knowledge and experience with the text. Regardless of a person's IQ, verbal ability, or reading ability, subjects with more background knowledge in a specific domain tested higher on reading comprehension than those subjects with less background knowledge in that domain (Yekovich, Walker, Ogle, & Thompson, 1990).

Some children's lack of the requisite vocabulary or background knowledge reflects years of poor language and learning environments (Scarborough, Dobrich, &

Hager, 1991). Young children who live in impoverished circumstances in the early years are at risk for developmental trajectories that diverge from their more advantaged peers. In programs such as EHS, the goal is to interrupt the effects of poverty on parenting and help parents provide the sensitivity, responsiveness, and stimulation that promote children's early development and may serve as protective factors.

### **Risk and Protective Factors**

Risk factors can be identified as any number of biological and environmental factors associated with academic achievement deficits or other negative developmental outcomes. Some factors that have been identified as risks are low parental education, poverty, poor parental mental health, inadequate parenting, and an impoverished home environment. In the IHDP study of 704 low-birthweight, premature children, the number of risk factors a child experienced was associated with a decreased IQ, and different sets of risk factors were related to cognitive development and behavior problems (Liaw & Brooks-Gunn, 1995). Poverty is the most prevalent risk factor in this study and thus must be considered.

Living in poverty predicts lower intelligence scores and cognitive functioning, less academic achievement, and more social-emotional problems even after controlling for family characteristics such as maternal education (McLoyd, 1998). These impacts are greater for children from families whose living conditions are persistently below the poverty threshold than those who experience occasional or transitory poverty (Brooks-Gunn & Duncan, 1997; McLoyd, 1998), and with nearly 70% of Americans staying in

the same social class they were born in, poverty is fairly stable (Neuman, 2006).

Although research about the impact of the timing of poverty on child outcomes is sparse, it does indicate that experiencing poverty during the preschool and early school years is related to lower rates of school completion (Brooks-Gunn & Duncan, 1997).

Poverty has been associated with delays in language development (Fish & Pinkerman, 2003; Kaiser, Hancock, Cai, Foster, & Hester, 2000; Washington & Craig, 1999) and specifically in lower oral language skills at kindergarten (DeTemple, 2001; Snow & Dickinson, 1990, 1991; Snow et al., 2007). Home environment and child care experiences are indirectly related to reading skill through the enhancement of language and phonemic awareness skills (Poe et al., 2004). For children at risk due to poverty, mother-child interaction is a key mediating variable between SES and language development (Olsen, Bates, & Kaskie, 1992). In a longitudinal study of children across income groups, SES accounted for 42% of the variance in vocabulary growth for 3-year-old children (Hart & Risley, 1995). In addition to SES, mothers' discipline style and verbal interactions at age 2 predicted school age vocabulary scores (Olsen et al., 1992).

Low-income children face many challenges and are more likely to have several social and economic risk factors that tend to co-occur with poverty (Burchinal et al., 2000). A meta-analysis of studies suggests that children living in poverty tend to engage in a higher rate of behavior problems than children from families with more economic stability (Qi & Kaiser, 2003). Poverty has also been associated with higher levels of physical aggression (Romano, Tremblay, Boulerice, & Swisher, 2005). Additionally, conditions often associated with poverty such as financial and emotional stressors can

indirectly predict problems with infants' emotion regulation (Lowe, Woodward, & Papile, 2005). Almost one third of young children living in poverty are reported to have behavior problems that often include aggression. This rate is much higher than the 3% to 6% reported in the general population. While these studies suggest a strong link between poverty and behavior problems, it is difficult to distinguish the effects of poverty from the many other risk factors associated with low income (Qi & Kaiser, 2003). Negative parent-child interactions and child behavior problems may also result from maternal parenting stress and depression that are also more likely in low-income families (Reading & Reynolds, 2001). These risks are cumulative in that having more of them increases the overall risk of negative outcomes. Children in the FACES study whose parents reported four or more risks had lower vocabulary scores, lower ratings on early literacy, and performed significantly poorer on book knowledge, comprehension, print concepts, letter identification, and early writing (Zill et al., 2003). Hart and Risley (1995) found that SES was significantly related to children's vocabulary.

Gender is another factor that may be considered a risk for language and literacy development. We know that girls' vocabulary develops at a quicker pace than boys (Bauer, Goldfield, & Reznick, 2002; Bornstein, Haynes, & Painter, 1998; Fenson et al., 1993; Huttenlocher, Haight, Bryk, Seltzer, & Lyons, 1991), an indication that boys may be at additional risk for related early developmental delays. There are several school-related outcomes, beyond just vocabulary, that show boys may continue to struggle in school more often than girls do. For example, compared with girls, boys are over four times as likely to be diagnosed with attention-deficit disorder and attention-deficit

hyperactivity disorder, disabilities linked to reading delays (American Psychological Association [APA], 1994). In addition, compared with girls, boys are more likely to drop out of high school (National Center for Education Statistics, 1998) or to be retained a grade (Kleinfeld, 1999). Boys are three times more likely to be identified as having a reading disability in elementary school (National Center for Education Statistics, 2000), and females consistently outperform males in NAEP reading assessments in fourth grade (Lee, Gregg, & Donahue, 2007). All of these gender differences indicate that males are at increased risk for later attention and reading difficulties.

Maternal vocabulary and education are protective factors related to child language development (Bornstein et al., 1998; National Institute of Child Health and Human Development [NICHD], 2000). In a low-income sample, children's vocabulary growth was related to maternal vocabulary and literacy skills, specifically through diversity of word types (Pan, Rowe, Singer, & Snow, 2005). Although maternal talkativeness, which is related to number of word types, did not independently contribute to child language development in this study, it was related in two other studies of maternal influences on child language development (Hart & Risley, 1995; Huttenlocher et al., 1991). Mother's education, particularly postsecondary education, is often associated with improved economic status (Zhan & Pandey, 2004) and is related to child's cognitive development (Melhuish, Lloyd, Martin, & Mooney, 1990), to intellectual performance at 3 years old, and is believed to contribute to behaviors in mothers that foster child competence (McGowan & Johnson, 1984). Mother's education has also been found to be significantly and positively associated with both early language development and later reading skills

(Beron & Farkas, 2004). Parental education levels have also been associated with a positive home literacy and learning environment (Bradley, Mundfrom, Whiteside, Casey, & Barrett, 1989).

Parents who suffer from poor mental health are less likely to provide their children with learning experiences and more likely to have unsatisfactory parent-child interactions (Brooks-Gunn & Duncan, 1997). As discussed previously, early conversation-like behaviors along with contingently responsive behaviors are an essential part of early language development that can be disturbed when a parent is unable to respond appropriately to their child's cries and cues. Parental depression can present a serious risk for normal development of communication and other prosocial behaviors in the first year because it is difficult for a depressed parent to respond with well-timed, animated expressions and conversation (Leseman & van Tuijl, 2006). Children of depressed mothers have slower vocabulary growth, especially those children with depressed mothers earlier on and for the longest period of time (Pan et al., 2005). Depressed mothers themselves report that their depression makes it more difficult for them to be nurturing, responsive, patient, and involved during their interactions with their children (Taylor, Roberts, & Jacobsen, 1997), and mothers who are depressed talk to their children less (Breznitz & Sherman, 1987; Lovejoy, Graczyk, O'Hare, & Newman, 2000). The combination of these risk factors needs to be examined in conjunction with parental supportiveness and the early home environment.



### **Importance of Longitudinal Research**

Most of these researchers and theorists have studied reading, understandably, among school-age children who are assumed to be old enough to learn to read. Many of the skill and knowledge components begin developing long before school entry, however, and early supports for those components may vary in their availability to children early in life. To more fully understand the predictors of later reading comprehension, it is valuable to begin examining early supports for the requisite components of reading comprehension long before school entry. “Longitudinal research serves two primary purposes: to describe patterns of change and to establish the direction and magnitude of causal relationships” (Menard, 2002, p. 3).

Longitudinal research provides information that is not easily obtainable from traditional cross-sectional research methods. It is particularly valuable for studying phenomena that are changing and are inherently longitudinal such as children’s development. It is especially useful in describing the developmental path of children and identifying outcomes and influences on these paths along with providing insights about the consequences of early conditions on long-term outcomes (Keogh, 2004). It is also valuable for investigating causal processes such as the influence of early environmental factors on later development. For these reasons, longitudinal research is valuable for the questions proposed in this study.

### **Early Environmental Supports**

*That the environment influences children’s behavior is a well-established*

*maxim in early childhood education. As children engage in their environment, they adapt their intellectual tools to meet new situations or challenges, integrating thought and action.*

Roskos & Neuman, 2001, p. 281

*Early environments* affect children's developing language and literacy skills.

Research on brain development suggests that environmental factors are a critically important part of brain development that can influence children's learning and behavior (DiPietro, 2000). Parent's support of their child's development is one area of the environment that can either buffer or amplify other aspects of the environment that may have an impact on a child's developmental trajectory. Regarding literacy, parents influence children's exposure to oral and written language and model literacy activities (Goldenberg, 1987). Parents of children who become early readers were more likely to read to their children, provide numerous reading materials, and talk about the sounds of letters (Durkin, 1966). On the other hand, parents of children who became poor readers in second grade were more likely to have provided fewer early literacy experiences for their children than parents of children who became good readers (Scarborough et al., 1991). Children's early language development is influenced by both quantitative and qualitative characteristics of parental speech (e.g., quantity of affirmatives, questions, nouns, modifiers; quality of responses; Bornstein et al., 1998; Hart & Risley, 1995; Snow, 1983). These parental speech characteristics are influenced by culture, socioeconomic status (SES), and parents' verbal intelligence and parenting knowledge (Bornstein et al., 1998; Hart & Risley, 1995; Tardif, Shatz, & Naigles, 1997). Other home activities, such as storytelling, shared toy play, and mutually focused daily interaction support language and

literacy (RAND, 2002; Snow, 1983). Home literacy experiences, such as book reading, writing, and having books available, all foster children's early literacy skills of connecting print with language (Dickinson et al., 1999; Lyon, 1999; RAND, 2002), which in turn are proposed to "ease the burden of decoding and later reading comprehension" (Mason, 1992, p. 236). The amount and quality of early book reading and family attitudes toward reading predict later decoding skills and reading performance (DeTemple, 1999). Overall, the way a parent and child interact appears to influence the child's literacy development.

The *home learning environment* plays an important part in a child's cognitive and early language development. Home activities, such as storytelling, shared toy play, and mutually focused daily interaction support language and cognitive development (RAND, 2002; Snow, 1983), as well as their emotional development and regulation abilities (Bost, Vaughn, Washington, Cielinski, & Bradbard, 1998). Parents' sources of support and stress can be determinants of parental quality that can affect the outcome of the child's cognitive and early language competence. Several studies have found a positive relationship between economic resources in the home and children's cognitive stimulation (Baharudin & Luster, 1998; Garrett, Ng'andu, & Ferron, 1994; Votruba-Drzal, 2003). Learning stimulation in the home has been found to be associated with language competence and achievement across ethnic groups (Bradley, O'Brien, Berlin, & Ware, 2001). The home environment has been found to be the most consistent predictor of children's language and literacy skills over and above maternal literacy behaviors in an at-risk population (Roberts, Jurgens, & Burchinal, 2005). Activities and resources in the

home make a significant contribution to a child's literacy and later school success by both providing a child with opportunities to develop language and vocabulary skills as well as engaging in specific literacy activities such as book-reading which have both been shown to be related to short- and long-term literacy outcomes (Dickinson & Tabors, 2001).

*Parenting behaviors* are a critical part of a child's early environment. "There is clear evidence that parents can and do influence children" (Maccoby, 2000, p. 1).

Parenting that is responsive and supportive is especially important in the early years because of the support that parents are able to provide for their young children's immature attention and language skills (Landry & Smith, 2006), both essential for later literacy. When early responsive parenting behaviors have been compared to the same behaviors at later ages they have been found to be more predictive of language and cognitive development. In a study by Landry, Smith, and Swank (2003), children were followed through age 8, and even when controlling for responsive parenting at later time points, those children whose mothers were most responsive in their early years continued to show the most optimal development in language and problem-solving skills, both important to literacy.

As previously mentioned the home environment is important in the early years and in addition to economic resources, studies have demonstrated that greater parent involvement positively affects children's readiness for school. Specifically, warm and reciprocal parent-child interactions, parent understanding of play, and parent ability to facilitate learning all contributed to school readiness by increasing sensory concept activation, classroom skills, and child independence (Parker, Boak, Griffin, Ripple, &

Peay, 1999).

Parent-child interactions influence children's language skills, which are important precursors to literacy development and significantly related to second-grade reading comprehension (Landry & Smith, 2006). Parent-child interactions that support early language development include longer utterances, use of a rich and varied vocabulary, word expansions, questioning, affirmatives (Hart & Risley, 1995), imitation, and contingent responsiveness (Hardy-Brown & Plomin, 1985). This suggests that conversations between mother and child are an important part of language development beginning early in life.

The first form of communication a child has is the infant's cry; it is through the mother's sensitive responsiveness to the child's early attempts at communication that the child learns how to have a conversation (Bornstein & Tamis-LeMonda, 1989). Maternal responsiveness to the infant's earliest forms of communication is important for a child's developing language skills and lays the foundation for future literacy experiences, but a sensitive and responsive mother does not provide verbal input alone. During conversations, parents are also able to help their young children develop skills that will help them learn language more efficiently. These skills include maintaining attention, self-regulation, and memory abilities, all skills that can be scaffolded by a highly responsive parent (Landry & Smith, 2006). When a parent is able to assist their child in developing these skills by promoting and supporting their abilities the child will have less work to do to maintain attention and regulate their behavior thus allowing them to be more engaged and actively involved and more likely to learn language efficiently (Landry

& Smith, 2006; Landry, Smith, Swank, Assel, & Vellet, 2001; Trevarthen, 1988).

Contingent responsiveness, a parenting behavior that promotes early language, is related to parent sensitivity. A parent who is sensitive and prompt in responding provides the child with a predictable, positive environment, supports the child's abilities, and promotes willingness on the child's part to communicate and cooperate with the parent (Landry & Smith, 2006). Children whose parents respond to their vocalizations are more likely to reach language milestones such as combining words and recalling events on schedule (Tamis-LeMonda, Bornstein, & Baumwell, 2001). Parent responsiveness to child language is also related to children acquiring social, cognitive, and language skills (Landry et al., 2003). Although attachment research has demonstrated the importance of responsiveness for early social-emotional development, both attachment and responsiveness are related to language development (Landry et al., 2001, 2003; Thompson, 1999).

Parent-child book sharing predicts several aspects of language and literacy development. Indeed, it has been said, "children are made readers on the laps of their parents" (Buchwald, 2005). Vygotsky's theory suggested that children learn as a result of social interactions and that through parent-child reading activities meaning is created. Language also develops in an interactive context that involves the connection of thought with speech and communication, it is through experiences such as being read to that children build a foundation for vocabulary learning and background knowledge that later helps them comprehend the text they read (Tracey & Morrow, 2006). Listening comprehension and expressive skills are facilitated when children are read to and

involved in conversation about books with supportive adults (Lyon, 1998; Sénéchal, 1997). Phonological awareness is facilitated through book reading and language games (Bryant, Maclean, & Bradley, 1990; Caravolas & Bruck, 1993; Dickinson et al., 1999). Shared bookreading introduces children to literacy by showing how print is used to communicate meaning. Shared bookreading has been studied as a strategy to promote language and early literacy skills in young children at risk (Crain-Thoreson & Dale, 1999; Ezell & Justice, 2000; Justice, Chow, Capellini, Flanigan, & Colton, 2003). The research on specific bookreading interventions has found that in both dialogic reading and print referencing interventions relatively simple changes in parent reading styles contributed to the early literacy skills of these young children (Justice & Pullen, 2003). Repeated readings, in particular, promote both expressive and receptive vocabularies and facilitate knowledge about print (e.g., directionality of print, letter-sound patterns) in the context of previously established shared meaning (Mason, 1992; Sénéchal, 1997). Parent-child book sharing is most effective when it is frequent, interactive, and pleasurable (Leseman & de Jong, 1998). While it is clear that parenting behaviors and the home environment are important supports for children's language and literacy development the child also brings skills of their own to the interaction.

### **Early Developmental Skills and School Readiness Indicators**

*Learning starts in infancy, long before formal education begins, and continues throughout life. Early learning begets later learning and early success breeds later success, just as early failure breeds later failure.*

James J. Heckman, 2004, p. 1

## **Cognitive Development and Memory**

Cognitive development and memory skills are as necessary for reading comprehension as for reading ability. A study of 8- to 11-year-old children's working memory capacity explained the unique variance in reading comprehension after controlling for decoding skills and vocabulary (Cain, Oakhill, & Bryant, 2004). Memory related skills necessary for decoding text include a large vocabulary, the ability to learn and remember the letters of the alphabet, and sufficient word recognition skills. According to Kintsch's comprehension theory, the final stage of reading comprehension takes place when the reader constructs a situational model. This occurs when the reader integrates background knowledge and experience with the text (Kintsch & Kintsch, 2005). Thus, comprehension requires the reader to have both background knowledge (related to cognitive development and experience) and working memory available to integrate that that is read with inferences made about the text from information retrieved from long-term memory (Cook, Halleran, & O'Brien, 1998).

## **Self-Regulation**

*Self-regulation*, the ability to regulate one's emotions, interactions, and attention, is necessary for academic success and has been credited for improved school performance (Feldman, Martinez-Pons, & Shaham, 1995). Learning-related social skills are important for academic achievement and include such skills as listening to instructions and directions, complying with the teacher, working independently, and demonstrating self-control (McClelland, Morrison, & Holmes, 2000). Self-control in preschool, as measured by delay of gratification, has been found to predict later



cognitive, social, and academic competence (Mischel, Shoda, & Peake, 1988; Mischel, Shoda, & Rodriguez, 1989; Shoda, Mischel, & Peake, 1990). Children who have difficulty following teacher's instruction, paying attention in class, and who overall are less accepted by their peers tend to do worse in school (Ladd, Kochenderfer, & Coleman, 1997). Self-regulation has been defined as an internal process of bringing oneself into compliance with the expectations inherent to the situation (Deci & Ryan, 1985) by using the ability to regulate one's emotions, interactions, and attention to delay gratification and tolerate change in the environment (Gross, 1998). It encompasses both emotion regulation and attention regulation.

*Emotion regulation* is emotion self-management, "the extrinsic and intrinsic processes responsible for monitoring, evaluating, and modifying emotional reactions,... to accomplish ones goals" (Thompson, 1994, p. 27). Emotion regulation has been linked to cognitive processes such as memory, learning, and problem solving (Gross, 1998), and children who demonstrate disregulated emotions are more likely to have communication problems (Mendez, Fantuzzo, & Cicchetti, 2002). Both emotion regulation and language have been found to influence each other's development (Bloom, 1993) and lay the groundwork for early reading skills (Pianta, 2006).

*Emotion regulation* involves more than just the expression of emotion; it includes the internal and external factors or "processes by which individuals influence which emotions they have, when they have them, and how they experience and express these emotions" (Gross, 1998, p. 275). Emotional regulation represents a person's ability to monitor, evaluate, and modify their emotions in an adaptive way, emotions have also

been found to direct and disrupt multiple psychological processes, including the ability to focus attention, solve problems, and support relationships (Cole, Martin, & Dennis, 2004). These are skills that are necessary for a child to succeed, and children who have developed appropriate emotional regulation have lower levels of externalizing problems, more positive peer relations, better planning abilities, and better school readiness.

*Attention regulation* is related to reading comprehension (Anderson, 1982) and is evident in infancy in joint attention and task engagement, which both predict later language and literacy skills (Boyce, Cook, Jump, Akers, & Innocenti, 2003; Newland, 2000). Parent report of child inattention has been linked to delays in development of early literacy skills during the preschool years (Rowe & Rowe, 1999). A recent meta-analysis of six large longitudinal studies indicates that two of the strongest predictors of academic success for both boys and girls from all socioeconomic backgrounds are reading and attention skills at school entry (Duncan et al., 2007).

### **Conclusion**

Reading and comprehending what one reads is a very complex task that requires multiple cognitive skills and can be influenced by many contextual factors as well. Because the majority of the work in the field of reading and reading comprehension has focused on single components or skills of reading comprehension our knowledge is limited regarding the environmental and developmental predictors of reading, how they may mediate or moderate each other, and which factors make independent contributions (see Cain et al., 2004; Hannon & Daneman, 2001). The goal of this study was fourfold;

first is to understand the influence of the early environment on reading and comprehension abilities, second is to recognize the unique contribution each child's cognitive and language development brings to their ability to read, third is to understand the relations and interaction between the skills and contextual factors that are part of the reading comprehension process, and finally is to develop a model that can identify the most important early factors related to later vocabulary, reading ability, and reading comprehension.

## **CHAPTER III**

### **METHODS**

#### **Participants**

One hundred and seventeen children from low-income families who were previously in the national Early Head Start (EHS) study (1996-2003) were tested again in second grade; these children were recruited but are no longer part of the EHS study. Some of these children did receive early intervention services (51%) but this is a study of these children's development after early intervention services were no longer provided. These children have extant developmental data at 36 months and just prior to kindergarten entry (54 months) that was used to predict their second-grade reading comprehension as part of this study. This multi-method design incorporated extant longitudinal data from standardized measures, interviews, observations, and self-report. This in-depth longitudinal design builds on a comprehensive extant data set with second-grade intensive data collection focused on reading comprehension.

Of the 201 original participants, 198 children were still available to contact in second grade. No attempts were made to contact the remaining three children as two children were no longer in their parents' custody and one child was deceased. Of the original 201 families enrolled in the beginning of the study, 139 families participated in the prekindergarten study and 117 families participated in the second-grade study.

In this sample, approximately 88% of the families are Caucasian and 9% Hispanic. At the time of enrollment, approximately 91% of these parents were married or

cohabitating, and approximately 94% of the families had one or both parents employed. Mothers' ages ranged from 14 to 44 years, with a mean age of 23 and approximately 32% under the age of 20 at enrollment. Participant families had an average parent education of twelfth grade and an average income of just over \$10,000 per year. All participant families were enrolled in the EHS research project by the time the target child was 12 months old and were randomly assigned to the EHS program or a comparison group. Of this sample 51% had received EHS services. The EHS program provided mostly home-based services with some center-based services.

Family demographics including family income, family size, parent minority status, maternal education, maternal age, maternal vocabulary, and maternal depression for the sample are reported below (see Table 1).

Table 1

*Descriptive Information for Family Demographics*

Variable	<i>n</i>	Min	Max	Mean	<i>SD</i>
Family income					
Baseline	110	0	\$50,000	\$10,404	8,562
Family size (# of children)					
36 months	98	1	7	2.51	1.25
Second grade	116	1	7	3.61	1.33
Maternal education					
Baseline	116	6	16	12.41	2.09
Maternal age					
Baseline	116	14	44	22.89	5.63
Maternal vocabulary (PPVT)					
Baseline	110	52	125	98.90	10.77
Maternal depression (CES-D)					
36 months	101	0	31	8.38	6.84
Second grade	82	0	28	8.12	6.01
% Minority					
Caucasian	88%				
Latino	9%				
% Married or living with someone					
Second grade	109%			91%	

Approximately 90% of the participating families lived in northern Utah with the remainder living in Idaho along the Utah border. The gap between good and poor readers in Utah is particularly salient because of generally good supports available for children's learning. Although Utah ranks only 36<sup>th</sup> in parents reading to their children (Toomer-Cook, 2007), Utah's adult literacy rates are high and over 80% of adults have a high school diploma (Jenkins & Baldi, 1992). Thus, the majority of children in Utah have the benefit of educated literate parents who live in a state that promotes early literacy (Jenkins & Baldi, 1992; Kinch & Azer, 2002), even though Utah parents read to their children less than parents in most states. The research sample available for this study, then, offers a unique opportunity to identify environmental, developmental, and social predictors of reading comprehension problems that individual children may experience when general supports are available but family literacy activities are relatively infrequent.

### **Procedures**

Procedures included in-home direct child assessment, parent interview, and observational data from the EHS and Up to second-grade studies. Assessments and interviews occurred in families' homes, scheduled at times convenient for them. All measurement constructs and instruments for both the EHS and the second-grade study are included in Table 2.

Data collectors were trained in standardized assessment procedures and interview procedures, and all staff were trained in practices to protect participant confidentiality.

Table 2

*Construct and Measurement Instrument for Each Age Point*

Skill measured	Instrument	36 mo	54 mo	second gr.
Home language and literacy environment				
Family reading	Family Reading Survey (FRS; adapted from Whitehurst, 1990)			X
Home language & literacy environment	Home Observation Measure of Environment HOME (Caldwell & Bradley, 1984)	X	X	X
Parenting behaviors				
Parent-child interaction	Codes: supportiveness (adapted from Bradley, Corwyn, McAdoo, & Garcia Coll, 2001)	X	X	
Parent-child bookreading	Parent report of bookreading frequency	X	X	
Reading and comprehension skills				
Comprehension	Listening and Passage Comprehension subtests of Woodcock Johnson Revised (WJ-R; Woodcock & Johnson, 1989, 1990)			X
Fluency	Rapid Naming subtest of Comprehensive Test of Phonological Processing (CTOPP; Wagner, Torgesen, & Rashotte, 1999)			X
Decoding	Letter-Word Identification subtest of WJ-R		X	X
Phonological awareness	Phonological Awareness subtest of CTOPP			X
Phonological memory	Phonological Memory subtest of CTOPP			X
Knowledge of phonics	Word Attack subtest of WJ-R			X
Early developmental skills				
Oral comprehension	Listening Comprehension subscale of Story and Print Concepts (FACES Research Team, 2001; adapted from Mason & Stewart, 1989)		X	
Vocabulary--receptive	Peabody Picture Vocabulary Test (PPVT-III; Dunn & Dunn, 1997)	X	X	X
Cognitive development	Bayley Scales of Infant Development: MDI (BSID-II; Psychological Corp., 1993)	X		
Cognitive development	Applied Problems subtest of WJ-R		X	
Early literacy	Book Knowledge subscale of Story and Print Concepts (FACES Research Team, 2001)		X	
Self-regulation	Bayley Scales of Infant Development-II: Behavior Rating Scale (BRS)	X		

*(table continues)*

Skill measured	Instrument	36 mo	54 mo	second gr.
Self-regulation	Leiter International Performance Scale-Revised (Roid & Miller, 1997)		X	
Emotion regulation	Leiter International Performance Scale -Revised (Roid & Miller, 1997)		X	
Risk and protective factors				
Family risk index	Baseline demographics (e. g., mom education, income, age, vocabulary, depression, child gender)			

All questionnaires were presented to parents in an interview format in their preferred language.

Data were collected at second grade across 3 years.

1. Year 1 (*N* of assessments = 61): Cohort 1—Second Grade
2. Year 2 (*N* of assessments = 44): Cohort 2—Second Grade
3. Year 3 (*N* of assessments = 12): Cohort 3—Second Grade

### **In-Home Data Collection**

Data collection specialists conducted each in-home assessment during a 4-month window around the child's 36<sup>th</sup> month, 54-month assessments were conducted the spring before kindergarten entry, and second-grade data were collected the spring of the second-grade year. The specialist explained procedures to parents and their children using a standardized script and then began with the child, conducting all standardized child assessments. Once the child assessments were completed, the specialist conducted the parent interviews and assessments. In-home testing took about two hours, and families were compensated \$25-\$50 depending upon the visit.



## **Instruments and Measures**

A list of measurement constructs and instruments by age point are shown in Table 2. Constructs were selected based on the research questions. Measures from the EHS data set and the second-grade follow up will be described; several measures were used across both studies and will only be discussed once.

### **Child Assessment Measures**

Child assessments (Table 2) were used to assess child cognitive and social development through testing of reading and comprehension skills.

The standardized Bayley Scales of Infant Development-II (BSID-II; Psychological Corporation, 1993) was used at 36 months to assess *cognitive development* using the Mental Development Index (MDI) and to assess *social competence* using the Behavior Rating Scale (BRS). Both scales are known to have good validity. Adequate short-term test/retest stability and interrater reliability are reported and reliability coefficients for MDI range from .78 to .93 (Psychological Corporation, 1993). Reliability coefficients for the BRS are considerably lower ranging from .44 to .54 and will be interpreted cautiously (Psychological Corporation, 1993). Data collection specialists were trained to administer the test using standardized procedures and agreement was assessed using a criterion of .95.

The Sustained Attention/Staying on Task subscale and the Emotion Regulation subscale of the Leiter-Revised Sustained Attention Task (Roid & Miller, 1997) were collected at the prekindergarten (pre-k) assessment point to measure *self-regulation and attention and emotion regulation*. These subtests are designed to measure a child's ability

to focus and attend to a task and to regulate emotions and is a valid and reliable measure, with Cronbach's alphas of .83 and .63 reported for 4- to 5-year-old children.

Selected subtests from the Woodcock-Johnson Revised (WJ-R; Woodcock & Johnson, 1989, 1990) were used at pre-k and in second grade. At pre-k, reading ability or *decoding* was measured with the Letter-Word Identification subtest of WJ-R and *general cognitive development* with the Problem Solving subtest. At second grade, reading skills included *comprehension* assessed with the Passage Comprehension subtest of WJ-R and the Listening Comprehension subtest of WJ-R, and *general cognitive development* with the Applied Problems subtest of WJ-R. Reading ability or *decoding* was assessed with the Letter-Word Identification subtest of WJ-R and the Word Attack subtest of WJ-R as well as subscales from the Comprehensive Test of Phonological Processing (CTOPP; Wagner et al., 1999) described below. These batteries can be used for a wide age range, and are well suited to testing both reading ability and achievement and have established reliability and validity on a normative sample, Cronbach's alpha of .84-.94.

The Comprehensive Test of Phonological Processing (CTOPP; Wagner et al., 1999) was used to measure phonological processing/decoding skills and background knowledge in second grade. *Phonological processing skills* include direct assessment with the phonological awareness and phonological memory subtests of CTOPP and background knowledge includes *fluency* tested with the rapid naming subtest of CTOPP. Validity was established through item response theory and criterion-related validity was tested against the Lindamood Auditory Conception Test, and several predictive measures, such as the Woodcock Reading Mastery Test-R (word attack and word identification

subtests) which indicated good validity (Lennon & Slesinski, 2001). Reliability has been established on the subtests with a Cronbach's alpha above .90.

The Peabody Picture Vocabulary Test (PPVT-III; Dunn & Dunn, 1997) was used in the EHS at 36 and 54 months to measure *receptive vocabulary* as an indicator of background knowledge and PPVT-III was also used to test second-grade vocabulary. Children were shown four pictures and asked to point to the picture that best represents a stimulus word presented orally by the examiner. The items are arranged in order of increasing difficulty. One point is awarded for each correct response, and a sum of the correct responses is used as the index of receptive vocabulary (Dunn & Dunn, 1997). Scores are converted into standard scores, with a mean of 100 and a standard deviation of 15 (Umbel, Pearson, Fernandez, & Oller, 1992). While the PPVT-R (Dunn & Dunn, 1981) has been shown to be a culturally unfair instrument, the PPVT-III has been found to be appropriate for use with minority populations (Washington & Craig, 1999). Studies have found that it may now be positively biased to these populations which brings up a concern in the clinical use of the PPVT as a screening tool and because of this positive bias it is also advised that PPVT-R scores are not compared to PPVT-III scores (Stockman, 2000; Ukrainetz & Duncan, 2000). The authors report high reliability and validity scores with a Cronbach's alpha of .93 and correlations ranging from .69-.91 with other verbal and vocabulary tests such as the WISC-III.

### **Parent Interview Measures**

Parent interviews (Table 2) were used to collect basic demographic information and to assess the home language and literacy environment. An interview format was used

because some families have limited literacy skills that would compromise the reliability of paper-and-pencil survey instruments. A self-administered questionnaire was available for parents who preferred that option. ACYF (2002) chose to use the administrative protocol preferred by each participant in order to obtain more complete data. Other studies have found both administration methods to be equally reliable and accurate (Durant & Carey, 2000; Kalichman, Kelly, & Stevenson, 1997).

The Head Start Family Information Survey (HSFIS) was used to collect background and demographic information in the EHS study. These data provided information on parental education level, income, employment, amount of schooling, parental age, family size, and childcare situations.

A family demographic questionnaire was used again to update background and demographic information, with additional questions added to determine the school the child was attending and the child's current grade level. The second-grade study used additional questionnaire measures to assess family literacy.

The Family Reading Survey (adapted from Whitehurst, 1990) is a multiple-choice and fill-in-the-blank questionnaire that asks about family reading practices and attitudes. This survey provides information such as the number of books available to the child, the number of adult-child reading sessions per week, and the amount of television watched each day.

The Story and Print Concepts task (Modified; FACES Research Team, 2001) is an assessment designed to test a child's knowledge of books and includes questions regarding the location of the title, the front of the book, and the author of the book. The

assessor reads the child the book and then asks questions about the books content and the mechanics of reading. Book knowledge and comprehension were measured along with phonological awareness and rhyming awareness. The FACES study reports good face validity but low to moderate reliability (internal consistency) on the subscales of Book Knowledge (.57 and .59) and Oral Comprehension (.43 and .41). Individual items from this measure were examined along with the subscales and the strongest correlations were between the oral comprehension subscale and reading comprehension at second grade. None of the individual items was as highly correlated as the subscales so the subscales were used in further analyses.

Questions regarding maternal depression were from the Center for Epidemiological Studies Depression scale (CES-D; Radloff, 1977) and were asked during baseline telephone interviews with mothers, at 36 and 54 months, and again in second grade. The CES-D has had validity established on a wide range of demographic characteristics. Reliability for this measure was reported as a Cronbach's alpha of .92, and local reliability was estimated as a Cronbach's alpha of .91. All of the other risk variables were collected from program application forms, also collected before randomization and program enrollment.

The quality of the *home environment* was assessed at 36 months with the Early Childhood Home Observation for the Measurement of the Environment (HOME; (Caldwell & Bradley, 1984) which assesses the amount and type of support available to the child. An adaptation of the Middle Childhood HOME (Caldwell & Bradley, 1984) for language and literacy was used at 54 months and again in second grade. The HOME uses

an observational unstructured interview approach to assess parent-child interactions and parents' use of a variety of objects and experiences with toddlers that provide opportunities for stimulation and growth (Caldwell & Bradley, 1984). The HOME has been used in many studies with a variety of racial/ethnic groups and has been found to be valid and reliable. The internal consistency of the HOME for children 6-10 is reported as a Kuder-Richardson-20 coefficient of .90. Assessors were trained to score the test using standardized procedures. Training sessions and randomly selected interview sessions were videotaped and scored by a second assessor to assess agreement.

### **Observational Data**

In the EHS study parents were asked to involve their children in semi-structured play sessions that were videotaped. Parent-child interactions in play, book reading, and in a teaching task were videotaped. These videotapes were coded by trained observers for play and book reading behaviors and a variety of mother-child interaction outcomes. The *quality of the parent-child interaction* was coded at Columbia University using the Parent Responsiveness scale (adapted from Bradley, Corwyn, McAdoo, & Garcia Coll, 2001). These were coded by a team of trained raters to yield measures of *Parent Supportiveness* during the child's play. Percent agreement (exact or within one point) was achieved on 11% of the observation tapes and averaged 94% when the children were 36 months old, with a range of 86% to 100% (Berlin, Brady-Smith, & Brooks-Gunn, 2002).

### **Cumulative Risk Index**

A cumulative risk score was calculated using cut-offs for each of the risk factors

and assigning a 0 if there was no risk indicated or a 1 if there was a risk indicated.

Sameroff and his colleagues developed a risk index in order to include more proximal indicators of risk instead of relying solely on distal socioeconomic status indicators (Sameroff, Seifer, Baldwin, & Baldwin, 1993; Sameroff, Seifer, Barocas, Zax, & Greenspan, 1987). They argued that both the quantity and quality of family risk factors can negatively affect children's development. Using this model in a 20-year longitudinal study in Rochester, New York, they were able to demonstrate the value of the risk-index approach in predicting cognitive development (Sameroff et al., 1987, 1993). A recent study using data from the national Early Head Start Research Project, which this study is a subsample of, was conducted to explore the predictive power of cumulative risk indices. This study concluded that the dichotomized approach outperformed the decile and quartile approach for predicting differences in outcomes. They also concluded that theoretically based risk indices were the most predictive and that predictive power increases with the inclusion of more indicators (e.g., 4 versus 13 indicators; Puma et al., 2006). The following variables were used to create the cumulative risk index: child is male; mother was a teen when child was born, below average income for this group, mother has not completed high school, mother has below average vocabulary score, and mother has a high depression score indicative of depression. A score of 0-6 is possible for this index with a 6 indicating high risk.

### **Analysis of Data**

A detailed data analysis plan is described below for each research question.

Several statistical techniques were used to analyze data, depending on the level of measurement each instrument provides and the nature of each research question. Data were integrated from standardized instruments, direct observation, interviews, and self-report, combining new second-grade data with extant longitudinal data from the Early Head Start research sample. Data were processed and analyzed using well-established procedures for integrating longitudinal data sets. Data files from both data sets were examined, and necessary variable names were changed to consistent names across age points. Missing values were identified consistently across data sets, and value labels were added as needed. Data were examined initially through the use of descriptives, histograms, frequency distributions, and scatter-plots to ensure that the data are accurate, normally distributed, and free of outliers. For those variables that were combined into a single composite, such as reading ability and reading comprehension, all individual data points were standardized by converting to  $z$ -scores prior to computing the composite. The reading ability composite consisted of the Woodcock-Johnson Letter Word Identification and Word Attack subscales and the CTOPP subscales. This composite is comprised of measures of decoding, fluency, and memory and while it is primarily a measure of processing ability it will be referred to as reading ability. The reading comprehension composite consists of the Woodcock-Johnson Passage Comprehension and Listening Comprehension subscales. While this is more than a measure of just reading comprehension and may be considered a measure of general language comprehension it will be referred to as reading comprehension throughout the study.

Analytic strategies included using predictive models to test environmental and



child development data at the earlier time points in relation to continuous vocabulary, reading ability, and reading comprehension scores at the second-grade time point. Initial data analyses explored relations between dependent and independent variables. Pearson correlation coefficients were used to explore patterns of bivariate relations among the variables (see Table 4 shown later in this document).

Specifically, correlations between early literacy variables (e.g., vocabulary, print awareness) and later reading comprehension were explored to determine which specific skills are important in the prekindergarten years for later reading comprehension and also to determine the most parsimonious model for predicting from earlier to later time points. Multiple regression analyses were used to determine which relations among the several interrelated variables contribute to outcomes independently of the other variables (Figure 2). The multiple regression analyses were conducted with cumulative risk and 36- and 54-month variables entered in separate blocks to determine if 54-month variables, due to their proximity to second-grade outcomes, add predictive power to the regression models above and beyond 36-month variables.

Path analysis, an extension of regression modeling, was conducted to examine several models and to compare the direct influences of early family risk, environmental supports, and child developmental indicators on later vocabulary, reading ability, and reading comprehension. Path analysis can examine more complicated models, incorporating indirect effects that involve a conceptual chain of events. Path estimates were calculated by maximum likelihood estimation (MLE) using the statistical package Mplus Version 5.1 (Muthén & Muthén, 1998-2006). A sample-size-adjusted Bayesian

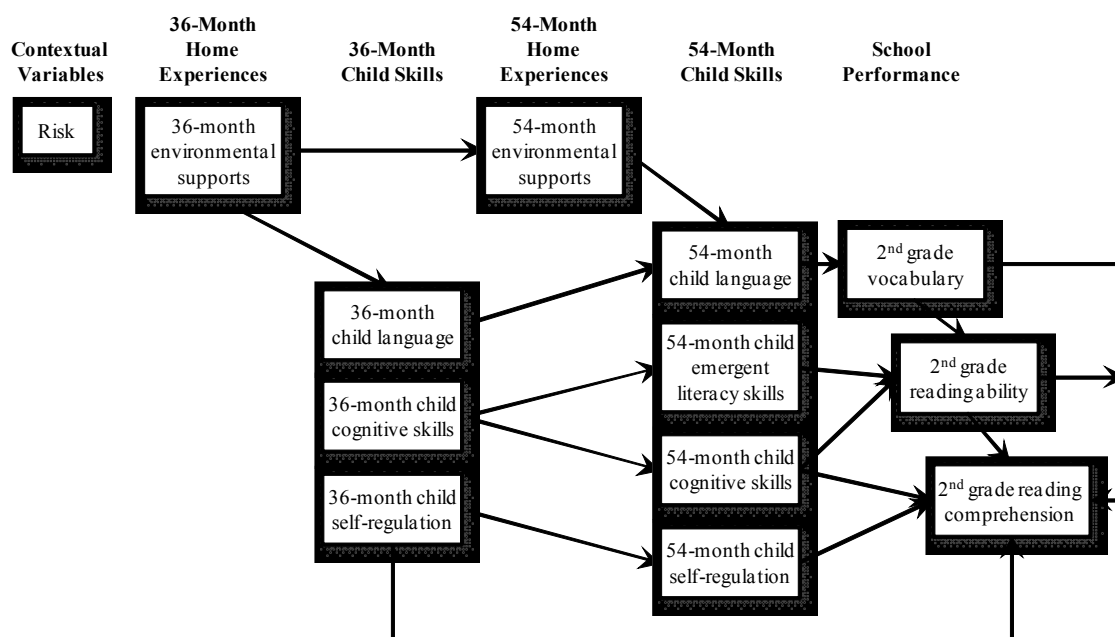


Figure 2. Reading and reading comprehension analytic model.

information criterion was used to determine which models best fit the data. In addition, RSMEA, CFI, and TLI goodness-of-fit indices were computed and compared across the final path models which were determined by the magnitude of the path coefficients from home and parenting behaviors and earlier child developmental indicators to second-grade vocabulary, reading ability, and reading comprehension outcomes.

MPlus was also used to examine mediation and moderation in the final models.

Susman-Stillman, Kalkoske, and Egeland (1996) stated,

A mediator model attempts to discern why or how effects may occur rather than informing under what conditions an effect may occur. Thus, mediation models provide better support for conceptually causal process models. A variable is considered to be a mediator when it accounts for all or part of the relation between the independent variable and the dependent variable. (p. 36)

Moderation analysis is distinctly different and used to discern under what conditions an

effect may occur. Moderation analysis was conducted in this study to determine if the association between vocabulary and reading comprehension is different at different levels of reading ability.

Slopes for vocabulary, across the age points of 36 months, PreK, and second-grade, were calculated and examined in the path models, but 36-month vocabulary was a better predictor of outcomes than either of the other vocabulary scores and also a better predictor of outcomes than the slopes. Therefore, slopes are not reported in any of the results. Slopes for the home environment measures were originally intended to be examined, but this aspect of the data analysis was eliminated. Due to the different items across versions of the HOME measure used at each age, the difference in scale total scores at different ages, and the different aspects of the environment that are considered appropriate for each age, it was determined that growth over time in this measure of the home environment was not an appropriate expectation (B. Bradley, personal communication, November 2009). Therefore, the slopes for the HOME measure were not examined.

## CHAPTER IV

### RESULTS

#### Descriptive Information

Descriptive statistics were examined for all study variables and are reported in Table 3. The *t* tests were examined between program and comparison groups for the second-grade outcomes. No significant group differences were found. Attrition analyses were also conducted on seven demographic variables: family income, risk status, child cognitive ability at 36 months, maternal ethnicity, marital status, mother age, and mother education level. Of the 7 variables examined only maternal education was statistically significantly different for those subjects that remained in the study with a slightly lower education level for those subjects who were either lost or dropped out of the study (11.5 years vs. 12.4 years).

*Research question 1: What early environmental supports predict later reading, given varying levels of risk for academic problems? Because children vary in the number of risks they face, a cumulative risk variable was used as a covariate in regression analyses for this question.*

*a. Which aspects of early environmental supports (i.e., quality of home environment, number of books available, frequency of family reading, and parent supportiveness) measured at 36 and 54 months are related to second-grade vocabulary, reading ability, and reading comprehension?*

Zero-order correlations between child environmental skills and reading

Table 3

*Descriptive Information for Study Variables*

Variable	<i>n</i>	Min	Max	Mean	<i>SD</i>
HOME language & literacy subscale					
36 mo	93	8	13	12.02	1.20
Parent-child interaction: Supportiveness					
36 mo	87	2.33	6.33	4.39	.83
Frequency of family reading (1-never; 4-every day)					
36 mo	99	1	4	2.46	1.00
54 mo	109	1	4	3.28	.83
Passage comprehension					
Second grade	117	70	139	113.01	12.14
Fluency					
Second grade	117	61	133	98.13	12.52
Decoding					
54 mo	99	68	132	90.47	12.92
Second grade	117	40	154	115.30	16.60
Phonological awareness					
Second grade	115	73	127	102.43	12.53
Phonological memory					
Second grade	116	55	127	94.98	12.84
Knowledge of phonics					
Second grade	117	69	152	113.67	15.36
Listening comprehension (raw score)					
Second grade	115	11	29	21.84	3.12
Oral comprehension: Story and print					
54 mo	101	0	6	4.52	1.55
Early literacy: Story and print					
54 mo	101	0	5	3.42	1.19
Cognitive development: Bayley MDI					
36 mo	81	54	134	96.74	13.45
Cognitive development: Applied problems					
54 mo	99	56	124	99.81	14.13
Self-regulation: Bayley BRS					
36 mo	88	2	5	4.32	.74
Self-regulation: Leiter					
54 mo	100	67	109	95.20	8.50
Emotion regulation: Leiter					
54 mo	101	76	113	92.32	6.56

*(table continues)*

Variable	<i>n</i>	Min	Max	Mean	<i>SD</i>
Vocabulary: Receptive					
36 mo	83	40	121	88.95	15.24
54 mo	98	61	134	99.91	15.06
Second grade	116	74	130	98.53	12.38
Reading/decoding second grade composite	103	-12.49	7.63	.05	3.95
Reading comprehension second grade composite	105	-4.12	9.04	.04	1.96
Risk	116	0	6	1.88	1.54

comprehension were explored were explored to determine which specific skills are important in the early years for later vocabulary, reading ability, and reading comprehension, and also to determine the most parsimonious model for predicting from earlier to later time points (Table 4). Of the environmental variables that were examined, second-grade vocabulary scores were significantly correlated with 36- and 54-month quality of home environment, 36- and 54-month number of books available, and 54-month frequency of family reading. Reading ability scores in second-grade were associated only with 36-month quality of home environment and 36-month parent supportiveness. Reading comprehension scores approached significance with 36-month parent supportiveness. Thus, the most consistent predictor of all second-grade outcomes was the quality of the home environment. Variables that were statistically significantly correlated were then included in models predicting language, reading, and comprehension outcomes.

Partial correlations between early environmental supports and later reading comprehension, partialling out cumulative risk, were explored to identify any early environmental supports with potential long-term impacts on reading (Table 5). Only two

Table 4

*Bivariate Correlations of the 36- and 54-Month Environmental Supports and Child Developmental Skills with Second-Grade Reading and Vocabulary Outcomes (n = 82-106)*

Variables	Second-grade outcomes		
	Vocabulary	Reading ability composite	Comprehension composite
36-month variables			
Quality of home environment	.295*	.222*	.095
Maternal supportiveness	.201	.239*	.208 <sup>+</sup>
Frequency of reading	-.080	.032	.146
# of children's books in home	.217*	.102	.067
Cognitive development	.353**	.323**	.382*
Vocabulary	.503**	.211 <sup>+</sup>	.266*
54-month variables			
Quality of home environment	.371**	.156	.086
Maternal supportiveness	.052	.185 <sup>+</sup>	-.071
Frequency of reading	.222*	-.052	-.157
# of children's books in home	.268**	.127	.158
Book knowledge	.369**	.141	.127
Oral comprehension	.372**	.243*	.302**
Sustained attention	.094	.249*	.385**
Vocabulary	.588**	.302**	.382**
Letter word knowledge	.204*	.135	.195 <sup>+</sup>
Math ability	.552**	.382**	.438**
Emotion regulation (Leiter)	.122	.201 <sup>+</sup>	.061

*Note.* Tested separately for EHS and Comparison groups with similar patterns.

\* Correlation is significant at the 0.05 level (2-tailed).

\*\* Correlation is significant at the 0.01 level (2-tailed).

+ Correlation is significant at the 0.10 level (2-tailed).

partial correlations were significant, 36-month quality of the home environment with second-grade vocabulary and 36-month frequency of family reading with second-grade reading comprehension. Three partial correlations approached significance, 36-month quality of the home environment with second-grade reading ability and 36-month parent supportiveness with second-grade reading ability and reading comprehension.

Table 5

*Partial Correlations of 36- and 54-Month Environmental Supports with Second-Grade Reading and Vocabulary Outcomes Controlling for Risk (n = 73-84)*

Variables	Second-grade outcomes		
	Vocabulary	Reading ability composite	Comprehension composite
36-month			
Quality of home environment	.281*	.223 <sup>+</sup>	.144
Parent supportiveness	.177	.218 <sup>+</sup>	.219 <sup>+</sup>
Frequency of family reading	-.055	.122	.239*
Number of books in home	.118	.151	.106
54-month			
Quality of home environment	.110	.115	.099
Parent supportiveness during play	.166	.096	-.118
Frequency of family reading	.043	-.071	-.143
Number of books in home	.071	.023	.172

\* Correlation is significant at the .05 level (2-tailed).

\*\* Correlation is significant at the .01 level (2-tailed).

+ Correlation is significant at the .10 level (2-tailed).

b. *What combination of early environmental supports best predicts second-grade vocabulary, reading ability, and reading comprehension?*

Models were tested that predicted second-grade child vocabulary, reading ability, and reading comprehension, as continuous measures, using linear regression and controlling for cumulative risk. From the extant data set, assessments of environmental supports were examined in multiple regression models to estimate the combined influence of various supports on later vocabulary, reading ability, and reading comprehension, given equal levels of risk. These supports included quality of the home environment to determine if home environment variables make independent contributions



when entered into the same regression model as risk and other predictors. Analyses were conducted separately for 36- and 54-month predictor variables.

First, regression models were tested with second-grade vocabulary as the dependent variable (Table 6). The combination of 36-month home environment and the number of children's books in the home significantly predicted second-grade vocabulary, controlling for cumulative risk. The 54-month measures of quality of the home environment, family reading frequency, and number of books available also statistically significantly predicted second-grade vocabulary, controlling for cumulative risk.

Next, regression models were tested with second-grade reading ability as the dependent variable (Table 7). The combination of 36-month home environment and parent supportiveness variables approached statistical significance in predicting second-grade reading ability, controlling for cumulative risk. The 54-month measure of parent supportiveness significantly predicted second-grade reading ability.

Then, a multiple regression analysis of second-grade reading comprehension was conducted (Table 8). The combination of 36-month measures of parent supportiveness and reading frequency were statistically significantly related to second-grade reading comprehension. The 54-month measure of the number of books available also approached statistical significance in predicting second-grade reading comprehension.

Finally, both 36-month and 54-month measures of environmental supports were examined together to test additive models in which each set of predictors is tested while controlling for the other set. A multiple regression model was tested to examine the additive effects of the 54-month variables on second-grade vocabulary, while controlling

Table 6

*Regressions of Early Environmental Supports Predicting Second-Grade Vocabulary*

Step predictors	<i>t</i> entry	<i>t</i> final	<i>B</i>	SEB	$\beta$	$R^2$ step	$\Delta R^2$	<i>F</i> change	<i>df</i>
<i>Model A: 36-month predictors</i>									
Step 1. Cumulative risk index	-1.70 <sup>+</sup>	-.13	-.13	1.04	-.02	.03			
Step 2. 36m home environment		2.09*	1.05	.50	.26				
36m # of children's books in home		.61	1.20	1.97	.07	.09	.06	2.91 <sup>+</sup>	90
<i>Model B: 54-month predictors</i>									
Step 1. Cumulative risk index	-2.77*	-.81	-.70	.87	-.09	.07			
Step 2. 54m home environment		2.69*	.70	.26	.27				
54m reading frequency		1.41	3.42	2.42	.14				
54m # of children's books in home		1.66 <sup>+</sup>	5.59	3.36	.17	.20	.17	5.19*	99

\*  $p < .05$ \*\*  $p < .01$ +  $p < .10$

Table 7

*Regressions of Early Environmental Supports Predicting Second-Grade Reading Ability*

Step predictors	<i>t</i> entry	<i>t</i> final	<i>B</i>	SEB	$\beta$	$R^2$ step	$\Delta R^2$	<i>F</i> change	<i>df</i>
<i>Model A: 36-month predictors</i>									
Step 1. Cumulative risk index	-.68	.57	.16	.27	.07	.01			
Step 2. 36m home environment		1.81 <sup>+</sup>	.25	.14	.24				
36m parent supportiveness of play		1.80 <sup>+</sup>	.81	.45	.20	.10	.06	3.77*	76
<i>Model B: 54-month predictors</i>									
Step 1. Cumulative risk index	-1.54	-1.19	-.27	.23	-.13	.03			
Step 2. 54m parent supportiveness of play		1.48	.48	.32	.16	.05	.03	2.19	90

\*  $p < .05$ \*\*  $p < .01$ +  $p < .10$

Table 8

*Regressions of Early Environmental Supports Predicting Second-Grade Reading Comprehension*

Step predictors	<i>t</i> entry	<i>t</i> final	<i>B</i>	SEB	$\beta$	<i>R</i> <sup>2</sup> step	$\Delta R^2$	<i>F</i> change	<i>df</i>
<i>Model A: 36-month predictors</i>									
Step 1. Cumulative risk index	.52	.72	.08	.12	.08	.00			
Step 2. 36m parent supportiveness of play		2.36*	.52	.22	.27				
36m reading frequency		1.79 <sup>+</sup>	.21	.12	.20	.09	.06	3.67*	79
<i>Model B: 54-month predictors</i>									
Step 1. Cumulative risk index	-.14	.68	.07	.10	.08	.00			
Step 2. 54m # of children's books in home		1.72 <sup>+</sup>	.76	.44	.19	.03	.01	2.95 <sup>+</sup>	100

\*  $p < .05$ \*\*  $p < .01$ +  $p < .10$

for 36-month and risk variables and was statistically significant (Table 9). This model indicates an additive effect of 54-month variables on second-grade vocabulary as shown by the increased  $R^2$  from .07 to .20,  $F = 3.95$ ,  $p < .01$ . Additional multiple regression models were tested to examine the additive effects of the 54-month variables on second-grade reading ability and reading comprehension by entering cumulative risk in the first block, 36-month variables in the second block, and 54-month variables in the final block (Tables 10 and 11). The results of these models indicate that the addition of the 54-month variables does not significantly increase the  $R^2$  and thus indicate no additive influence of 54-month variables on second-grade reading ability or reading comprehension. Thus, the only model that showed an additive effect of 54-month variables was the model for second-grade vocabulary.

*c. Does timing matter, that is, do environmental supports at 54 months, because of their temporal proximity to second-grade outcomes, mediate any impact of earlier environmental supports at 36 months on second-grade reading?*

Support for mediation has three requirements (Baron & Kenny, 1986; Kline, 2004). First, the distal predictor must be significantly related to the outcome. Second, the proposed mediator must be significantly related to the outcome, when controlling for the distal predictor. Third, the distal predictor must be significantly related to the proposed mediator. The direction of these associations must be consistent with the conceptual model of mediation. For this question, the associations of the distal predictors at 36 months with second-grade outcomes were established in previous analyses. Additional analyses were needed to test the indirect effects of the 36-month predictors.

Table 9

*Regressions of Early Environmental Supports Predicting Second-Grade Vocabulary Controlling for 36-Month Predictors*

Step predictors	<i>t</i> entry	<i>t</i> final	<i>B</i>	SEB	$\beta$	$R^2$ step	$\Delta R^2$	<i>F</i> change	<i>df</i>
Step 1. Cumulative risk index	-1.49	.28	.31	1.08	.04	.03			
Step 2. 36m home environment	1.64 <sup>+</sup>	.73	.42	.57	.10				
36m # of children's books in home	.53	-.24	-.53	2.23	-.03	.07	.04	1.88	
Step 3. 54m home environment		2.14*	.66	.31	.26				
54m reading frequency		1.65 <sup>+</sup>	4.67	2.82	.18				
54m # of children's books in home		1.34	6.44	4.83	.17	.20	.13	3.95*	82

\*  $p < .05$ \*\*  $p < .01$ +  $p < .10$ 

Table 10

*Regressions of Early Environmental Supports Predicting Second-Grade Reading Ability Controlling for 36-Month Predictors*

Step predictors	<i>t</i> entry	<i>t</i> final	<i>B</i>	SEB	$\beta$	$R^2$ step	$\Delta R^2$	<i>F</i> change	<i>df</i>
Step 1. Cumulative risk index	-.42	.88	.26	.29	.12	.00			
Step 2. 36m home environment	1.82 <sup>+</sup>	1.90 <sup>+</sup>	.27	.14	.25				
36m parent supportiveness of play	1.73 <sup>+</sup>	1.47	.70	.47	.17	.09	.05	3.40*	
Step 3. 54m parent supportiveness of play		1.09	.38	.35	.13	.11	.06	1.18	72

\*  $p < .05$ \*\*  $p < .01$ +  $p < .10$

Table 11

*Regressions of Early Environmental Supports Predicting Second-Grade Reading Comprehension Controlling for 36-Month**Predictors*

Step predictors	<i>t</i> entry	<i>t</i> final	<i>B</i>	SEB	$\beta$	$R^2$ step	$\Delta R^2$	<i>F</i> change	<i>df</i>
Step 1. Cumulative risk index	.53	1.06	.14	.13	.13	.00			
Step 2. 36m parent supportiveness of play	2.33*	2.13*	.48	.23	.25				
36m Reading frequency	1.70 <sup>+</sup>	1.65 <sup>+</sup>	.20	.12	.19	.09	.05	3.49*	
Step 3. 54m # of children's books in home		.98	.61	.62	.12	.10	.05	.96	78

\*  $p < .05$ \*\*  $p < .01$ +  $p < .10$

The advantage of using MPlus is that it has the ability to combine multiple types of data correctly into one single statistical model and can simultaneously model several related regressions. It also has the ability to account for missing data by using full information maximum likelihood to compute standard errors using the average of the standard errors and the between analysis parameter estimates of the observed rather than the expected information matrix (Muthen, 2003).

Three models were tested using MPlus to determine which variables in each model had indirect effects and to examine mediation. The first model predicted second-grade vocabulary from 36- and 54-month quality of the home environment, 36- and 54-month number of books available, 54-month frequency of family reading, and cumulative risk. The model indicated an indirect effect on second-grade vocabulary by 36-month quality of home environment through 54-month quality of home environment. As indicated by a statistically significant mediation effect, *Sobel test* = 2.23,  $p < .05$ , the effect of the home environment at 36 months on second-grade vocabulary was partially mediated by the home environment at 54 months.

The second model predicted second-grade reading ability from 36-month quality of the home environment, 36- and 54-month parent supportiveness, and cumulative risk. None of the 36-month variables had indirect effects on second-grade reading ability, and thus none of the paths were mediated. The third model predicted second-grade reading comprehension from 36-month parent supportiveness, 36-month frequency of family reading, 54-month number of books available, and cumulative risk. None of the 36-month variables had indirect effects on second-grade reading comprehension, and thus



none of the paths were mediated. Thus, the only variable that mediated earlier significant predictors was 54-month quality of home environment as a predictor of second-grade vocabulary.

*Research question 2: What early developmental skills predict later reading, given varying levels of risk for academic problems? Again, cumulative risk will be used as a covariate in all analyses for this question.*

a. Which *early developmental skills* (i.e., vocabulary, cognitive skills, self-regulatory skills, and early literacy skills) measured at 36 and 54 months are related to second-grade vocabulary, reading ability, and reading comprehension?

Zero-order correlations between child developmental skills and reading comprehension were explored to determine which specific skills are important in the early years for later vocabulary, reading ability, and reading comprehension and also to determine the most parsimonious model for predicting from earlier to later time points (Table 4). Specifically, correlations between second-grade outcomes and developmental measures at 36 and 54 months were explored to determine which specific skills in the prekindergarten years are related to later reading. Several correlations showed that second-grade vocabulary, reading ability, and reading comprehension were statistically significantly related to 36-month cognitive development, 36- and 54-month vocabulary, 54-month oral comprehension, and 54-month math ability.

Partial correlations between children's early developmental skills at ages 36 and 54 months and their later skills in second grade, controlling for cumulative risk, were then examined. The early developmental skills included child cognitive ability at 36

months, vocabulary at 36 and 54 months, book knowledge and oral comprehension at 54 months, letter-word identification and math ability at 54 months, and attention and emotion regulation at 54 months. Second-grade skills included vocabulary, reading ability, and reading comprehension scores (Table 12). Several partial correlations showed early developmental indicators that, at equivalent levels of risk, were significantly correlated with second-grade vocabulary, including 36-month cognitive ability, 36- and 54-month vocabulary, 54-month book knowledge, 54-month oral comprehension, and 54-month math ability. Three partial correlations with reading ability were statistically significant, including those with 36-month cognitive ability, 54-month math ability,

Table 12

*Partial Correlations of the 36- and 54-month Child Developmental Skills with Second-Grade Reading and Vocabulary Outcomes Controlling for Risk (n = 72-101)*

Variables	Second-grade outcomes		
	Vocabulary	Reading ability composite	Comprehension composite
36-month variables			
Cognitive development	.375**	.356*	.522**
Vocabulary	.526**	.202	.300*
54-month variables			
Book knowledge	.480**	.108	.364**
Oral comprehension	.471**	.183	.302*
Sustained attention	.185	.141	.298*
Vocabulary	.599**	.171	.361*
Letter word knowledge	.067	-.125	.035
Math ability	.627**	.285*	.467**
Emotion regulation (Leiter)	.185	.348*	.266+

\* Correlation is significant at the 0.05 level (2-tailed).

\*\* Correlation is significant at the 0.01 level (2-tailed).

+ Correlation is significant at the 0.10 level (2-tailed).

and 54-month emotion regulation. Seven partial correlations with second- grade reading comprehension were statistically significantly correlated, including those with 36-month cognitive ability, 36- and 54-month vocabulary, 54-month book knowledge, 54-month oral comprehension, 54-month sustained attention, and 54-month math ability.

b. What combination of *early developmental skills* (i.e., vocabulary, cognitive skills, and self-regulatory skills), measured at 36 and 54 months best predict second-grade vocabulary, reading ability, and reading comprehension?

Models were tested that predicted second-grade child vocabulary, reading ability, and reading comprehension, as continuous measures, using multiple regression and controlling for cumulative risk. Correlations were again examined to develop a parsimonious model for this question. From the extant data set, child developmental skills at 36 months were examined in multiple regression analyses to estimate their potential influence on second-grade vocabulary, reading ability, and reading comprehension. These early developmental indicators included vocabulary and cognitive variables. Analyses were then conducted with similar indicators measured at 54 months. A series of regression models were tested that predicted second-grade vocabulary with 36- and 54-month predictors separately (Table 13).

The first model included risk, 36-month cognitive development, and 36-month vocabulary and significantly predicted second-grade vocabulary. The 54-month measures of book knowledge, oral comprehension, vocabulary, letter-word knowledge, and math ability also statistically significantly predicted second-grade vocabulary, controlling for cumulative risk.

Table 13

*Regressions of Early Developmental Skills Predicting Second-Grade Vocabulary*

Step predictors	<i>t</i> entry	<i>t</i> final	<i>B</i>	SEB	$\beta$	$R^2$ step	$\Delta R^2$	<i>F</i> change	<i>df</i>
<i>Model A: 36-month predictors</i>									
Step 1. Cumulative risk index	-.72	1.17	1.11	.95	.13	.01			
Step 2. 36m cognitive development		-.12	-.02	.13	-.02				
36m vocabulary		3.78**	.49	.13	.56	.26	.23	11.81**	73
<i>Model B: 54-month predictors</i>									
Step 1. Cumulative risk index	-2.15*	.24	.16	.68	.02	.05			
Step 2. 54m book knowledge		.69	.64	.92	.06				
54m oral comprehension		.93	.65	.70	.08				
54m vocabulary		3.27*	.28	.09	.35				
54m letter-word knowledge		-.58	-.05	.08	-.05				
54m math ability		3.70**	.31	.09	.37	.46	.42	13.65**	96

\*  $p < .05$ \*\*  $p < .01$ +  $p < .10$

Next, a series of multiple regression models predicting second-grade reading ability were tested with 36- and 54-month predictors separately (Table 14). The first model included 36-month cognitive development and 36-month vocabulary and was statistically significant. The second model included 54-month oral comprehension, vocabulary, sustained attention, emotion regulation, and math ability and was also statistically significant.

Third, a series of multiple regression models predicting second-grade reading comprehension were tested with 36- and 54-month predictors separately (Table 15). The first model included 36-month cognitive development and vocabulary and was statistically significant. The second model included 54-month book knowledge, oral comprehension, sustained attention, vocabulary, letter-word knowledge, and math ability and was also statistically significant, controlling for risk.

In partial correlations controlling for risk, all variables were statistically significantly correlated with reading comprehension. When attempting to find a more parsimonious model, omitting any of these variables resulted in a nonsignificant model. Again, the combination of predictors are different for each outcome, but it is clear that various early developmental skills contribute to later vocabulary and reading outcomes.

Finally, both 36-month and 54-month measures of developmental supports were examined together to test additive models in which each set of predictors is tested while controlling for the other set. A multiple regression model was tested to examine the additive effects of 54-month variables on second-grade vocabulary while controlling for 36-month and risk variables (Table 16). This model indicates an additive effect of 54-

Table 14

*Regressions of Early Developmental Skills Predicting Second-Grade Reading Ability*

Step predictors	<i>t</i> entry	<i>t</i> final	<i>B</i>	SEB	$\beta$	$R^2$ step	$\Delta R^2$	<i>F</i> change	<i>df</i>
<i>Model A: 36-month predictors</i>									
Step 1. Cumulative risk index	-.12	.55	.14	.26	.07	.00			
Step 2. 36m cognitive Development		2.20*	.08	.04	.37				
36m Vocabulary		.03	.00	.04	.01	.13	.09	4.60*	65
<i>Model B: 54-month predictors</i>									
Step 1. Cumulative risk index	-1.18	-.20	-.05	.23	-.02	.02			
Step 2. 54m oral comprehension		.02	.01	.27	.00				
54m vocabulary		.93	.03	.03	.13				
54m sustained attention		.17	.02	.14	.02				
54m emotion regulation		1.26	.07	.05	.14				
54m math ability		1.86 <sup>+</sup>	.06	.03	.25	.18	.11	2.93*	82

\*  $p < .05$ \*\*  $p < .01$ +  $p < .10$

Table 15

*Regressions of Early Developmental Skills Predicting Second-Grade Reading Comprehension*

Step predictors	<i>t</i> entry	<i>t</i> final	<i>B</i>	SEB	$\beta$	$R^2$ step	$\Delta R^2$	<i>F</i> change	<i>df</i>
<i>Model A: 36 Month Predictors</i>									
Step 1. Cumulative risk index	.91	2.14*	.25	.12	.26	.01			
Step 2. 36m cognitive development		2.17*	.04	.02	.34				
36m vocabulary		1.05	.02	.02	.17	.22	.18	8.31**	67
<i>Model B: 54-month predictors</i>									
Step 1. Cumulative risk index	.41	1.93 <sup>+</sup>	.19	.10	.19	.00			
Step 2. 54m book knowledge		-1.77 <sup>+</sup>	-.26	.15	-.21				
54m oral comprehension		1.54	.19	.12	.17				
54m vocabulary		1.48	.02	.01	.20				
54m sustained attention		2.16*	.13	.06	.24				
54m letter-word knowledge		.35	.00	.01	.04				
54m math ability		2.09*	.03	.01	.26	.30	.24	5.65**	86

\*  $p < .05$ \*\*  $p < .01$ +  $p < .10$

Table 16

*Regressions of Early Developmental Skills Predicting Second-Grade Vocabulary Controlling for 36-Month Predictors*

Step predictors	<i>t</i> entry	<i>t</i> final	<i>B</i>	SEB	$\beta$	$R^2$ step	$\Delta R^2$	<i>F</i> change	<i>df</i>
Step 1. Cumulative risk index	-.65	1.67 <sup>+</sup>	1.25	.75	.15	.01			
Step 2. 36m cognitive development	.06	-2.38*	-.27	.11	-.31				
36m vocabulary	3.59**	2.29*	.24	.11	.28	.26	.22	11.05**	
Step 3. 54m book knowledge		.66	.72	1.08	.08				
54m oral comprehension		1.67 <sup>+</sup>	1.44	.86	.16				
54m vocabulary		3.38**	.31	.09	.39				
54m letter-word knowledge		-.42	-.04	.09	-.04				
54m math ability		3.04*	.31	.10	.34	.58	.32	9.40**	69

\*  $p < .05$ \*\*  $p < .01$ +  $p < .10$



month variables on second-grade vocabulary as shown by the increased  $R^2$  from .26 to .58,  $F$  change = 9.40,  $p < .01$ .

Next, a multiple regression model was tested to examine the additive influence of 54-month variables on second-grade reading ability while controlling for 36-month and risk variables (Table 17) and while adding the 54-month variables did significantly improve the model it appears that 36-month cognitive ability is the best developmental predictor of second-grade reading ability and indicates no additive influence of 54-month variables on the model.

Then, a multiple regression model was tested to examine the additive influence of 54-month variables on second-grade reading comprehension while controlling for 36-month and risk variables (Table 18). Regression results were statistically significant, and while 36-month child developmental skills predicted significantly over and above the cumulative risk score, 54-month child developmental skills did not predict significantly over and above 36-month child developmental skills or cumulative risk indicating no additive influence of 54-month variables on the model. Thus, the only model that showed an additive effect of 54-month variables was the model for second-grade vocabulary.

c. Does timing matter, that is, do *child developmental skills* at 54 months because of their proximity to second-grade outcomes mediate any impact of developmental skills at 36 months on second-grade reading, controlling for cumulative risk?

As previously indicated in question 1, analyses were conducted using MPlus to determine which variables in each model had indirect effects and to examine mediation.

Table 17

*Regressions of Early Developmental Skills Predicting Second-Grade Reading Ability Controlling for 36-Month Predictors*

Step predictors	<i>t</i> entry	<i>t</i> final	<i>B</i>	SEB	$\beta$	<i>R</i> <sup>2</sup> step	$\Delta R^2$	<i>F</i> change	<i>df</i>
Step 1. Cumulative risk index	-.35	.48	.13	.26	.06	.00			
Step 2. 36m cognitive development	1.98*	.97	.05	.05	.22				
36m vocabulary	.45	.21	.01	.04	.04	.15	.10	4.87**	
Step 3. 54m oral comprehension		-.10	-.04	.34	-.02				
54m vocabulary		.13	.00	.03	.02				
54m Sustained attention		-.75	-.13	.17	-.12				
54m emotion regulation		1.12	.07	.06	.16				
54m math ability		1.32	.05	.04	.24	.20	.08	.73	60

\*  $p < .05$ \*\*  $p < .01$ +  $p < .10$

Table 18

*Regressions of Early Developmental Skills Predicting Second-Grade Reading Comprehension Controlling for 36-Month Predictors*

Step predictors	<i>t</i> entry	<i>t</i> final	<i>B</i>	SEB	$\beta$	<i>R</i> <sup>2</sup> step	$\Delta R^2$	<i>F</i> change	<i>df</i>
Step 1. Cumulative risk index	.93	2.10*	.25	.12	.26	.01			
Step 2. 36m cognitive development	2.00*	.50	.01	.02	.10				
36m vocabulary	1.20	.52	.01	.02	.09	.22	.21	7.89**	
Step 3. 54m book knowledge		-1.04	-.19	.18	-.16				
54m oral comprehension		1.02	.16	.16	.14				
54m vocabulary		.71	.01	.02	.12				
54m sustained attention		1.04	.08	.08	.16				
54m letter-word knowledge		.42	.01	.02	.06				
54m math ability		1.35	.02	.02	.22	.31	.19	1.15	63

\*  $p < .05$ \*\*  $p < .01$ +  $p < .10$

The first model predicted second-grade vocabulary from 36-month cognitive development, 36- and 54-month vocabulary, 54-month math ability, and cumulative risk. The model indicated no indirect effects on second-grade vocabulary, and thus none of the paths were mediated.

The second model predicted second-grade reading ability from 36-month cognitive development, 36- and 54-month vocabulary, 54-month oral comprehension, 54-month sustained attention, 54-month math ability, 54-month emotion regulation, and cumulative risk. As indicated by a statistically significant mediation effect, *Sobel test* = 2.12,  $p < .05$ , the effect of vocabulary at 36-months on second-grade reading ability was partially mediated by oral comprehension at 54 months.

The third model predicted second-grade reading comprehension from 36-month cognitive development, 36- and 54-month vocabulary, 54-month book knowledge, 54-month oral comprehension, 54-month sustained attention, 54-month letter-word knowledge, 54-month math ability, and cumulative risk. As indicated by a statistically significant mediation effect, *Sobel test* = 3.00,  $p < .01$ , vocabulary at 36-months was a significant predictor of second-grade reading comprehension and was partially mediated by oral comprehension at 54 months. Cognitive development at 36-months was also a significant predictor of second-grade reading comprehension and was partially mediated by sustained attention at 54 months, as indicated by a statistically significant mediation effect, *Sobel test* = 2.27,  $p < .05$ .

Thus, the only variables that mediated earlier significant predictors were in the models predicting second-grade reading ability and reading comprehension. Mediation

was shown by 54-month oral comprehension, which mediated the effect of 36-month vocabulary on second-grade reading ability and reading comprehension, and 54-month sustained attention, which mediated the effect of 36-month cognitive development on second-grade reading comprehension.

*Research question 3: How do early environmental supports and developmental skills combine to influence second-grade vocabulary, reading ability, and reading comprehension in the context of risk for academic problems?*

A series of path models was tested using multiple regression in SPSS to compare the direct influence of family risk, early environmental supports, and child developmental skills on vocabulary, reading ability, and reading comprehension. These models include direct paths, from 36-month environmental and child developmental variables to second-grade outcomes and indirect paths mediated by 54-month environmental and child developmental variables. Again, cumulative risk was included as a covariate in the analyses.

a. What combination of *early environmental supports and early developmental skills* best predict second-grade vocabulary, reading ability, and reading comprehension?

Models were tested to predict child vocabulary, reading ability, and reading comprehension scores, as continuous measures, using linear regression and controlling for cumulative risk. From the extant data set, assessments of both environmental supports and child developmental skills at 36 months were examined in linear regression analyses to estimate the influence of various supports and skills on later reading ability and reading comprehension scores. Previous models and analyses informed the variables that

were included in this model. Multiple regression analyses were examined to determine if both home environment and child skill variables make independent contributions when entered into the same regression model. Three multiple regression models were tested to estimate the additive influence of 54-month variables while controlling for 36-month and risk variables.

The first regression model predicted second-grade vocabulary from 36-month cognitive development, 36- and 54-month vocabulary, 36- and 54-month home environment, 54-month books available, 54-month parent-child reading frequency, 54-month oral comprehension, 54-month math ability, and the cumulative risk score (Table 19). This model indicates an additive effect of 54-month variables on second-grade vocabulary as shown by the increased  $R^2$  from .28 to .52,  $F = 7.11$ ,  $p < .01$ , indicating an additive influence of 54-month variables on earlier variables.

The second regression model predicted second-grade reading ability from 36-month cognitive development, 36-month home environment, 36-month parent supportiveness, 54-month math ability, and the cumulative risk score (Table 20). The regression was conducted with cumulative risk and 36- and 54-month variables entered in separate blocks. Regression results were statistically significant, and while the 36-month child developmental skills in the second block predicted significantly over and above the cumulative risk score, the 54-month child developmental skills added in the third block did not predict significantly over and above the 36-month child developmental skills. Thus, the 54-month variables did not show an additive influence in this model.

Table 19

*Regressions of Early Environmental and Developmental Skills Predicting Second-Grade Vocabulary Controlling for 36-Month**Predictors*

Step predictors	<i>t</i> entry	<i>t</i> final	<i>B</i>	SEB	$\beta$	<i>R</i> <sup>2</sup> step	$\Delta R^2$	<i>F</i> change	<i>df</i>
Step 1. Cumulative risk index	-.75	1.58	1.44	.91	.18	.01			
Step 2. 36m home environment	.43	.03	.01	.48	.00				
36m cognitive development	-.18	-2.55*	-.29	.12	-.33				
36m vocabulary	3.65**	2.39*	.27	.11	.32	.28	.27	7.58**	
Step 3. 54m home environment		.43	.12	.28	.05				
54m reading frequency		.33	.76	2.33	.03				
54m # of children's books in home		.03	.15	4.49	.00				
54m vocabulary		2.82**	.30	.11	.38				
54m oral comprehension		1.58	1.46	.92	.17				
54m math ability		2.96**	.32	.11	.36	.52	.31	7.11**	66

\*  $p < .05$ \*\*  $p < .01$ +  $p < .10$

Table 20

*Regressions of Early Environmental and Developmental Skills Predicting Second-Grade Reading Ability Controlling for 36-Month**Predictors*

Step predictors	<i>t</i> entry	<i>t</i> final	<i>B</i>	SEB	$\beta$	$R^2$ step	$\Delta R^2$	<i>F</i> change	<i>df</i>
Step 1. Cumulative risk index	.03	.82	.23	.28	.11	.00			
Step 2. Home environment	.55	.50	.08	.16	.07				
36m parent supportiveness	.85	.86	.43	.50	.11				
36m cognitive development	2.12*	1.03	.04	.04	.17	.14	.14	3.35*	
Step 3. 54m math ability		1.42	-.04	.34	-.02	.17	.03	2.01	65

\*  $p < .05$ \*\*  $p < .01$ +  $p < .10$



The third regression model predicted reading comprehension from 36-month cognitive development, 36-month parent-child reading frequency, 36-month parent supportiveness, 54-month book knowledge, 54-month sustained attention, 54-month books in home, 54-month math ability, and the cumulative risk score (Table 21). The regression was conducted with cumulative risk and 36- and 54-month variables entered in separate blocks. Regression results were statistically significant, and while the 36-month child developmental skills predicted significantly over and above the cumulative risk score, the 54-month child developmental skills added in the third block did not predict significantly over and above the 36-month child developmental skills. Thus, indicate no additive influence of 54-month variables in this model.

b. Are the influences of the *early environment* mediated by early impacts of the environment on *developmental skills*?

To provide a more complete picture of the necessary skills and early risk factors that are involved in the development of second-grade language and reading ability, path analysis using maximum likelihood estimators was conducted in MPlus. A path model for each outcome (see Figures 3-5 discussed and shown later in this section) was developed that includes *both environmental and developmental indicators* at 36 and 54 months. Variables that were significantly correlated were included in models predicting second-grade vocabulary, reading ability, and reading comprehension outcomes.

None of the models had an overall model fit that was acceptable. Multiple fit indices can be examined to determine the model fit and are preferred over chi-square due to its sensitivity to sample size, model complexity, and violations of normality (Tanaka,

Table 21

*Regressions of Early Environmental and Developmental Skills Predicting Second-Grade Reading Comprehension Controlling for 36-Month Predictors*

Step predictors	<i>t</i> entry	<i>t</i> final	<i>B</i>	SEB	$\beta$	$R^2$ step	$\Delta R^2$	F change	<i>df</i>
Step 1. Cumulative risk index	1.00	1.89 <sup>+</sup>	.22	.12	.23	.02			
Step 2. 36m cognitive development	3.53**	1.41	.02	.02	.22				
36m parent supportiveness	.78	.81	.17	.21	.09				
36m reading frequency	1.17	1.61	.18	.11	.18	.22	.20	5.31**	
Step 3. 54m book knowledge		-.53	-.08	.15	-.07				
54m # of children's books in home		.44	.27	.62	.05				
54m sustained attention		1.03	.07	.07	.14				
54m math ability		2.04*	.03	.02	.30	.31	.09	1.87	66

\*  $p < .05$

\*\*  $p < .01$

+  $p < .10$

1993). It has been recommended that a relative fit index such as the Comparative Fit Index (CFI) and the Tucker-Lewis Index (TLI) be reported along with a noncentrality based index such as the Root Mean Square Error of Approximation (RSMEA; Bentler, 1990). A CFI > .95, a TLI > .90, and a RSMEA < .06 indicates a good fit. Although multiple models were examined separately for each outcome, an acceptable model fit was not achieved. The best fitting model results for each outcome are presented below.

In the first model (see Figure 3), both the direct path from risk to second-grade vocabulary and the indirect path from risk through 36-month vocabulary were statistically significant,  $\beta = -.22$  and  $\beta = .10$ , respectively, as were the direct paths from 36- and 54-month vocabulary to second-grade vocabulary,  $\beta = .47$  and  $\beta = .36$ , respectively. While the overall model fit was not acceptable, CFI = .235; TLI = -4.74; RMSEA = .95, and 28% of the variance was explained,  $R^2 = .28$ ,  $p < .01$ .

In the second model (Figure 4), there were no significant indirect paths from 36-month variables, but there were significant direct paths from 36-month home environment and parent supportiveness to second-grade reading ability,  $\beta = .41$  and  $\beta = .28$ , respectively. The baseline cumulative risk score was also statistically significantly directly related to second-grade reading ability,  $\beta = -.17$ . While the overall model fit was not acceptable, CFI = .566; TLI = -1.172; RMSEA = .25, and 15% of the variance was explained,  $R^2 = .15$ ,  $p = .01$ .

In the third model (Figure 5), 36-month cognitive ability was both directly related to second-grade reading comprehension,  $\beta = .40$ , and indirectly related through 54-month math ability,  $\beta = .20$ , and 54-month sustained attention,  $\beta = .23$ . The direct paths from the

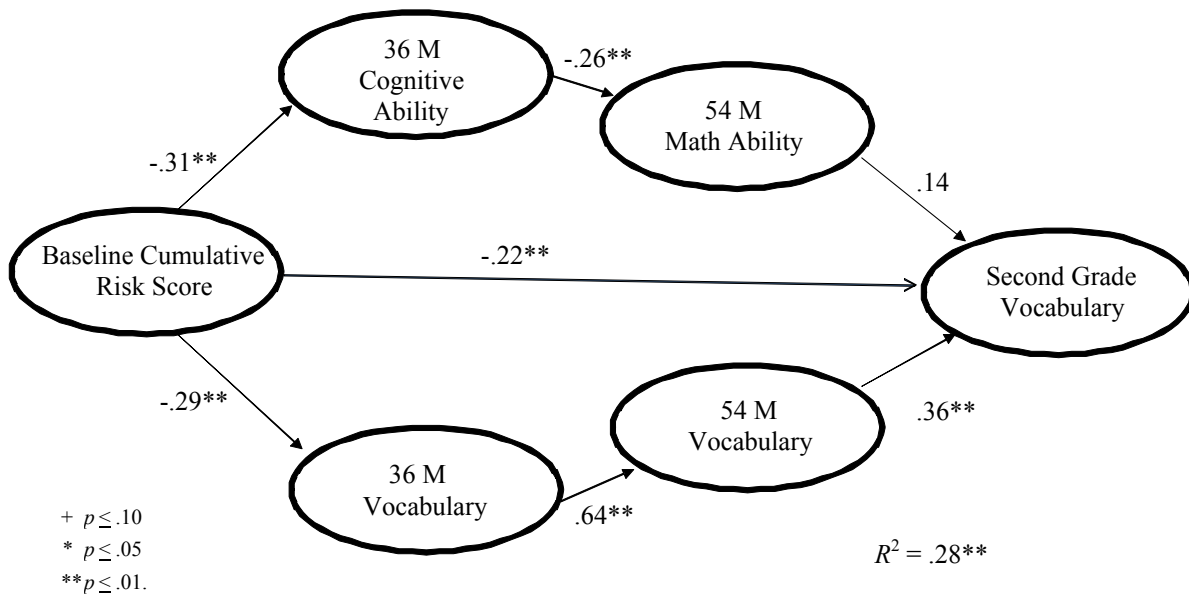


Figure 3. Path model of environmental and developmental indicators of second-grade vocabulary.

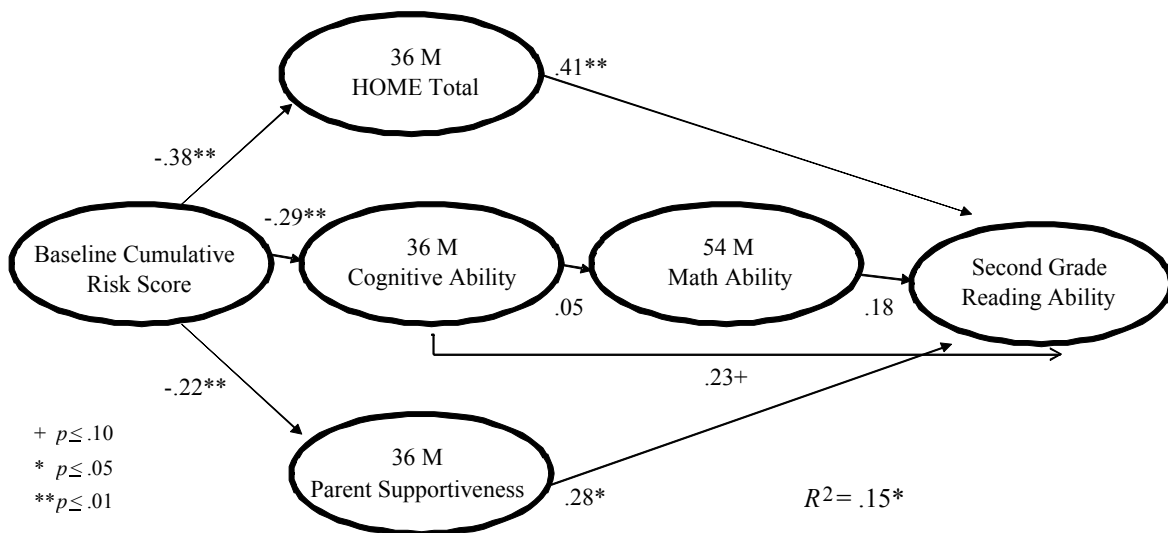


Figure 4. Path model of environmental and developmental indicators of second-grade reading ability.

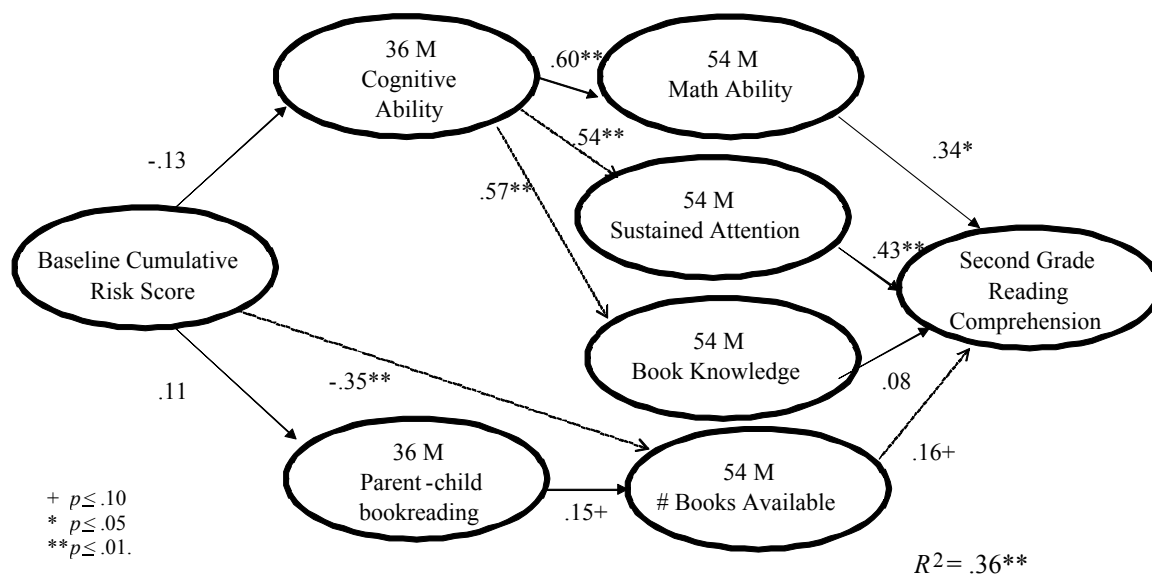


Figure 5. Path model of environmental and developmental indicators of second-grade reading comprehension.

cumulative risk score and 36-month frequency of family reading were significantly related to second-grade reading comprehension,  $\beta = -.15$  and  $\beta = .15$ , respectively. The more proximal variables of 54-month math ability and 54-month sustained attention were also statistically significant,  $\beta = .34$  and  $\beta = .43$ . Again, the overall model fit was not adequate, CFI = .190; TLI = -2.240; RMSEA = .58, and 36% of the variance was explained,  $R^2 = .36$ ,  $p < .01$ .

While none of the models had acceptable fit indices they did have significant  $R^2$ s and explained a considerable amount of the variance. This indicates that the model may be “overfit” or that there are too many variables for the sample size and that while this model has a large  $R^2$  for this group the predictive power for other samples may not be as strong (Colton & Bower, n.d.). This suggests that a more parsimonious model may have a

better fit, but will not necessarily have a stronger  $R^2$ , so while this model is a statistically significant model for this group the predictive power for other groups has not been indicated. The types of fit indicators used in MPlus are fundamentally different than prediction based measures such as  $R^2$  in regression analyses. The typical fit index does not quantify how well the model predicts individual observations in the sample, instead it measures how closely the estimated correlations are to the observed correlations (Bentler & Bonett, 1980; Kline, 2005). It is also suggested that when examining models using MPlus multiple models are identified and the best fitting model is reported. For the above models 3 or more models were tested and the reported models indicate the best fitting model examined.

c. How are the three second-grade outcomes (vocabulary, reading ability, reading comprehension) related to each other? Are they consistently or differentially predicted by similar environmental supports, developmental skills, and their combination?

Multiple regression results from three separate sets of analyses, previously conducted in question 2, were examined to determine if the three outcomes are predicted by the same environmental and child development variables or if they are predicted by different sets of variables. While 36-month cognitive ability is a common predictor in all three models, there are other variables that are unique to each model, indicating that different early predictors are important for each of the three second-grade outcomes (Figures 3-5).

While early vocabulary, at both 36- and 54-months, is the strongest predictor of second-grade vocabulary, which in turn is related to second-grade reading ability and

reading comprehension (Table 22), early vocabulary did not predict reading ability or reading comprehension. This is surprising because early vocabulary is significantly correlated with other predictors of second-grade reading ability and reading comprehension such as cumulative risk, the home environment, maternal supportiveness, and book comprehension. Furthermore, early vocabulary is strongly correlated with the early cognitive measures at both 36 months and 54 months, which consistently predict second-grade reading ability and reading comprehension (Table 23).

Analyses were then conducted to determine if the association between vocabulary and reading comprehension is dependent upon reading ability. An interaction or moderation model was tested to determine if second-grade reading ability moderates the relation between second-grade vocabulary and reading comprehension. Moderation was tested in multiple regression with a multiplicative interaction term. Second-grade reading ability and vocabulary both significantly predicted reading comprehension,  $\beta = .39, p < .01$ ,  $\beta = .28, p < .01$ , respectively, as would be expected, and the moderation analysis

Table 22

*The Bivariate Correlations of Concurrent Second-Grade Reading and Vocabulary*

*Outcomes (n = 115-117)*

Variable	Second-grade vocabulary	Second-grade reading ability	Second-grade reading comprehension
Second-grade vocabulary		.27*	.33*
Second-grade reading ability	.27*		.48*
Second-grade reading comprehension	.33*	.48*	

Table 23

*Bivariate Correlations of the 36- and 54-Month Environmental Supports and Child Developmental Skills with 36- and 54-Month Vocabulary (n = 77-116)*

Variable	36m vocabulary	54m vocabulary
Cumulative risk	-.29*	-.29*
36m home environment	.35*	.25*
36m maternal supportiveness	.34*	.33*
36m cognitive ability	.64*	.58*
54m home environment	.25*	.40*
54m math ability	.54*	.64*
54m book comprehension	.41*	.52*

approached significance. That is, the interaction between second-grade vocabulary and reading ability did predict reading comprehension,  $\beta = 1.25$ ,  $p = .06$ . To interpret this interaction, two models were examined at high and low levels of reading ability. When reading ability was high, vocabulary was a significant predictor of reading comprehension,  $\beta = .32$ ,  $p = .01$ , and when reading ability was low, vocabulary was also a significant predictor of reading comprehension,  $\beta = .29$ ,  $p = .05$ . Thus, vocabulary predicted reading comprehension for both groups and both reading ability and vocabulary contribute to reading comprehension in an additive way.

*Research question 4:* Can a final model improve prediction and identify the most important early factors that early intervention can address? If second-grade outcomes of vocabulary, reading ability, and reading comprehension are consistently predicted by the same set of supports and developmental skills, will the model in Question 3 change if these variables are treated as one outcome factor?



Question 3 results indicate that the three outcome variables (vocabulary, reading ability, and reading comprehension) are predicted by different combinations of predictors, so no further analysis was conducted. Furthermore, structural equation modeling was not appropriate for this question. A number of assumptions and conditions must be met in order to use structural equation modeling (SEM). First, SEM requires a large data set. Recommendations for actual sample size vary, but the complexity of the models, the number of measured variables, and the multivariate normality of the variable distributions must all be taken into consideration when choosing sample sizes. One recommended rule is to use 5 to 10 cases per parameter estimated, including measured variables, path coefficients, and error terms (Bentler & Chou, 1987; Klem, 2000). Stevens (1996) recommended 15 cases per measured variable, while Loehlin (1992) recommends at least 200 cases for 10 variables. Kline (2005) concluded that with fewer than 100 cases, almost any type of SEM analysis is untenable unless a very simple model is evaluated. For this model the sample size drops to just above 100 cases (maximum  $n = 103$ ) and is complex, including a dozen or more variables. For these reasons, it was concluded that further analyses would not be conducted to answer Question 4.

### **Summary**

In summary, these results indicate that for second-grade vocabulary the home environment at both 36 and 54 months, availability of books at 36 and 54 months, and frequency of reading at 54 months are important environmental predictors, while 36-month cognitive ability, 36- and 54-month vocabulary, and 54-month math ability are

important developmental predictors. In the final model predicting second-grade vocabulary, when all significant variables were combined, the significant predictors of second-grade vocabulary were the developmental variables of cognitive ability at 36 months, math ability at 54 months, and vocabulary at both 36 and 54 months.

Overall results for second-grade reading ability indicate that home environment at 36 months and maternal supportiveness at 36 and 54 months are important environmental predictors, while 36-month cognitive ability, 36- and 54-month vocabulary, 54-month oral comprehension, 54-month sustained attention, and 54-month math ability are important developmental predictors. In the final model predicting second-grade reading ability, when all significant variables were combined, the significant predictors of second-grade reading ability were the early variables of cognitive ability, home environment, and maternal supportiveness all from the 36-month time point.

Finally, the results of the second-grade reading comprehension analyses indicate maternal supportiveness at 36-months, reading frequency at 36-months, and the number of books available at 54-months are more important environmental predictors, while 36-month cognitive ability, 36- and 54-month vocabulary, 54-month oral comprehension, 54-month sustained attention, 54-month book knowledge, 54-month letter-word identification, and 54 month math ability are important developmental predictors. In the final model predicting second-grade reading comprehension, when all significant variables were combined, the significant predictors of second-grade reading ability were the early variables of risk and 36-month cognitive ability, and the more proximal variables of 54-month sustained attention and math ability.

## CHAPTER V

### DISCUSSION

The purpose of this study was to identify early predictors of later reading success for children at risk for reading problems. Previous research on reading suggests that this is a problem especially for low-income children, among whom 56% are unable to read proficiently by fourth grade (NAEP, 2004). This study attempts to identify specific environmental supports and developmental skills that are important for learning to read and, in turn, succeeding in school. An overview of the results of this study will be followed by a discussion of the results, the relevance of the results to the theories previously presented, the study's strengths and limitations, and suggestions for future research.

Environmental and developmental influences on children's language and literacy are complex. In general, the results were in the expected direction, with both environmental supports and developmental skills in the years before school predicting children's outcomes in second grade. The contributions of specific early influences, however, depend on the specific outcome and the age of the child. It was anticipated that the three second-grade outcomes might be similarly predicted and that specific recommendations could be made for intervention programs that would help children succeed in all aspects of reading. Unfortunately, the answers to the research questions are much more complex than that, and different recommendations to help children succeed must be discussed by age and for each outcome. Examining both environmental and developmental pathways to literacy, using multiple measures and multivariate analyses,

helped to clearly identify not only which early influences are related to which later outcomes but also which early influences, such as the child's early cognitive ability and home environment, need to be examined further to determine which specific skills and supports would be most beneficial for which children at what age.

### **Early Environmental Supports**

Several environmental supports were related to second-grade language and literacy outcomes. At both ages 3 and 5, the richness of the home environment, reading frequency, books available, and maternal supportiveness were associated with second-grade vocabulary and reading outcomes. These characteristics of the environment are inter-related, of course, and in analyses of multiple predictors, the early environmental supports that predicted later outcomes were more specific. The specific predictors of second-grade vocabulary included the quality of the home environment and the number of books available at ages 3 and 5 and the frequency of parent-child reading at age 5. The only specific predictors of second-grade reading ability were the quality of the home environment at age 3 and maternal supportiveness at ages 3 and 5. In addition, the specific predictors of second-grade reading comprehension were maternal supportiveness and the frequency of parent-child reading at age 3. These results indicate that the home environment, availability of books, and frequency of reading are important predictors of vocabulary, while the home environment and maternal supportiveness are important predictors of reading ability and maternal supportiveness and reading frequency are more important for reading comprehension. Although specific predictors vary by outcome, it is

clear that early environmental supports do contribute to later vocabulary and reading outcomes.

When timing of environmental supports was examined, the only mediator identified was the home environment at age 5, which mediated the influence of the home environment at age 3 on second-grade vocabulary. Second-grade vocabulary was also the only outcome that showed an additive effect of age 5 predictors. This suggests that for second-grade vocabulary timing does matter and that the home environment at age 5 can mediate the impact of earlier environmental supports at age 3 on later vocabulary.

The home environment does affect children's developing language and literacy skills. Parent's support of their child's development is one area of the environment that can either buffer or amplify other aspects of the environment that may have an impact on a child's developmental trajectory. These findings support the family literacy theory. Family literacy researchers have concluded that an environment rich in literacy materials and experiences is more important to a child's early successful literacy development than even the best preschool and kindergarten classrooms (Bus et al., 1995; Dickinson & Tabors, 2001; Hart & Risley, 1995; Jordan et al., 2000; Scarborough & Dobrich, 1994). In these homes, children have access to books and other literacy materials, have reading models, are read to frequently, have parents that are interested and involved in their development and education, and live in homes that are full of supportive and interactive experiences that encourage early literacy skills (Tracey & Morrow, 2006). This theory emphasizes the importance of at-home experiences and the critical role of parents on their children's reading success.

### **Early Developmental Skills**

All early developmental skills tested, except emotion regulation, were strongly correlated with at least one of the second-grade outcomes. For these children, the best predictors of second-grade vocabulary were earlier vocabulary and cognitive development. The best predictor of second-grade reading ability and reading comprehension was earlier cognitive development. Second-grade vocabulary was correlated with vocabulary at ages 3 and 5, cognitive ability at age 3, and math ability, oral comprehension, and book knowledge at age 5. All of these predictors, with the exception of book knowledge, together explained nearly half the variance in second-grade vocabulary.

Early vocabulary has been identified as a strong predictor of later literacy in many other studies of reading (Nation & Snowling, 2000; Qian, 1999; Roggman et al., 2000; Schatschneider et al., 2004; Snow et al., 1998; Stanovich et al., 1984; Whitehurst & Lonigan, 2001). It was shown that in this study early vocabulary was related to second-grade reading ability in bivariate analyses, but when examined in multivariate models there were other stronger predictors of reading, and early vocabulary was not significantly associated with reading ability or reading comprehension. This may be due to the moderate to high intercorrelations between vocabulary and other predictors. At each age point, vocabulary was strongly related to cognitive and other skills and also related to environmental supports, especially the home environment.

Early cognitive ability at age 3 was the best developmental predictor of second-grade reading ability. Age 5 developmental skills did not influence second-grade reading

ability above and beyond age 3 skills. Early cognitive ability at age 3 was also the best early predictor of later reading comprehension. These results suggest that children at risk for later reading difficulties can be identified as early as age 3.

When timing of developmental skills was examined, two mediators were identified, oral comprehension at age 5 for both second-grade reading ability and reading comprehension, and sustained attention at age 5 for reading comprehension. Only for second-grade vocabulary was there an additive effect of age 5 predictors. This suggests that for second-grade vocabulary, reading ability, and reading comprehension timing does matter and that the developmental supports at age 5 can mediate the influence of vocabulary at age 3 and increase the impact of earlier environmental supports at age 3 on vocabulary in second grade.

### **Risk**

When studying early indicators of later outcomes in an at-risk population, it is also important to identify and control for the influence of early risk on later outcomes. Risk factors are simply indicators of a set of influences and are not necessarily expected to have direct effects, but rather, to be mediated by a series of intermediary consequences of the circumstances that are associated with the risk factors. The specific risk factors used in the cumulative risk score include: child is male, mother was a teen when child was born, below average income for this group, mother has not completed high school, mother has below average vocabulary score, and mother has a high depression score indicative of depression, all of which are associated with and exacerbate the overall risk

of living in poverty. Low maternal education, for example, is likely to limit the quality of the child's early experiences more generally and likely to limit the quality of the child's early language environment more specifically. A poor language environment has been shown in repeated research to be related to poor language development (Greenwood, 2010; Hart & Risley, 1995). It is not surprising, then, that in this study, children's vocabulary at age 3 mediated the effects of early risk factors on later vocabulary and reading ability. Similarly, in most models analyzed for this study, the influence of other variables such as home environment and sustained attention were significant predictors after controlling for risk. Meaning that the home environment and a child's ability to sustain attention are both additive and their influence can compensate for earlier risk.

Poverty is the most prevalent risk factor among participants in this study and thus must be considered. Many studies show that children from families living in poverty have lower intelligence scores and cognitive functioning, less academic achievement, and more social-emotional problems even after controlling for family characteristics such as maternal education (McLoyd, 1998). These impacts are greater for children from families whose living conditions are persistently below the poverty threshold than those who experience occasional or transitory poverty (Brooks-Gunn & Duncan, 1997; McLoyd, 1998). It was important for this study, therefore, to identify the mediators of risk that would explain how the indicators of risk may lead to factors that could have more direct causal effects on children's language and learning. Thus, one goal of this study was to identify indirect effects of a set of recognized demographic risk factors on later development. For these children from low-income families, it is difficult to reduce or



eliminate many of the variables that put them at risk, such as maternal age or marital status. Fortunately, however, this study indicates that the negative effects of risk on school-age literacy are mediated by children's vocabulary, which is more modifiable by developmental support or intervention programs such as Early Head Start, which did have impacts on children's vocabulary (Association for Children, Youth, and Families [ACYF], 2002).

Furthermore, although risk was related to second-grade reading comprehension in the final model, the more proximal indicators of math ability and sustained attention were stronger indicators of later reading comprehension. These results highlight the importance of identifying both children's vocabulary and ability to sustain attention early on, long before they begin school, so that necessary supports can be provided for children at risk.

### **Environmental and Developmental Influences Combined**

The results of this study indicate not only that children's early developmental skills contribute to later reading success but also that early environmental supports do. Children's early cognitive skills, vocabulary, sustained attention, and oral comprehension contribute to later reading success, but so do the level of risk, the home environment, maternal supportiveness, books available in the home, and frequency of family reading.

When both environmental and developmental predictors were considered together, the results suggest that earlier, more distal variables are better predictors of reading ability while both distal and proximal variables are better predictors of reading

comprehension. Specifically, reading ability was best predicted by risk, 36-month home environment, 36-month maternal supportiveness, and 36-month cognitive ability, and reading comprehension was best predicted by risk, 36-month maternal supportiveness, 36-month bookreading, 36-month cognitive ability, 54-month math ability, and 54-month sustained attention. Vocabulary was not a significant predictor of reading ability or reading comprehension although it was the strongest indicator of later vocabulary and was related to concurrent measures of cognitive measures that predicted reading ability and reading comprehension.

Although the final path models that included both developmental and environmental predictors did not have adequate fit indices, they do show which predictors are strongest when considering all of them together. The lack of fit for the path models may be due to the small sample size and large number of variables tested. While these models do not have adequate fit, they still indicate that these variables are important in predicting reading success. Clearly, early vocabulary is related to later vocabulary; the early home environment, maternal supportiveness, and early cognitive ability are all indicators of reading ability; and the more proximal indicators of math ability and sustained attention are strong influences on reading comprehension.

Some of the skills that have been identified as necessary for a student for successful reading comprehension include attention, memory, inferencing, motivation, vocabulary knowledge, background knowledge, and comprehension strategies (Snow & Sweet, 2003). These skills are not all necessarily skills that are essential to decoding text. Comprehending text requires different and additional abilities than those required for

decoding text. Simply put, both word recognition and language comprehension combined allows the reader to understand the concepts and ideas provided by the text (Vellutino, 2003). Because these skills are different, it is not surprising that these outcomes have different predictors.

The RAND Reading Study Group defined reading comprehension as “the process of simultaneously extracting and constructing meaning through interaction and involvement with written language” (RAND, 2002), but to reach this goal, decoding and fluency skills must first be acquired and then vocabulary, listening comprehension skills, and background knowledge become important. Comprehension requires the reader to have both background knowledge (related to cognitive development and experience) and working memory available to integrate that that is read with inferences made about the text from information retrieved from long-term memory (Cook et al., 1998). This may explain why the more proximal indicators of cognitive ability are the strongest predictors of reading comprehension. Children may have to already have acquired the ability to decode words and once they are able to decode their ability to comprehend may be related to their ability to extract and construct meaning, both skills related to cognitive ability and more recently gained knowledge. Reading ability depends on component skills such as phonological awareness that could be increased by the earlier and broader language experiences indicated by larger early, vocabularies (Ehri, 2004).

## **Second-Grade Reading Ability and the Relation Between Second-Grade Vocabulary and Reading Comprehension**

Reading ability and vocabulary size are related (Stanovich et al., 1984), in that word recognition is slowed when a child is trying to read a word that is not in their vocabulary, and slowed word recognition makes comprehension more difficult. The possibility of reading ability as a moderator is based on the idea that the first requirement for understanding text is to be able read text, but then after those skills are established, children's background knowledge may come into play and affect reading comprehension. Reading ability does moderate the relation between second-grade vocabulary and reading comprehension. In this study as in many other studies, it is clear that while vocabulary is important to later reading comprehension a strong vocabulary early on does not always lead to later reading comprehension (Snow et al., 2007). Reading ability is somewhat dependent upon vocabulary knowledge but also important for comprehension. Without the ability to read words accurately and fluently, comprehending the meaning of words is extremely difficult. Nevertheless, if the words are unknown, the meaning will not be clear even if the words are read accurately and fluently. This study supports the importance of both vocabulary and reading fluency because fluency "provides a bridge between word recognition and comprehension" (Briggs, 2003). Fluency can be thought of as a moderator or filter. Slow readers use too much processing capacity leaving less for comprehension tasks such as inference and integration (Hannon & Daneman, 2001; Perfetti, 1985). When fluency is adequate or higher, reading comprehension then can be affected by child cognitive and vocabulary skills (RAND, 2002).

### **Results for Children Related to School Success**

The results of this study point to important early foundations for later school success. Once a child has the ability to read and comprehend what he/she is reading, they are then able to do well in other subjects and tasks required to be successful in school (Cunningham & Stanovich, 1998). Solving reading comprehension problems early or preventing them altogether will prevent serious losses in academic achievement.

Children's literacy development is influenced by their early environment as well as by their early cognitive development. Although literacy skills are important for a child entering school, many children also need additional supports in place in order to become good comprehenders and successful students. The long list of predictors in this study alone may make it difficult to know where to start and what the effective steps might be to prepare children for school. Nevertheless, if children at risk for later reading difficulties can be identified early, the negative effects of living in an at-risk family may be ameliorated by effective developmental support services.

Through early identification and intervention programs that build children's language and attention skills, children's risk for poor academic outcomes can be reduced. Children can learn to read with the proper supports, and parents can be taught the skills that children need for future success. While some predictors seem easy to support, such as increased frequency of family reading and the number of books available in a child's home, other predictors such as cognitive ability, the overall home environment, and maternal supportiveness, are likely to be more difficult to change. Early intervention programs and researchers continue to implement new programs and test interventions to

help support those predictors that may be less easily altered. Programs such as Early Head Start and Head Start have shown success in improving home environments and maternal supportiveness (Brooks-Gunn, Berlin, & Fuligni, 2000; Love et al., 2002; Lyons-Ruth, Connell, Grunebaum, & Botein, 1990). Continued support for these programs is important as they implement research-informed strategies to improve outcomes for children from families living in at-risk environments.

### **Theory**

Because there is not one overarching theory that takes into account the combined contributions of environmental and developmental factors to later school reading performance, four theories were introduced to guide this study: (a) Kintsch's Construction-Integration Model and Comprehension Theory, (b) van den Broek's Landscape model, (c) Vygotsky's Socio-Historical theory of Cognitive Development, and (d) Family Literacy theory.

The first two theories are constructivist theories, which emphasize the individual's part in actively constructing knowledge through integration of new knowledge with existing knowledge (Tracey & Morrow, 2006). These constructivist theories suggest that it is the cognitive abilities of a child that are important to later outcomes. The third theory is a contextual theory, and its emphasis is on the importance of social interactions as influences on language and literacy learning, suggesting the important influence of parents and teachers on a child's reading ability. Finally, the last theory is a developmental theory, and while it is still evolving, the importance of both the

child's cognitive abilities and the home environment is emphasized.

The final regression models for each outcome and the path model for vocabulary suggest that the cognitive abilities of the child are the most important indicators of later reading success and support the constructivist theories. The path models for reading ability and reading comprehension indicate that there may be more influence from the environment than can be seen in the regression models. Several previous studies have demonstrated the importance of parental supportiveness and the home environment for children's future reading success (Dickinson & Tabors, 2001; RAND, 2002; Roberts et al., 2005) and for their future ability to sustain attention (Landry & Smith, 2006; Rowe & Rowe, 1999), which is related to reading comprehension in this study. These findings support the contextual and developmental theories and confirm the importance of the family's role in a child's later reading success.

In conclusion, the family literacy theory, which is described as a theory of literacy development as a continuous and ongoing process that begins at birth, is the theory most closely supported by these results. While this theory only briefly touches upon the importance of children's cognitive skills, it does emphasize children's development of preliteracy skills such as listening, speaking, reading, and writing (Morrow, 2005), along with a strong emphasis on the home environment and the parents' influence on literacy outcomes. This theory is still emerging and may be more clearly delineated as more research, such as this study, examines the multiple environmental and developmental influences on a child's reading success.

### **Study Strengths and Limitations**

The major strength of this study was the longitudinal design. The importance of examining early supports for reading comprehension long before school entry is needed to gain the information necessary to help children at risk succeed in school. Longitudinal research provides information that is not easily obtainable from traditional cross-sectional research methods. It is particularly valuable for studying phenomena that are changing and are inherently longitudinal such as children's development. It is also valuable for investigating causal processes such as the influence of early environmental factors on later development.

Another strength of this study was the large number of measures that identified both environmental and developmental predictors as well as the number of outcome measures that made it possible to examine specific aspects of reading; vocabulary, decoding, and comprehension. Inclusion of similar predictor variables at two different ages helped identify the time points when specific supports or skills are most important. Without multiple measures and the longitudinal design, this study would not have been able to specify which skills and supports at which ages influenced which outcomes.

The study location was one weakness of this project; this study was conducted in Utah where the low-income population, generally considered at risk, includes a high number of Caucasian two-parent families with educated mothers ("highly educated" generally refers to post grad study). These characteristics may have influenced the child outcomes in a way that may have masked the importance of some variables such as the home environment or maternal supportiveness. This may make the results less



generalizable to other populations with more ethnic or cultural diversity and lower average levels of maternal education.

Another weakness of this study is that the measures and age points for the initial data were determined by the previous study measures and were not selected specifically for this study. Particularly, language delays and language development were not ideally measured in the first three years, and the lack of information available for these constructs limited the questions that could have been explored more deeply regarding the influence of language delay on later reading ability and comprehension.

Finally, attrition and sample size were a major weakness of this study. The original EHS study recruited 201 families, but by the time these children were in second-grade the sample had decreased to as low as 103 on some measures. The large number of variables and the longitudinal nature of the research questions made it difficult to complete some of the proposed analyses due to the small sample size. While a sample of over 100 subjects may be large enough for some types of analyses, it was not sufficient for the complex models proposed in research questions 3 and 4.

### **Suggestions for Future Research**

This study provides a preliminary examination of multiple predictors of second-grade vocabulary and reading outcomes, but further examination of more specific aspects of these predictors is needed. Studying reading outcomes in a low-income sample using multiple measures helped clarify not only which variables were related to each outcome but also which variables were not related. It also suggested other predictors that need to

be examined, such as more specific environmental and developmental factors. While home environment, cognitive ability, and vocabulary were all found to be related to some aspect of reading, more specific skills and supports need to be identified and interventions examined. What is it about home environment that is the most important? What aspect of cognitive ability is related to later reading success? Do language delays influence later reading success, and if so, how? Are there additional environmental supports that are related to increased vocabulary? Do children with poor cognitive or language skills need different kinds of environmental support? Research that can identify which supports and skills are most important for which children will help guide the development of interventions that may be the most beneficial for the most children.

Additionally, further examination of both risk factors and intervention services is needed. Unpacking the specific risk factors and identifying which risk factors might moderate second-grade outcomes is important. Equally important is identifying early intervention services that moderate outcomes. Improving outcomes for children from families living in at-risk environments is a focus of Early Head Start and if specific risk factors and services can be identified as significant moderators then intervention programs can know which risk factors should be the focus and which services make a difference. Child outcomes are likely to differ in relation to different types of services and risk factors. To the extent that these outcomes and risk factors are responsive to intervention, further research could show how specific services are related to specific risks and child outcomes.

## **Conclusion**

It is expected that most children will come to school ready to learn and that in turn they will make the expected progress from year to year and become readers in the primary grades. It is also assumed that good early literacy skills will automatically lead to later literacy. While it has been shown that children who do not have early literacy skills are more likely to fail, it is not necessarily true that those with early literacy skills will succeed. Considerable evidence has shown that while there is continuity between early literacy success and later literacy success, it is not enough (Snow et al., 2007). The results of this study show, in addition, that while specific early developmental skills may be key to later reading success, continuing environmental support throughout the preschool years is also necessary.

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- Yekovich, F. R., Walker, C. H., Ogle, L. T., & Thompson, M. A. (1990). The influence of domain knowledge on inferencing in low-aptitude individuals. In A. C. Graesser & G. H. Bower (Eds.), *The psychology of learning and motivation* (Vol. 25, pp. 175-196). New York, NY: Academic.
- Zhan, M., & Pandey, S. (2004). Economic well-being of single mothers: Work first or postsecondary education? *Journal of Sociology and Social Welfare, 31*, 87-112.
- Zill, N., Resnick, G., Kim, K., O'Donnell, K., Sorongon, A., McKey, R. H., ..., D'Elia, M. A. (2003). *Head Start FACES 2000: A whole-child perspective on program performance*. Washington, DC: U.S. Department of Health and Human Services, Administration on Children, Youth, and Families.

## CURRICULUM VITAE

GINA A. COOK

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### EDUCATION

Ph.D., 2010 Utah State University (Family and Human Development)  
Dissertation: *Environmental and Developmental Indicators in Early Childhood: Relations to Second-Grade Reading Comprehension*  
M.S., 1999 Utah State University (Family and Human Development)  
B.S., 1992 Utah State University (Fashion Merchandising and Marketing)

### GRANTS

Consultant—Dads' Parenting Interactions with Children: Checklist of Observations Linked to Outcomes (PICCOLO-D)—Head Start Graduate Student Grant (to Sheila Anderson; Lori Roggman PI); Administration for Children, Youth, & Families, Department of Health & Human Services, 2009-2011, \$50,000.

Professional Development Coordinator/Teacher Mentor—PEECSE: Promoting Early Engagement, Communication, and Self-Regulation in English Language Learners, Administration for Children, Youth, & Families, Department of Health & Human Services, 2007-2011, \$900,000.

Practitioner Trainer/Coding Coordinator—UTELL/2: Using Technology to Enrich Language Learning, U.S. Office of Education, 2008-2010, \$600,000.

Co-PI—Parents, Parenting, & Child Outcomes/2ndary Analysis. Administration for Children, Youth, & Families, Department of Health & Human Services, 2007-2010, \$100,000.

Co-PI—G5—Grade 5 Longitudinal Follow-up of the Early Head Start Sample; Mathematica Policy Research, 2007-2009, \$68,600.



- Co-PI—Examining Parent Language and Regulation Supporting Behavior in Early Aggression. Community University Research Initiative, Utah State University, 2007-2008. \$25,000.
- Data Manager—Parenting Interactions with Children: Checklist of Observations Linked to Outcomes (PICCOLO)—Measurement Grant; Administration for Children, Youth, & Families, Department of Health & Human Services, 2004-2008, \$600,000.
- Co-PI—Very Low Birthweight Infants and School Readiness: What Factors Contribute to Their Success. Community University Research Initiative, Utah State University, 2006-2007. \$25,000.
- Data Manager—Expanding PICCOLO—Measuring Parenting in a Longitudinal Sample; Community University Research Initiative, Utah State University, 2006-2007. \$19,700.
- Data Manager—Home Visit Video - Observing home visit interactions in Utah & Iowa; Zero To Three, 2005-2007, \$7,000.
- Project Coordinator—Up to 2<sup>nd</sup> & 8<sup>th</sup> -Longitudinal Follow-Up of 2 Samples; Community University Research Initiative, Utah State University, 2004-2007. \$17,000, \$11,000.
- Project Coordinator—Early Head Start Tracking to Pre-Kindergarten: Longitudinal Follow-Up (TPK), Administration for Children, Youth, & Families, Department of Health & Human Services, 2001-2005, \$630,000.
- Grant Recipient—Head Start Dissertation Fellowship Grant (to Gina Cook; Lori Roggman PI); Administration for Children, Youth, & Families, Department of Health & Human Services, 2003-2005, \$40,000.
- Coding Coordinator/Data Manager—BELLS: Bilingual Early Language and Literacy Support, 2000-2005, \$1.2 million.
- Data Collector—Natural Environments Project, Puckett Institute, 2000-2001.
- Data Manager—Early Head Start Local Research Partnership Grant, Administration for Children, Youth, & Families, Department of Health & Human Services, 1996-2002, \$873,549.
- Data Manager—Father Research, Subcontract, Mathematica Policy Research, 1998-2001, \$53,600.

Data Manager—Newborn Research, Subcontract, Mathematica Policy Research, 1998-2001, \$40,230.

Data Collector/Qualitative Data Analyst—InReach Project, 1998-2001.

Data Collector—From 1 to 7, College of Family Life, Utah State University, 1998-2000, \$7,116.

### **OTHER PROFESSIONAL/RESEARCH EXPERIENCE**

Arizona First Things First Evaluator—Personal interviews with community partners and report preparation, EndVision Research and Evaluation, Summer 2010.

Conference Coordinator—Teacher Training Workshop on Reading Motivation, Emma Eccles Jones Early Childhood Center, Utah State University, June 2010.

Curriculum Developer—ABC's of Autism curriculum development/trainer manual, Center for Persons with Disabilities, Utah State University, 2010.

Reading Assessor—Bi-Annual DIBELs Assessments (K-5<sup>th</sup> grade), Bureau of Indian Education (BIE), Reading First Evaluation, 2009-ongoing as needed.

Dialogic Reading Trainer - Provided training on dialogic reading methods to two Head Start Programs, 2008-ongoing as needed.

Up to 12<sup>th</sup>—Longitudinal Follow-Up (2007-2010): Follow-up in twelfth grade of children and parents who were in research projects when the children were infants.

CLASS certified observer - Completed CLASS preschool classroom observation tool training course and met reliability requirements, Ogden, UT, 2009.

Second Step Trainer - Completed Second Step Preschool Emotion Regulation Train the Trainer course, San Diego, CA, 2008.

Reading Aide Substitute—North Park Elementary School (K-2<sup>nd</sup> grades), North Logan, UT, 2006-2007.

SHELLS: Storytelling for Home Enrichment of English Language and Literacy Support (2004-2007): Development and evaluation of family book-making strategies with Spanish-speaking families.

Up to 2<sup>nd</sup> & 8<sup>th</sup> -Longitudinal Follow-Up of 2 Samples (2004-2007): Follow-up in second grade and eighth grade of children and parents who were in research projects when the children were infants.

TPK: Tracking and Pre-Kindergarten Follow-up of the EHS Research Sample (2001-2005). Comprehensive follow-up data collection on participants of the original EHS research project.

VISIT: Visions and Interventions to Stimulate Talk (2000-2001). Early Head Start language intervention project in cooperation with Rural Utah Head Start, Wellington, UT, to assess and design home visiting interventions to promote toddler language development.

Fathers and Infant Development (1997-2001). Longitudinal research on fathers of infants in connection with and in addition to the Early Head Start project.

### **COURSES TAUGHT**

Research Methods, Distance Ed.	(2 semesters)
Research Methods, Online Course	(developed; 8 semesters)
Research Methods, Teaching Assistant	(1 semester)
Infancy	(1 semester)
Human Development Across the Lifespan	(1 quarter; 4 semesters)
Guidance of Children, Teaching Assistant	(1 quarter)

### **REFEREED PUBLICATIONS**

Boyce, L. K., Innocenti, M. S., Roggman, L. A., Price, C., Jump Norman, V. K., Cook, G. A., & Ortiz E. (2010). Family Bookmaking: An Approach to Support Parent-Child Language Interactions in Natural Environments. *Review of Disabilities Studies: An International Journal*.

Roggman, L. A., Boyce, L. K., & Cook, G. A. (2009). Keeping Kids on Track: Impacts of a parenting-focused Early Head start program on attachment security and cognitive development. *Early Education & Development, 20*(6), 920-941.

Boyce, G. C., Boyce, L. K., King, J., Cook, G. A., D'zatko, K., Akers, A. L., & Mabey, V. (2008). Developing Relationships between Very Low Birthweight Infants and their Mothers: A Look at Timing of Intervention in Relation to Infant and Maternal Characteristics. *Early Childhood Services, 2*, 173-193.

Roggman, L. A., Cook, G. A., Peterson, C. A., & Raikes, H. H. (2008). Who Drops Out of Early Head Start Home Visiting Programs? *Early Education & Development, 19*, 574-599.

Korfmacher, J., Green, B. L., Starkel, F., Peterson, C., Cook, G. A., Roggman, L. A., Faldowski, R., & Schiffman, R. (2008). Parent involvement in early childhood home visiting. *Child and Youth Care Forum, 37*, 171-196.

- Boyce, L., Cook, G. A., Roggman, L. A., Innocenti, M., Jump, V., & Akers, J. (2004). Looking at Books and Learning Language: What do Hispanic mothers and children do? *Early Education & Development*.
- Roggman, L. A., Boyce, L. K., Cook, G. A., Christiansen, K., & Jones, D. (2004). Playing with Daddy: Social Toy Play, Early Head Start, and Developmental Outcomes. *Fathering Journal*.
- Roggman, L. A., Boyce, L. K., Cook, G. A., & Cook, J. (2002). Getting Dads Involved: Predictors of Father Involvement in Early Head Start and with their Children. *Infant Mental Health Journal*, 23, 62-78.
- Roggman, L. A., Boyce, L. K., & Cook, G. A. (2001). Inside Home Visits: A Collaborative Look at Process and Quality. *Early Childhood Research Quarterly*, 16, 53-71.

## **BOOKS & OTHER PUBLISHED PRODUCTS**

- Roggman, L. A., Cook, G. A., Innocenti, M. S., Jump Norman, V. K., & Christiansen, K. (in press, pending contract). *PICCOLO (Parenting Interactions with Children: Checklist of Observations Linked to Outcomes)*. Baltimore, MD: Brookes.

## **CHAPTERS**

- Roggman, L. A., Cook, G. A., & Jump Norman, V. K. (2008). Parent Satisfaction with the Home Visitor and Home Visit: A survey for parents. In L. A. Roggman, L. K. Boyce, & M. S. Innocenti (Eds.), *Developmental Parenting: A Guide for Early Childhood Practitioners* (pp. 206-208). Baltimore: Paul H. Brookes Publishing.
- Roggman, L. A., Cook, G. A., Jump Norman, V. K., Christiansen, K., Boyce, L. K., & Innocenti, M. S. (2008). Home Visit Rating Scales. In L. A. Roggman, L. K. Boyce, and M. S. Innocenti (Eds.), *Developmental Parenting: A Guide for Early Childhood Practitioners* (pp. 209-217). Baltimore: Paul H. Brookes Publishing.
- Roggman, L. A., Boyce, L. K., Cook, G. A., & Hart, A. D. (2002). How Much Better Than Expected? Improving Cognitive Outcomes in Utah's Bear River Early Head Start. In *Making a Difference in the Lives of Infants and Toddlers and Their Families: The Impacts of Early Head Start*. Washington, DC: Department of Health and Human Services, Administration for Children, Youth, & Families.
- Roggman, L. A., Boyce, L. K., & Cook, G. A., (2001). Keeping kids on track: Interactive effects of age and intervention. In *Mathematica Policy Research and the Head Start Bureau, Early Head Start Interim Report to Congress*. Washington, DC: DHHS, ACF, ACYF.

## REPORTS

- Roggman, L. A., Cook, G. A., Christiansen, K., Price, C., & Jones, D. (2006, July). *Final Report of the Longitudinal Pre-Kindergarten Follow-Up of Early Head Start Research Project*, Logan, UT: Utah State University. (Submitted to Head Start Bureau, Administration for Children, Youth, & Families, US Department of Health and Human Services, Washington, DC).
- Cook, G. A., & Roggman, L. A., (2006, January). *Final Report of the Early Environmental, Cognitive, and Social Indicators in Infancy: Relations to Second-Grade Reading Comprehension Project*, Logan, UT: Utah State University. (Submitted to Head Start Bureau, Administration for Children, Youth, & Families, US Department of Health and Human Services, Washington, DC).
- Roggman, L. A., Boyce, L. K., Cook, G. A., Hart, A. D., & Callow-Heusser, C. (2002, July). *Nurturing Children and Their Families: Impacts of Bear River Early Head Start—Final Report of the Local Research Partnership*, Logan, UT: Utah State University. (Submitted to Head Start Bureau, Administration for Children, Youth, & Families, US Department of Health and Human Services, Washington, DC).
- Roggman, L. A., Boyce, L. K., Cook, G. A., & Hart, A. D. (2002, June). How Much Better Than Expected? Improving Cognitive Outcomes in Utah's Bear River Early Head Start. In *Making a Difference in the Lives of Infants and Toddlers and Their Families: The Impacts of Early Head Start*. Washington, DC: Department of Health and Human Services, Administration for Children, Youth, & Families.
- Roggman, L. A., Boyce, L. K., & Cook, G. A. (2001, June). Keeping kids on track: Interactive effects of age and intervention. In *Building Their Futures: How Early Head Start Programs are Enhancing the Lives of Infants and Toddlers in Low-Income Families* (appendix C). Washington, DC: US Department of Health and Human Services, Administration for Children, Youth, & Families.
- Roggman, L. A., Cook, G. A., & Jump, V. K. (2000, June). *Early Head Start Continuous Program Improvement: Final Report*. Bear River Early Head Start, Logan, UT.
- Roggman, L. A., Cook, G. A., Jump, V. K., & Boyce, L. K. (1998, December). *Early Head Start Continuous Program Improvement: Year 2*. Bear River Early Head Start, Logan, UT.

## REFEREED CONFERENCE PROCEEDINGS

- McKelvey, L. M., Schiffman, R. F., Fitzgerald, H. E., Roggman, L. A., Brophy-Herb, H. E., Cook, G. A., & Johnson, D. L. (2008, June). *Examining the Psychometric Properties of the Family Crisis Oriented Personal Scale for Mothers of Toddlers*

in *Low-Income Families*. Head Start Research Conference Proceedings, Washington, DC.

- Roggman, L. A., Jump, V. K., Innocenti, M. S., Cook, G. A., Akers, J., & Christiansen, K. (2006, June). *Developing PICCOLO: A Measure of Parenting Interactions with Children in a Checklist of Observations Linked to Outcomes* (pp 1-2). Head Start Research Conference Proceedings, Washington, DC. [http://www.acf.hhs.gov/programs/opre/hsrc/proceedings/symposia/measures\\_203.pdf](http://www.acf.hhs.gov/programs/opre/hsrc/proceedings/symposia/measures_203.pdf)
- Roggman, L. A., Innocenti, M. S., Cook, G. A., Jump, V. K., Christiansen, K. & Akers, J. (2006, June). *PICCOLO: Measuring the high notes of parenting interactions*. Head Start Research Conference, Washington, DC. [http://www.acf.hhs.gov/programs/opre/hsrc/proceedings/symposia/hhs\\_309.pdf](http://www.acf.hhs.gov/programs/opre/hsrc/proceedings/symposia/hhs_309.pdf)
- Roggman, L. A., Jump, V. K., Innocenti, M. S., Cook, G. A., Akers, J., & Christiansen, K. (2006, June). *Developing PICCOLO: A Measure of Parenting Interactions with Children in a Checklist of Observations Linked to Outcomes*. Head Start Research Conference, Washington, DC.
- Roggman, L. A., Boyce, L. K., Cook, G. A., Christiansen, K., & Jones, D. (2006, June). *Early Head Start Impacts On Father Involvement And Child Development: Direct, Indirect, And Moderating*. Head Start Research Conference, Washington, DC.
- Roggman, L. A., Cook, G. A., Peterson, C., & Raikes, H. H., (2004). Who Drops Out of Early Head Start Home Visit Programs? *Conference Proceedings of the National Head Start National Research Conference*, Washington, DC, 678-679.
- Cook, G. A. & Roggman, L. A. (2004). Promoting language development in an Early Head Start home visiting program: What makes it work? *Conference Proceedings of the National Head Start National Research Conference*, Washington, DC, 628-629.
- Cook, G. A., & Roggman, L. A. (2004). Second-grade reading comprehension: A look at early environmental supports. *Conference Proceedings of the National Head Start National Research Conference*, Washington, DC, 610-611.
- Roggman, L. A., Boyce, L. K., Cook, G. A., & Hart, A. D. (2002) Observational data on father play with infants: Challenging to get but valuable to have. *The First Eight Years: Pathways to the Future: Implications for Research, Policy, and Practice, Summary of Conference Proceedings of Head Start's 6<sup>th</sup> National Research Conference*. Washington, DC: Head Start Bureau, ACYF.

- Roggman, L. A., Cook, G. A., Boyce, L. K., & Hart, A. D., (2002) Home visit quality: Changes over time in relation to future child outcomes. *The First Eight Years: Pathways to the Future: Implications for Research, Policy, and Practice, Summary of Conference Proceedings of Head Start's 6<sup>th</sup> National Research Conference*. Washington, DC: Head Start Bureau, ACYF.
- Roggman, L. A., Cook, G. A., & Thurgood, S. (2000). Assessing the quality of home visits in Early Head Start. *Conference Proceedings of the National Head Start National Research Conference*, Washington, DC.
- Roggman, L. A., Newland, L. A., & Cook, G. A. (2000). Home visits and parents' mental health. *Conference Proceedings of the National Head Start National Research Conference*, Washington, DC.
- Roggman, L. A., Boyce, L. K., Cook, G. A., & Jump, V. (1998). Correlates of attachment security among 10-month-olds in an Early Head Start Research Project. *Conference Proceedings of the National Head Start National Research Conference*, Washington, DC.

#### **REFEREED CONFERENCE PRESENTATIONS**

- Cook, G. A., & Roggman, L. A. (2010, June). *Second-grade reading comprehension and early environmental supports: Does timing matter?* Head Start Research Conference, Washington, DC.
- Cook, G. A., & Roggman, L. A. (2010, June). *Father-Toddler Interaction & Academic Outcomes in Grade 5*. Head Start Research Conference, Washington, DC.
- Roggman, L. A., Jump Norman, V. K., Cook, G. A., Innocenti, M. S., & Boyce, L. K. (2010, June). *Mother-child interaction and children's later self-regulation and aggression within three major ethnic groups*. Head Start Research Conference, Washington, DC.
- Roggman, L. A., Cook, G. A., Innocenti, M. S., & Boyce, L. K. (2010, February). *Home Visit Flags: A Self-Reflection Measure of Home Visiting Quality*. Conference on Research Innovations in Early Intervention, San Diego, CA.
- Cook, G., & Roggman, L. A. (2010, June) *Fathers' support of children's development: How early and for how long does it matter?* World Association on Infant Mental Health, Leipzig, GERMANY.
- Roggman, L., Cook, G., Innocenti, M., & Jump Norman, V. (2010, June). *PICCOLO: A practical parenting observation tool*. World Association for Infant Mental Health, Leipzig, GERMANY

- Roggman, L., Innocenti, M., Cook, G. & Jump Norman, V. (2010, June). *Learn to become a better observer of parenting strengths: A new measurement tool and strategies for supporting positive parenting*. World Association for Infant Mental Health, Leipzig, GERMANY
- Roggman, L. A., Cook, G. A., Jump Norman, V. K., & Boyce, L. K. (2010, July). *Early paternal and maternal contributions to child attachment and exploration*. World Association for Infant Mental Health, Leipzig, GERMANY.
- Cook, G., Roggman, L., Boyce, L., & D'zatko, K. (2009, June). *How does early self-regulation influence 2nd grade reading comprehension?* Society for the Scientific Study of Reading, Boston, MA.
- Roggman, L., Cook, G., & Boyce, L. (2009, June). *Family coping strategies and home visiting success*. Paper presented at the International Family Nursing Conference, Reykjavik, ICELAND.
- Schiffman, R., McKelvey, L., Fitzgerald, H., Roggman, L., Cook, G., Johnson, D., & Brophy-Herb, H. (2009, June). *Examining changes in the coping strategies of low-income mothers of children from infancy to elementary school*. Paper presented at the International Family Nursing Conference, Reykjavik, ICELAND.
- McKelvey, L., Schiffman, R., Fitzgerald, H., Roggman, L., Brophy-Herb, H., Cook, G., & Johnson, D. (2009, June). *Examining the psychometric properties of the family crisis oriented personal evaluation scale in low-income families*. Paper presented at the International Family Nursing Conference, Reykjavik, ICELAND.
- Roggman, L. A., Cook, G. A., & Boyce, L. K. (2009, June). *Family coping strategies and home visiting success*. Paper presentation at the International Family Nursing Conference, Reykjavik, ICELAND.
- Boyce, L. K., & Cook, G. A. (2009, May). *Story-telling for the home enrichment of language and literacy (SHELLS): Impacts on language and parenting through the parent-child relationships in two Part C early intervention programs*. Paper presentation at the Pac-Rim Conference, Honolulu, HI.
- Roggman, L. A., Cook, G. A., Boyce, L. K., & Hart, A. D. (2009, April). *Father involvement as a moderator of intervention impacts on mothers' parenting behavior*. Paper presentation at the Society for Research in Child Development, Denver, CO.
- Cook, G. A., D'zatko, K. W., & Boyce, L. K. (2009, April). *Examining Parent Language Supporting Behavior and Toddler Language in Relation to Early Aggression*. Poster presented at the Society for Research in Child Development, Denver, CO.



- Cook, G. A., D'zatko, K. W., & Roggman, L. A. (2009, April). *A Person-Oriented Approach to Understanding Dimensions of Parenting*. Poster presentation at the Society for Research in Child Development, Denver, CO.
- McKelvey, L. M., Schiffman, R. F., Fitzgerald, H. E., Roggman, L. A., Cook, G. A., Johnson, D. L., & Brophy-Herb, H. E. (2008, Sept.). *Examining Changes in the Coping Strategies of Low-Income Mothers of Children from Infancy to Elementary School*. National Council on Family Relations Conference, Little Rock, AK.
- McKelvey, L. M., Schiffman, R. F., Fitzgerald, H. E., Roggman, L. A., Brophy-Herb, H. E., Cook, G. A., & Johnson, D. L. (2008, June). *Examining the Psychometric Properties of the Family Crisis Oriented Personal Scale for Mothers of Toddlers in Low-Income Families*. Poster presented at the World Association for Infant Mental Health's 11th World Congress, Yokohama, Japan.
- McKelvey, L. M., Schiffman, R. F., Fitzgerald, H. E., Roggman, L. A., Brophy-Herb, H. E., Cook, G. A., & Johnson, D. L. (2008, June). *Examining the Psychometric Properties of the Family Crisis Oriented Personal Scale for Mothers of Toddlers in Low-Income Families*. Poster presented at the Head Start's Ninth National Research Conference, Washington, DC.
- Cook, G. A., & Roggman, L. A. (2008, April). *Parenting Behaviors and 2nd Grade Outcomes: Does Child Age or Gender Matter?* Society for Research in Human Development. Little Rock, AK.
- Christiansen, K., Roggman, L. A., Innocenti, M., Jump, V., Cook, G. A., & Price, C. (2008, April). *Contributions of Parenting Behavior and Family Differences For Latino Children's Language Development*. Society for Research in Human Development. Little Rock, AK.
- Jones, D., Roggman, L. A., & Cook, G. A. (2008, April). *Heightened Taste Sensitivity to Propylthiouracil (PROP) as a Biological Marker for Greater Extremes in Parenting Stress and Child Behavior Problems Depending on Number of Stressful Life Events*. Society for Research in Human Development. Little Rock, AK.
- McKelvey, L. M., Schiffman, R. F., Fitzgerald, H. E., Roggman, L. A., Cook, G. A., & Johnson, D. L. (2008, April). *Examining Coping Strategies of Low-Income Mothers across Time*. Poster submitted to the 2008 Biennial Meeting of the Society for Research in Human Development, Little Rock, AR.
- Roggman, L. A., Cook, G. A., Jump, V. K., Innocenti, M. S., Christiansen, K., & Price, C. (2008, March). *Parenting across cultures: Different patterns but similar pathways*. International Conference on Infant Studies, Vancouver, BC.

- Boyce, L., Cook, G. A., & D'zatko, K. (2008, March). *Academic outcomes of very low birthweight infants: The influence of mother-child relationships*. International Conference on Infant Studies, Vancouver, BC.
- Boyce, L., Innocenti, M., Ortiz, E., & Cook, G. A. (2008, March). *Examining maternal vocabulary diversity in book sharing and play interactions: A longitudinal study of Latino toddlers living in poverty*. International Conference on Infant Studies, Vancouver, BC.
- Roggman, L. A., Cook, G. A., & Innocenti, M. (2008, February). *PICCOLO: A Parenting Measure In Practice*. Conference on Research Innovations in Early Intervention, San Diego, CA.
- Boyce, L. K., Cook, G. A., & Dzatko, K. W. (2007, March). *Risk and school readiness of very low birthweight infants: What maternal and child factors contribute to competence?* In H. Brophy-Herb Symposium, Profiles and understanding of risks and competencies among vulnerable children and families. Society for Research in Child Development, Boston, MA.
- Roggman, L. A., Innocenti, M. S., Cook, G. A., Jump, V. K., & Akers, J. F. (2007, March). *Parenting interactions with children: Checklist of observations linked to outcomes (PICCOLO)*. In L. Roggman & M. Innocenti Symposium, Measuring "good" parenting and parent-child interactions: Diversity, utility, reliability, and validity in new measures. Society for Research in Child Development, Boston, MA.
- Innocenti, M. S., Boyce, L. K., Roggman, L. A., Akers, J. F., Jump, V. K., & Cook, G. A. (2007, March). *Improving language and enriching home literacy: Positive influences of a home visiting program with low-income, Latino families*. Society for Research in Child Development, Boston, MA.
- Roggman, L. A., Cook, G. A., Innocenti, M. S., & Jump, V. K. (2006, July). *The importance of maternal teaching/talking and responsiveness to later attachment: An examination of the PICCOLO measure of maternal-child interaction with attachment in the first 3-years of life*. World Association for Infant Mental Health, Paris, FRANCE.
- Roggman, L. A., Boyce, L. K., Cook, G. A., Christiansen, K., & Jones, D. (2006, July). *Father Depression & Involvement In Play: Direct And Indirect Effects*. In Symposium: An ecological perspective on father-child interactions: Implications for research and practice. World Association for Infant Mental Health, Paris, FRANCE.

- Roggman, L. A., Innocenti, M. S., Cook, G. A., Jump, V. K., Christiansen, K., & Akers, J. (2006, June). *PICCOLO: Measuring the high notes of parenting interactions*. Head Start Research Conference, Washington, DC.
- Roggman, L. A., Jump, V. K., Innocenti, M. S., Cook, G. A., Akers, J., & Christiansen, K. (2006, June). *Developing PICCOLO: A Measure of Parenting Interactions with Children in a Checklist of Observations Linked to Outcomes*. Head Start Research Conference, Washington, DC.
- Roggman, L. A., Boyce, L. K., Cook, G. A., Christiansen, K., & Jones, D. (2006, June). *Early Head Start Impacts On Father Involvement And Child Development: Direct, Indirect, And Moderating*. Head Start Research Conference, Washington, DC.
- Cook, G. A., Roggman, L. A., Christiansen, K., & Price, C. (2006, April). *What Makes a Difference in School Readiness?: Predictors and Outcomes in an Early Head Start Study*. Early Intervention Research Institute, Utah State University, Logan, UT.
- Cook, G. A., Roggman, L. A., Price, C., & Christiansen, K., (2006, March). *How does early self-regulation influence 2nd grade reading comprehension?* Society for Research in Human Development, Fort Worth, TX.
- Jump, V., K., Cook, G., A., Roggman, L. A., Innocenti, M. S., & Christiansen, K. (2006, March). *Parenting behaviors: Do they affect child outcomes?* Society for Research in Human Development, Fort Worth, TX.
- Christiansen, K., Cook, G., Roggman, L., & Price, C. (2006, March). *Children's attachment security and psychosocial aspects of school readiness*. Society for Research in Human Development, Fort Worth, TX.
- Roggman, L. A., Cook, G. A., Christiansen, K., & Price, C. (2006, March). *How soon can we help? Attachment, aggression, maternal well-being, and intervention*. Society for Research in Human Development, Fort Worth, TX.
- Roggman, L., Boyce, L., Cook, G., Christiansen, K., & Jones, D. (2005, July). *Do Fathers Contribute to Children's Early Language in Low Socioeconomic Status Families?* International Congress for the Study of Child Language, Berlin, GERMANY.
- Cook, G., & Roggman, L. (2005, April). *Reading comprehension: A look at early indicators*. Society for Research in Child Development, Atlanta, GA.

- Roggman, L. A., & Cook, G. (2005, April). *Attachment and early risk factors: Intervention and outcomes*. Society for Research in Child Development, Atlanta, GA.
- Boyce, L., K., Cook, G., Roggman, L., & Innocenti, M. (2005, April). *Book sharing behaviors of Latino mothers and their young children*. Society for Research in Child Development, Atlanta, GA.
- Cook, G. A., & Roggman, L. A. (2004, June). *Promoting Language Development in an Early Head Start Home Visiting Program: What makes it work?* Head Start Research Conference, Washington, DC.
- Roggman, L. A., & Cook, G. A. (2004, June). *Who drops out of Early Head Start home visiting programs?* Head Start Research Conference, Washington, DC.
- Boyce, L. K., Roggman, L. A., Cook, G. A., & Christiansen, K. (2004, May). *Poverty and Mother-Toddler Pretend Play: Do Mothers Make a Difference?* International Conference on Infant Studies, Chicago, IL.
- Cook, G. A., Boyce, L. K., Jump, V. K., Roggman, L. A., & Innocenti, M. (2004, May). *Hispanic Mother's Warmth and Support: A Look at Context and Stability*. International Conference on Infant Studies, Chicago, IL.
- Roggman, L. A., Boyce, L. K., Cook, G. A., Christiansen, K., & Jones, D. (2004, May). *Playing with Daddy: Social Toy Play, Early Head Start, and Developmental Outcomes*. International Conference on Infant Studies, Chicago, IL.
- Roggman, L. A., Cook, G. A., & Akers, J. F. (2004, May). *Attachment Q-Set Measures: Reliability and Stability in Three Samples*. International Conference on Infant Studies, Chicago, IL.
- Cook, G. A., Boyce, L. K., & Innocenti, M. (2004, April). *Shared book reading: Promoting literacy strategies in Hispanic families*. In M. Innocenti symposium, Examining language development in the home environment: A focus on young, low-income and bilingual children. Society for Research in Human Development, Park City, Utah.
- Boyce, L. K., Roggman, L.A., & Cook, G. A. (2004, April). *Learning to read: A look at early language development and the home environment*. In M. Innocenti symposium, Examining language development in the home environment: A focus on young, low-income and bilingual children. Society for Research in Human Development, Park City, Utah.

- Hatch, T., Roggman, L. A., Jones, D., & Cook, G. A. (2004, April) *Are foods feminine? Father, toddler-play, gender, and toy preference*. Society for Research in Human Development, Park City, Utah.
- Asher, C., Roggman, L. A., Boyce, L. K., Cook, G. A., & Christiansen, K. (2004, April). *Parent-toddler book reading: Fostering a love of reading*. Society for Research in Human Development, Park City, Utah.
- Roggman, L.A., Cook, G. A., Christiansen, K., Boyce, L. K., & Callow-Huesser, C. (2004, April) *3 Generations of Attachment*. Society for Research in Human Development, Park City, Utah.
- Boyce, L. K., Cook, G. A., Akers, J., & Jump, V. K. (2003, April). *Predicting early language development of Hispanic children: A look at parent-child interaction and acculturation*. Society for Research in Child Development, Tampa, Florida.
- Boyce, L. K., Roggman, L. A., & Cook, G. A. (2003, March). *Learning to read: A look at early language development and the home environment*. Poster presented at the Early Intervention Research Institute, Utah State University, Logan, UT.
- Innocenti, M. S., Cook, G. A., & Jump, V. K. (2002, September). *Increasing intervention quality through continuous process improvement*. The Early Childhood Special Education Conference, Provo, UT.
- Roggman, L. A., Boyce, L. K., Cook, G. A., & Hart, A. D. (2002, July). *Observational data on father play with infants: Challenging to get but valuable to have*. (Poster workshop.) World Association of Infant Mental Health, Amsterdam, NETHERLANDS.
- Roggman, L. A., Cook, G. A., Boyce, L. K., & Hart, A. D. (2002, June). *Home visit quality: Changes over time in relation to future child outcomes*. In C. A. Peterson symposium, The Real Question About Home Visiting: What Happens? Head Start Research Conference, Washington, DC.
- Roggman, L. A., Boyce, L. K., Cook, G. A., & Hart, A. D. (2002, June). *Observational data on father play with infants: Challenging to get but valuable to have*. In H. Fitzgerald symposium, Fathers and Early Head Start: Methodological Issues in Research and Implications for Program Involvement. Head Start Research Conference, Washington, DC.
- Roggman, L. A., Boyce, L. K., Hart, A. D., & Cook, G. A. (2002, June). *Parenting as the pathway to child outcomes in Utah's Early Head Start program*. In Early Head Start Research Consortium symposium, The Early Head Start Research Consortium's Poster Symposium on Mediators and Moderators of Local Early

Head Start Outcomes. Head Start Research Conference, Washington, DC.

- Cook, G. A., Jump, V. K., Akers, J., Boyce, L. K., Innocenti, M. S., & Roggman, L. A. (2002, April). *Bookreading across the ages: Development and culture*. International Conference on Infant Studies, Toronto, Ontario, Canada.
- Roggman, L. A., Boyce, L. K., Cook, G. A., & Hart, A. D. (2002, April). *Infant play with mothers and fathers: Exploring differences in an Early Head Start sample*. International Conference on Infant Studies, Toronto, Ontario, Canada.
- Roggman, L. A., Cook, G. A., Boyce, L. K., & Hart, A. G. (2002, April) *Observational data on father play with infants: Challenging to get but valuable to have*. In invited WAIMH symposium. International Conference on Infant Studies, Toronto, Ontario, Canada.
- Cook, G. A., & Roggman, L. A. (2002, March). *Home Visits in Early Head Start: Quality & Quantity in Relation to Parent & Child Outcomes*. Southwestern Society for Research in Human Development, Austin, TX.
- Boyce, G. C., Cook, G. A., Boyle, P., Ostler, T., Akers, A. L., & Boyce, L. K. (November, 2001). *InReach: A model to support parent-infant interaction through the transition from NICU to home and community early intervention*. National Perinatal Association Conference, San Antonio, TX.
- Roggman, L. A., Coyl, D., Newland, L. A., & Cook, G. A. (August, 2001). *Attachment measures in infancy, childhood, adulthood: Reliability, stability, and continuity*. American Psychological Association Conference, San Francisco, CA.
- Cook, G. A., Boyce, L. K., Boyce, G. C., & Akers, A. (December, 2000). *A day in the life of premature babies and their mothers*. International Division for Early Childhood Conference on Children with Special Needs and Their Families, Albuquerque, NM.
- Roberts, R. N., & Cook, G. A. (September, 2000). *Intervention in daily activity settings: What parents think*. The Early Childhood Special Education Conference, Provo, UT.
- Roggman, L. A., Boyce, L. K., & Cook, G. A. (July, 2000). *Evaluating Home Visits: A Collaborative Methodology*. International Conference on Infant Studies, Brighton, England.
- Boyce, L. K., Cook, G. A., & Roggman, L. A. (July, 2000). *The role of maternal characteristics in the effective implementation of an Early Head Start home visiting program*. International Conference on Infant Studies, Brighton, England.

- Roggman, L. A., Cook, G. A., & Thurgood, S. (June, 2000). *Assessing the quality of home visits in Early Head Start*. Head Start National Research Conference, Washington, DC.
- Roggman, L. A., Newland, L. A., & Cook, G. A. (June, 2000). *Home visits and parents' mental health*. Head Start National Research Conference, Washington, DC.
- Boyce, L. K., Roggman, L. A., Whittaker, N., & Cook, G. A. (June, 2000). *Mother-Infant play: Influences of poverty and disability status*. Head Start National Research Conference, Washington, DC.
- Newland, L. A., Roggman, L. A., Coyl, D. D., Boyce, L. K., & Cook, G. A. (March, 2000). *Mother and infant play preferences in relation to infant language competence*. Southwestern Society for Research in Human Development, Eureka Springs, AR.
- Roggman, L. A., Newland, L. A., Slocum, T. A., Cook, G. A., & Boyce, L. K. (March, 2000). *From 1 to 7: Predicting 2<sup>nd</sup> grade reading and math from infant language and cognitive skills*. Southwestern Society for Research in Human Development, Eureka Springs, AR.
- Cook, G. A., & Newland, L. A. (April, 1999). *Temperament in infancy and age 7: Relations to social competence in second grade*. Society for Research in Child Development, Albuquerque, NM.
- Boyce, L. K., Cook, G. A., Boyce, G. C., & Akers, A. (January, 1999). *InReach: A model to improve the transition of NICU infants and their parents into community-based services*. Six Annual Conference of the Early Intervention Research Institute, Logan, UT.
- Roggman, L. A., & Cook, G. A. (January, 1999). *Evaluating home visiting for continuous program improvement in Early Head Start*. Six Annual Conference of the Early Intervention Research Institute, Logan, UT.
- Roggman, L. A., Boyce, L. K., Cook, G. A., & Jump, V. K. (July, 1998). *Correlates of attachment security among 10-month-olds in an Early Head Start Program*. Head Start's Fourth National Research Conference, Washington, DC.
- Newland, L. A., Roggman, L. A., Boyce, L. K., & Cook, G. A. (April, 1998). *Mother-infant social play related to infant language and play behaviors at 11 and 14 months*. International Society on Infant Studies, Atlanta, GA.
- Roggman, L. A., Jump, V. K., Boyce, L. K., & Cook, G. A. (April, 1998). *Attachment and maternal responsivity: The context of infant affect and temperament*.

International Society on Infant Studies, Atlanta, GA.

Roggman, L. A., Cook, G. A., Boyce, L. K., & Benson, B. (March, 1998). *Maternal influence on infant level of play: A longitudinal analyses*. Southwestern Society for Research and Human Development, Galveston, TX.

Boyce, L. K., Benson, B., Roggman, L. A., & Cook, G. A. (April, 1997). *Influence of infant-mother play at home on infant's level of cognitive play in a laboratory setting*. Association for the Study of Play, Washington, DC.

Newland, L. A., Roggman, L. A., Boyce, L. K., & Cook, G. A. (April, 1997). *Toy sharing, symbolic play, and language development in infancy*. Association for the Study of Play, Washington, DC.

### **INVITED RESEARCH PRESENTATIONS**

Cook, G. A. (2010, June). *Fathers' support of children's development: How early and for how long does it matter?* Presentation at Early Head Start Consortium meeting, Washington, DC.

Cook, G. A. (2009, October). *Parents, parenting, & child outcomes: What works best for whom (Year 2 findings)*. Presentation at Early Head Start Consortium meeting, Washington, DC.

Cook, G. A. (2009, October). *Early Head Start Constructs: Baseline thru Grade 5*. Presentation at Early Head Start Consortium meeting, Washington, DC.

Cook, G. A., & D'zatko, K. (2008, December). *Parents, parenting, & child outcomes: What works best for whom (Year 1 findings)*. Presentation at Secondary Analysis grantee meeting, Washington, DC.

Cook, G. A., & Roggman, L. A. (2007, November). *Parents, parenting, & child outcomes: What works best for whom*. Presentation at Secondary Analysis grantee meeting, Washington, DC.

Cook, G. A. (2004, October). *Environmental and developmental indicators in early childhood: Relations to second-grade reading comprehension (Year 1 findings)*. Presentation at Head Start Dissertation Fellowship grantee meeting, Washington, DC.

Cook, G. A. (2003, October). *Environmental and developmental indicators in early childhood: Relations to second-grade reading comprehension*. Presentation at Head Start Dissertation Fellowship grantee meeting, Washington, DC.



Boyce, L. K., Roggman, L. A., & Cook, G. A. (2003, June). *Readiness to read: Early language development, home environment, and emergent literacy*. Early Head Start Consortium Meeting, Bethesda, MD.

Roggman, L. A., Cook, G., Peterson, C., Raikes, H., & Staerkel, F. (2003, June). *Who drops out of Early Head Start home visit programs?* Early Head Start Consortium Meeting, Bethesda, MD.

Roggman, L. A., Cook, G. A., Callow-Heusser, C., & Boyce, L. K. (2002, August). *The final report: What we learned about nurturing children and their families in Bear River Early Head Start*. Bear River Early Head Start, Logan, UT.

Roggman, L. A., & Cook, G. A. (1999, February). *Evaluating home visiting for continuous program improvement in Early Head Start*. Early Intervention Research Institute Mini Conference, Utah State University, Logan, UT.

#### **MANUSCRIPT SUBMISSIONS/IN PREPARATION**

Boyce, L. K., Roggman, L. A., Jump, V. K., Innocenti, M. S., & Cook, G. A. *Storytelling for the Home Enrichment of Language and Literacy Skills (SHELLS): A Curriculum Guide*. To be submitted to Zero To Three Publishing.

Innocenti, M. S., Jump, V. K., Roggman, L. A., Boyce, L. K., & Cook, G. A. (in revision). Using preschool classrooms to improve language and early literacy skills for young, at-risk bilingual children. Submitted to *Early Education and Development*.

Cook, G. A., & Roggman, L. A. (in revision). Three-Generation attachment: Caregiver relationships and attachment style as indicators of child attachment. Submitted to *Attachment & Human Development*.

Roggman, L. A., & Cook, G. A. (in revision). Attachment, aggression, and maternal depression in an Early Head Start sample.

Akers, J., Boyce, L. K., Innocenti, M. S., Cook, G. A., & Ortiz, E. (in revision). The Validity of a Parent Report Measure of Vocabulary at 24 Months for Low-Income, Bilingual Children. Submitted to *Journal of Speech, Language, and Hearing Research*.

Cook, G. A., D'zatko, K., & Roggman, L. A. (in preparation). A person-oriented approach to understanding dimensions of parenting. To be submitted to *Early Education and Development*.

Roggman, L. A., Cook, G. A., Innocenti, M. S., & Jump, V. K. (in preparation). PICCOLO: A new observational measure of parenting interactions. To be submitted to *Parenting*.

Peterson, C. A., Roggman, L. A., Staerkel, F., Cook, G. A., Jeon, H., & Thornburg, K. R., (in revision). Understanding the dimensions of family involvement in home visiting programs.

### **PUBLIC INTEREST PUBLICATIONS**

Roggman, L. A., & Cook, G. A. (2003, October). Promoting infant mental health: Ameliorating the effects of maternal depression and parenting stress on infant attachment through early intervention. *Utah Association of Infant Mental Health Newsletter*, 2, 2-3.

Roggman, L. A., Boyce, L. K., Cook, G. A., Christiansen, K., & Jones, D. (2003, Fall). Playing with Daddy: A Positive Impact of Early Head Start. *Research Update*, College of Education and Human Services, Utah State University, Logan, UT.

### **PUBLIC SERVICE PRESENTATIONS**

Cook, G. A. (2010, March 13). "What is PICCOLO? An Overview of an Observational Measure of Developmental Parenting." Workshop at Utah's 35<sup>th</sup> Annual Early Childhood Conference.

Cook, G. A. (2010, February 18). "Observing, Assessing, & Supervision: Why Every Staff Member Should be Involved." Preschool Teacher Training at Bear River Head Start.

Cook, G. A. (2010, February 17). "Language Development." Preschool Teacher Training at Bear River Head Start.

Cook, G. A. (2010, February 16). "Developmental Caregiving." Preschool Teacher Training at Bear River Head Start.

Cook, G. A. (2010, February 2). "What is PICCOLO? An Overview of an Observational Measure of Developmental Parenting." Workshop at the Zigler Western Research Institute.

Cook, G. A., & Innocenti, M. (2009, July). "Dialogic Reading: Head Start Teacher Training at Ogden-Weber Community Action Partnership.

Cook, G. A., & Boyce, L. K. (2003, March). "Observing and Recording Children's Behavior: The Strategies and Tools to Use." Continuing Education Workshop at

Utah's 28<sup>th</sup> Annual Early Childhood Conference.

Cook, G. A., Jump, V.K., & Roggman, L. A. (2002, July). "Videotaping home visits as a tool for Continuous Program Improvement." Training workshop with the home visitors at Bear River Early Head Start program.

Roggman, L. A., & Cook, G. A. (2002, June). "Final report results from the Local Research Partnership for Early Head Start." Presentation to the Bear River Early Head Start program, Logan, UT.

Roggman, L. A., Cook, G. A., & Jensen, H. (2000, March). "Continuous Program Improvement for Bear River Early Head Start: Home Visits." Presentation to Bear River Early Head Start staff, Logan, UT.

Roggman, L. A., Cook, G. A., & Jensen, H. (2000, April). "Continuous Program Improvement for Bear River Early Head Start: Baby Buddy Groups." Presentation to Bear River Early Head Start staff, Logan, UT.

Roggman, L. A., Cook, G. A., & Jensen, H. (2000, May). "Continuous Program Improvement for Bear River Early Head Start: Child Care." Presentation to Bear River Early Head Start staff, Logan, UT.

## **PROFESSIONAL SERVICE**

Guest Reviewer for Journal of Family Issues (2009-present)

Guest Reviewer for Brookes Publishing (2009)

Program Co-Chair (2008) for Society for Research in Human Development.

Grant Reviewer for Early Childhood Educator Professional Development panel for U.S. Department of Education grant applications (2004)

Grant Writing Assistance for  
Local Childcare Programs (2003, 2004, 2005)  
Head Start Programs—Early Reading First Grants (2006, 2007, 2009)

Training for Ogden-Weber Community Action Partnership Head Start Program (2008, 2009, 2010)

Training for Bear River Early Head Start Program (2000, 2002, 2003, 2006, 2010)

Member of the Ask-An-Expert Panel for the Utah State University, Aggie Care Program (2007- ongoing)

**HONORS & RECOGNITIONS**

Member of Phi Upsilon Omicron Honor Society

Dean's List 1989-1992

Academic Scholarship, Utah State University, 1987-1988

**PROFESSIONAL SOCIETIES**

International Society of Infant Studies (ISIS)

National Association for the Education of Young Children (NAEYC)

Utah Association for the Education of Young Children (UAEYC)

Society for Research and Human Development (SRHD)

Student Representative (2006-2008)

Society for Research in Child Development (SRCD)

Utah Association of Infant Mental Health (UAIMH)

World Association of Infant Mental Health (WAIMH)