ABSTRACT

Title of Document: THE PROTECTIVE ROLE OF HOME LEARNING ACTIVITIES IN THE DEVELOPMENT OF HEAD START CHILDREN'S SCHOOL READINESS SKILLS: A LONGITUDINAL ANALYSIS OF LEARNING GROWTH RATES FROM PRESCHOOL THROUGH FIRST GRADE

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Children's early learning experiences in the home have a significant impact on their readiness for school and future academic success. However, children in poverty often lack a high-quality home learning environment, and consequently, are more likely than their economically advantaged peers to be at risk for failure in school. In this study, data were analyzed from the Head Start Family and Child Experiences Survey of 1997 (FACES), a national longitudinal study of children and families participating in the federal Head Start program. A latent growth model estimated children's growth trajectories in vocabulary, numeracy, and writing skills from Head Start through first grade, and the influence of engagement in home learning activities on children's skills. On average, children demonstrated skills that scored significantly below national norms. By first grade, children caught up on basic numeracy skills; however, they persisted to demonstrate significantly weaker vocabulary skills and slightly weaker writing skills. Risk factors, such as low income-to-needs, low parent education, a non-English home language, and multiple children age five and under in the home, were associated with weaker skills. Children who entered Head Start with the weakest skills grew at a faster rate than children with stronger skills, thus demonstrating the greatest gains over time. Moreover, families engaged in various home learning activities with their children during Head Start. A factor analysis produced three activity factors: Academic Stimulation, Community Enrichment, and Family Entertainment. Academic Stimulation was associated with stronger vocabulary, numeracy, and writing skills, while Community Enrichment was not associated with child outcomes, and Family Entertainment was negatively associated with numeracy and writing skills. Engagement in activities varied by child and family characteristics. Families with low income-to-needs engaged in significantly fewer activities across all three factors. This study advances our knowledge of the significant influence of family income-to-needs on children's early learning experiences and their development of fundamental cognitive readiness skills. The results further substantiate the need for family intervention programs designed to improve the quality of low-income children's home learning environments. Additionally, the findings illustrate the utility of latent growth modeling in estimating children's school readiness trajectories.

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Dissertation submitted to the Faculty of the Graduate School of the
University of Maryland, College Park, in partial fulfillment
of the requirements for the degree of
Doctor of Philosophy
2008

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"If the children and youth of a nation are afforded the opportunity to develop their capacities to the fullest, if they are given the knowledge to understand the world and the wisdom to change it, then the prospects for the future are bright. In contrast, a society which neglects its children, however well it may function in other respects, risks eventual disorganization and demise."

–Urie Bronfenbrenner

Dedication

I would like to dedicate my dissertation to the millions of children in the world who are born into poverty and struggle each day to overcome obstacles that no child should have to face. May this work shed light on their experiences and inspire others to improve the home environments in which these children live.

Acknowledgements

I would like to thank my wonderful family and friends who have provided endless support and encouragement throughout the years. Mike, thank you for all that you do and for motivating me to go to graduate school and follow my dreams. I wouldn't have been able to do it without you. You were right—somehow it all gets done. To my ECE ladies, thank you for your guidance, advice, and friendships over the past four years. Graduate school would not have been the same without you, and I look forward to many more memorable moments in the future—as colleagues and as best friends.

Many thanks go to Elisa Klein, my adviser and mentor over the past four years, who has taught me to be confident in myself and utilize skills and knowledge that I didn't even realize I had. Additionally, I would like to thank my dissertation committee for their responsiveness and thoughtful feedback throughout the dissertation process.

I also acknowledge the Child Care and Early Education *Research Connections*, the Interuniversity Consortium for Political and Social Research (ICPSR) at the University of Michigan, and the Administration for Children and Families in the U.S. Department of Health and Human Services for use of the data from the Head Start Family and Child Experiences Survey (FACES).

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Chapter 1: Introduction

Young children's readiness for school has emerged as a critical factor for early academic achievement as well as long-term educational success. Over the past few decades, researchers have found that children's early learning experiences have a significant impact on their transition to kindergarten and their overall school performance (Duncan, Dowsett, Claessens, Magnuson, Huston, Klebanov et al., 2007). Understanding the variables that contribute to optimal contexts for supporting school readiness has been a central focus of research in early childhood education and development; however, researchers have primarily focused on the activities within preschool classrooms, even though a great deal of early learning occurs outside of preschool and in the home with families. Therefore, examining the home learning environment, or the educational quality of the setting parents establish for their children, is essential to promoting overall school readiness. This is particularly significant for low-income children who are more likely to have poor quality home learning environments (Bradley, Corwyn, McAdoo, & Garcia Coll, 2001), and consequently, poor school readiness skills (Duncan, Brooks-Gunn, & Klebanov, 1994).

Goal of Study within Current Educational Context

The goal of my dissertation research is to better understand the protective influence of early engagement in home learning activities on Head Start children's development of cognitive school readiness skills. Promoting school readiness among low-income children has long been a topic of national interest, highlighted by the establishment of Head Start in 1965 under President Johnson's War on Poverty initiatives. Head Start has since become the longest running school readiness program in the United States. A major strength of Head Start, and what made it unique from other early childhood intervention programs of its time, was its two-generational structure and emphasis on parent involvement as key to children's and families' successful development (Castro, Bryant, Peizner-Feinberg, & Skinner, 2004). In alignment with Bronfenbrenner's ecological systems theory (Bronfenbrenner, 1986), Head Start recognizes the significant influence of families on child development and the necessity to include families in children's learning, so that there may exist shared goals and efforts across all contexts children experience.

In 1990, the National Education Goals Panel emphasized the importance of school readiness in their first goal: "By the year 2000, all children in America will start school ready to learn" (1996, p. xiv). One of the objectives under this goal has a focus on parents: "Every parent in the United States will be a child's first teacher and devote time each day to helping such parents' preschool child learn, and parents will have access to the training and support parents need." Unfortunately, in spite of this goal and the attention on school readiness that it created, a significant number of children are starting kindergarten with delayed skills, which put them at risk of falling behind in school. Additionally, at a policy level, there is little emphasis on initiatives that support parents in improving the quality of young children's home learning environments as a mechanism for achieving school readiness. This is a significant area of concern that deserves increased political attention.

Even with early intervention programs like Head Start, and more recent federal initiatives, such as Early Reading First—a grant-based literacy program that supports the development of early childhood learning centers (U.S. Department of Education, 2002)—

a marked disparity still exists between low-income and middle- and high-income students' school readiness skills (Booth & Crouter, 2008). In response to low-income students' poor school readiness skills, over the last decade, multiple states across the country have implemented state-funded preschool programs to meet the educational needs of young children (Kirp, 2007). While these programs offer increased opportunities for learning that low-income children may not otherwise have, few preschool programs consistently address their experiences in the home and the quality of home learning environments. Some early childhood programs, such as Head Start, emphasize parent involvement as a means to improve child outcomes (Schumacher, 2003); however, in many cases, particularly with the families most in need, home-school collaboration is still limited.

Both Head Start center-based and home-based programs provide support for parents, but home-based services provide regular home visits from trained family specialists who work more intensively with parents to improve their parenting skills and the quality of the home environment. In some areas, parents do not have an option of the type of services they receive. There may be a wait-list for one program but not the other, or there may not be a home-based program in their neighborhood, as is often the case with Head Start programs housed within local public schools. Typically, when given the choice, Head Start parents choose center-based services for their preschoolers over home-based services, which are more common for infants and toddlers in Early Head Start (U.S. Department of Health and Human Services, Administration for Children and Families [HHS], 2008). Families receiving only center-based child care who lack the time to participate in center-based involvement activities may not receive the necessary training to learn ways to engage their preschoolers in home learning activities. Specifically, families living in severe poverty, who not only lack the financial resources to provide educational materials and enrichment activities for their children, but who lack the skills and knowledge to use these materials effectively, may fail to support their children's learning and development in the home. Even though the basic educational, social, and physical needs of many at-risk children are met through state preschool programs or Head Start, their learning must also be reinforced and enhanced in the home through positive family involvement and engagement in learning activities in order to achieve optimal school readiness.

Research on the effects of parent involvement in Head Start indicates that the movement of low-income parents into the workforce under welfare reform conflicts with the federal mandate for parent involvement in Head Start (Parker, Piotrkowski, Baker, Kessler-Sklar, Clark, & Peay, 2001). Under The Personal Responsibility and Work Opportunity Reconciliation Act of 1996 (Public Law 104-193, 110 Stat. 2105), recipients of federal financial assistance (Temporary Assistance for Needy Families, or TANF) are mandated by law to begin working after two years of receiving benefits and have a lifetime limit of five years of federal assistance. As a result of this law, many parents in Head Start have been required to seek employment and, consequently, have had less time to participate in the program. Castro and colleagues (2004) found that parent employment was the strongest negative predictor of parent involvement in Head Start, above and beyond other parental characteristics, such as maternal education, childrearing behaviors, and beliefs about the Head Start program. Parents who worked full-time participated in significantly fewer volunteer activities than parents who worked part-time or were unemployed. Recognizing the barriers to parent involvement, particularly scheduling conflicts due to work and school, some Head Start programs have created opportunities for parent involvement that meet the needs of working parents, including providing more ways for parents to participate from home and including activities performed from home as part of their mandated volunteer time (Castro et al., 2004). Educational researchers are also advocating for a revision of models of parent involvement to include both school-based and home-based involvement (Epstein, 1996; Fantuzzo, McWayne, Perry, & Childs, 2004).

> It would be necessary to assume a broader definition of parent involvement to include not only parents' activities to support the program, but also activities parents conduct at home to support their children's development and education. Expanding parents' participation from home may include providing parents with ideas and resources for a variety of activities they can do with their children at home, in connection with the school and the community. This would have implications for developing effective communication strategies with parents (Castro et al., 2004, p. 427).

Given the importance of early learning and school readiness for children's later learning and academic achievement, as well as the national focus on developing early education programs for children at risk with a focus on parent involvement, research on the influence of home learning activities on children's readiness for school is well warranted. Applying an ecological systems framework, in the present study, I examined a nationally representative sample of children enrolled in Head Start with the goal of demonstrating how the school readiness skills of low-income children can be further enhanced when children are engaged in home learning activities with their families, in addition to receiving early education services.

Overview of Literature

A key component of the home learning environment is engagement in family learning activities in both the home and community (Foster, Lambert, Abbott-Shim, McCarty, & Franze, 2005). These early learning experiences have a significant impact on children's readiness for school and future academic success (Brooks-Gunn & Duncan, 1997; Duncan, Brooks-Gunn, & Klebanov, 1994). Positive interactions with parents offer children opportunities to learn about their world, build general knowledge, and develop important language, numeracy, and emergent literacy skills. The skills children learn from parents during the first five years of life help to prepare them for the academic and social demands of formal schooling. Without enriching experiences early in life that support children's learning of necessary skills, children may be at risk for developmental delays and failure in school (Brooks-Gunn, Duncan, & Maritato, 1997). Moreover, children with early academic and social problems are more likely to exhibit problems throughout their schooling (Belsky & MacKinnon, 1994).

The quantity and quality of early experiences in the home generally vary depending on children's socioeconomic status (SES).[1] Families with unstable

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[1] In the reviewed studies, SES is defined by various criteria. Most commonly, researchers use a composite variable consisting of a combination of total household income, parent education level, and occupation status. Frequently, income is replaced by poverty status (i.e., living above or below the national poverty threshold), a poverty percentage (e.g., living at 200% of the federal poverty threshold), or an income-to-needs ratio, which reflects the number of residents in the household who are dependent on the household income. Education level is often represented by the total number of years of schooling or by a collapsed categorical variable (e.g., less than high school diploma, high school diploma, some college, four-year degree or more). Occupation status is sometimes replaced by employment status (e.g., working full-time, working part-time, not working, unemployed and looking for work) or is represented by a scale score on an occupational status scale (e.g., Hollingshead's Occupational Status Scale, 1975). In the present study, I use an income-to-needs ratio and the number of years of schooling of the respondent to the parent interview.

employment and low household incomes often lack the financial support, time, and ability to provide educational materials and enrichment activities for their children (Mayer, 1997). Moreover, parents who are poorly educated often do not have the skills and knowledge to engage their young children in learning. Consequently, low-income children tend to have poor quality home learning environments and few opportunities for active learning in the home (Bradley, Corwyn, McAdoo, & Garcia Coll, 2001).

Lack of stimulation in the home learning environment is one explanation for the poor school readiness skills of low-income children (Brooks-Gunn & Duncan, 1997). Even though some children attend child care or a preschool program where they are exposed to educational experiences, these skills are often not reinforced in the home. Additionally, many children do not begin preschool until they are four years old. Since approximately 80% of brain growth occurs before age three (National Research Council and Institute of Medicine, 2000; Zero to Three, n.d.), with the peak of synaptogenesis (or the formation of neuronal synapses) occurring between ages two and three (Webb, Monk, & Nelson, 2001), children's earliest experiences in the home are vital to their cognitive development. Low-income preschoolers' cognitive and language skills are frequently delayed (Noble, Norman, & Farah, 2005), and thus, they spend much time catching up rather than enhancing their skills. This is particularly evident for children in persistent, severe poverty (Smith, Brooks-Gunn, & Klebanov, 1997) and children who speak a non-English home language whose first experience with the English language and literature is in preschool or even kindergarten (García & Beltrán, 2003).

However, recent research on early childhood interventions indicates that engagement in home learning activities may serve as a protective factor against low family income and other risk factors associated with poverty, such as poor parent education and limited English proficiency (Parker, Boak, Griffin, Ripple, & Peay, 1999). Children in Head Start who are engaged in home learning activities with their families have better school readiness skills than their at-risk peers who are not engaged in such activities (D'Elio, O'Brien, & Vaden-Kiernan, 2003). Given this evidence, a next possible direction for research is to examine the influence of home learning activities on the development of low-income children's school readiness skills over time.

Study Rationale and Overview

Although extant literature reports that home learning activities experienced in early childhood may serve as a protective factor against socioeconomic risks such as low family income, few researchers have examined the effects of engagement in home learning activities in preschool on the growth of school readiness skills over time. In my study, I addressed this gap in the literature by using a latent growth model to estimate the contribution of early engagement in home learning activities to Head Start children's school readiness trajectories in the areas of vocabulary, numeracy, and writing skills. In addition, I examine the moderating effect of early engagement on the negative influences of low family income on children's skills, as measured by family income-to-needs (see Figure 1).

I analyzed data from the Family and Child Experiences Survey of 1997 (FACES), a national study of children participating in the federal Head Start program. The sample consisted of low-income children with various risk factors and diverse family histories. Approximately 71% of families were living below the federal poverty level at the beginning of the study and the remainder within a low-income range above poverty.

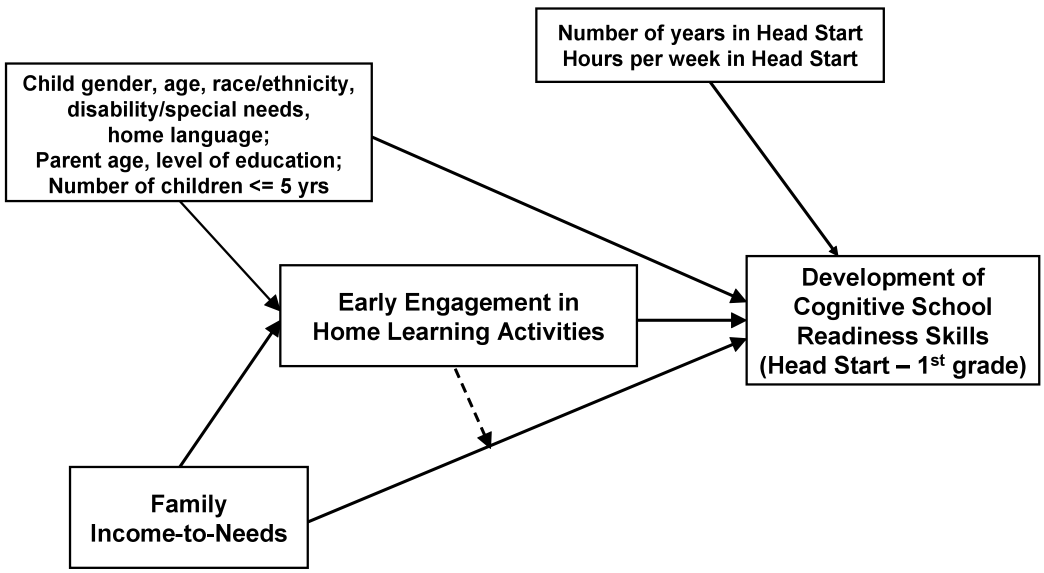

Figure 1. Conceptual model indicating associations between child and family characteristics, family income-to-needs, early engagement in home learning activities, and the development of cognitive school readiness skills from Head Start through 1st grade.

The following research questions and corresponding hypotheses were addressed:

Research Question 1: How do Head Start children's vocabulary, numeracy, and writing skills develop from Head Start through first grade? What are the average growth rates and variances in growth rates?

Hypothesis: Head Start children will score significantly below national norms on standardized measures of vocabulary, numeracy, and writing skills; however, there will be significant variances in the skills that they possess during Head Start and the rates at which their skills develop from Head Start through first grade.

Research Question 2: How does family income influence the growth of children's vocabulary, numeracy, and writing skills from Head Start through first grade?

Hypothesis: Children with lower family income-to-needs will demonstrate significantly weaker vocabulary, numeracy, and writing skills during Head Start and significantly smaller growth rates in these skills from Head Start through first grade than will children who have higher family income-to-needs.

Research Question 3: How do child and family characteristics, specifically child gender, race and ethnicity, home language, disabilities and special needs, number of years in Head Start, and number of hours in Head Start per week; parent age and level of education; and number of children age five and under in the household, influence the growth of children's vocabulary, numeracy, and writing skills from Head Start through first grade?

Hypothesis: Child and family demographic characteristics will have significant associations with children's average vocabulary, numeracy, and writing skills during Head Start and the growth in those skills through first grade. Being male and a racial/ethnic minority, and having a non-English home language, a disability or special need, one year of Head Start, few hours in Head Start per week, young parents, parents with fewer years of education, and multiple children age five or younger in the household will each be associated with weaker skills in Head Start and smaller growth rates in skills through first grade. Conversely, being female and White, and having English as a primary home language, no disabilities or special needs, two years of Head Start, a greater number of hours in Head Start per week, older parents, parents with more years of education, and fewer children age five or younger in the household will each be associated with greater skills during Head Start and larger growth rates in these skills through first grade.

Research Question 4: How does engagement in home learning activities vary across child and family characteristics, specifically child gender, age at baseline, race and ethnicity, home language, and disabilities and special needs; parent age and level of education; number of children age five and under in the household; and family income-to-needs?

Hypothesis: Child and family demographic characteristics will have significant associations with engagement in home learning activities. Being male, older, and a racial or ethnic minority, and having a non-English home language, a disability or special need, young parents, parents with fewer years of education, multiple children age five and younger in the household, and lower income-to-needs will be associated with lower engagement in home learning activities. Conversely, being female, younger, and White, and having English as a primary home language, no disabilities or special needs, older parents, parents with more years of education, fewer children age five and younger in the household, and higher income-to-needs will be associated with higher engagement in home learning activities.

Research Question 5: How does engagement in home learning activities during Head Start influence the growth of children's vocabulary, numeracy, and writing skills from Head Start through first grade?

Hypothesis: Children who have higher engagement in home learning activities will have significantly greater vocabulary, numeracy, and writing skills during Head Start and significantly larger growth rates in these skills through first grade than will children who have lower engagement in home learning activities.

Research Question 6: Does engagement in home learning activities during Head Start moderate the influence of family income-to-needs on children's vocabulary, numeracy, and writing skills?

Hypothesis: Children with low family income-to-needs who have high engagement in home learning activities will have significantly greater vocabulary, writing, and numeracy skills and significantly larger growth rates in these skills than their peers with low family income-to-needs who have low engagement in home learning activities.

Definitions of Main Constructs

The *home learning environment* describes the educational quality of the setting parents establish for their children, including access to learning materials (e.g., books and toys), engagement in learning activities in the home and community (e.g., shared reading; trips to a museum or zoo), and modeling of positive learning behaviors (e.g., parent reading in front of child). For the purposes of this study, I focused on one main component of the home learning environment: *engagement in home learning activities*. This construct was defined as children's participation in specific learning activities with a family member in the home and in the community. Some activities were more instructional in nature, such as teaching letters and numbers, while other activities were more constructive, such as playing games or helping with chores. However, all activities were considered to foster communication and contribute to children's learning.

School readiness was defined as the skills and abilities that children should possess for a successful transition to and performance in kindergarten. While various domains of development are crucial for school readiness, including social, emotional, and physical, for the purposes of this study, I focused on children's cognitive, or "academic," readiness skills, specifically, vocabulary (i.e., receptive language), numeracy (i.e., numerical literacy, or ability to reason with numbers and other mathematical concepts), and writing skills. This decision was made in light of research that indicates that living in an impoverished environment affects young children's early cognitive development, including language, more so than any other domain of development (Duncan, Yeung, Brooks-Gunn, & Smith, 1998). Additionally, the same assessment instrument must be used at each wave of data collection in order to measure development over time. Given the lack of standardized social-emotional assessments that are appropriate for ages 3 through 7, many longitudinal studies (including FACES) use different social-emotional assessments depending on the age of the child. My interest in the relationship between family income and children's cognitive skills, combined with the availability of longitudinal data for vocabulary, numeracy, and writing skills, led to my decision to focus specifically on the cognitive domain of school readiness.

Family income was defined by an income-to-needs ratio for each child's household. Income-to-needs ratios were based on monthly gross household income and number of individuals (adults and children) living in the household, which were reported by the child's primary caregiver during the parent interview. The ratios were computed by dividing the total monthly household income by the monthly poverty threshold for the appropriate family size (i.e., federal poverty threshold divided by 12 months). For example, in 1997, for a family of four with two children under the age of 18, the poverty threshold was $16,276 (U.S. Census Bureau, 2006a). If a family earned $1,500 in monthly household income, their income-to-needs ratio would be 1.11 (or $1,500/($16,276/12)). Families whose income-to-needs ratios are less than or equal to 1.00 are generally considered "poor" or "in poverty," whereas families whose income-to-needs ratios are greater than 1.00, but less than or equal to 2.00, are considered "near poverty" or "low-income." Ratios greater than 2.00, but less than or equal to 3.00 represent the "lower middle-class," and ratios greater than 3.00 represent the "middle-class." Few families in the FACES sample fit into the latter two categories. For modeling purposes, the exact income-to-needs ratio was used for a more accurate linear estimation.

Limitations

Although this study sheds light on the early experiences and abilities of the Head Start population, the results do not necessarily generalize to the entire low-income preschool population. Head Start's primary goal is school readiness; to achieve its goal the program assists low-income children and their families with their educational, health, nutritional, and social needs. Consequently, the families in this sample may engage in activities with their children more frequently than non-Head Start families who do not have the same resources and opportunities. However, the FACES sample does not have a comparison group of non-Head Start families. Findings from the Head Start Impact

Study, which randomly assigned families matched on various demographic characteristics to either Head Start or a control group, indicated that after one year of Head Start, participating parents engaged their children in more cultural enrichment activities and read more to their children than non-Head Start families (HHS, 2005b). Given the random assignment of participants, this change in level of engagement may be attributed to participation in Head Start. Since examining program effects was not the purpose of my study, I only analyzed engagement in activities at the beginning of Head Start, in order to avoid such confounds, and the associations between this early engagement and the acquisition of school readiness skills.

I chose to use the FACES dataset so that I may analyze the diversity in preschool children's experiences and skills within a low-income sample. Instead of categorizing low-income children together into one group, my study teased apart the individual trajectories that children took and the variance in their early experiences based on their sociodemographic characteristics. However, my choice of dataset limits my findings as there was no comparison group of middle- or high-income families as would be found in other national datasets (e.g., Early Childhood Longitudinal Study; National Center for Education Statistics [NCES], 1998). Therefore, the extent of any differences in the activities, skills, and behaviors among low-income and higher-income children were unable to be evaluated.

Additionally, the extent of generalizability to the current Head Start population is somewhat limited in that certain subgroups were not represented in the study, specifically children in migrant and Native American programs. Also, native Spanish speakers from Spanish-speaking areas (e.g., Puerto Rico) were given the child assessment measures in

Spanish throughout the study. Since I analyzed data from only the English version of the child assessment battery, the results cannot be generalized to this group of children.

Lastly, like many studies of young children, there was the limitation of parental report measures. Parents, or children's primary caregivers (e.g., grandmothers), reported the types of home learning activities their children performed; however, there were no observational data to validate the occurrence of the reported activities.

Contributions

The results of my dissertation study have potential to contribute to practice in the field of early childhood education. The findings may further substantiate the need for early intervention programs designed to educate low-income families about the importance of engaging in home learning activities with their children. Home-school collaborations or "add-on" programs to preschool curricula may facilitate communication between teachers and parents. By providing educational experiences for parents to learn hands-on activities that they can do at home with their children, learning can be transferred to the home environment to create a "continuous learning atmosphere" that connects development and learning at school with activities at home (Chilton, 1991, p. 1). It is important to make parents part of the learning process and create high-quality family education programs to enhance children's transition into school, with the ultimate goal of promoting long-term academic success.

Chapter 2: Literature Review

Children's early learning experiences in the home shape the skills they need for a successful transition to and performance in kindergarten. The fundamental skills that children acquire during the first five years of life are also critical to their long-term academic success, as they lay the foundation for their subsequent learning of more complex skills and set their academic trajectories in school. Unfortunately, children living in poverty often do not have the same quality experiences and engagement in home learning activities as their more advantaged peers (Bradley, Corwyn, McAdoo, & Garcia Coll, 2001). Consequently, poor children typically display underdeveloped cognitive and language skills (Klebanov, Brooks-Gunn, McCarton, & McCormick, 1998) and demonstrate low school achievement (Duncan, Yeung, Brooks-Gunn, & Smith, 1998). Nonetheless, there is evidence that engagement in home learning activities may serve as a protective factor against poverty and promote school readiness (D'Elio, O'Brien, & Vaden-Kiernan, 2003; Parker et al., 1999).

To better understand these associations and the significance of this area of research, I will review the literature on the following topics: (1) the significance of the family context in early development, according to Bronfenbrenner's ecological systems theory; (2) the concept of school readiness; (3) the effects of poverty on the development of school readiness skills; and (4) the role of the home learning environment in the development of school readiness skills, specifically, the mediating and moderating roles of home learning activities on the relationship between family income and school readiness.

Theoretical Framework

Parents are their children's first teachers and have a significant impact on early learning and achievement. According to Bronfenbrenner's ecological systems theory, multiple social contexts influence child development, although "the family is the principal context in which human development takes place" (1986, p. 723). The environment in which children are raised, parents' beliefs and practices, and the activities that families perform in the home compose the microsystem of the family. Bronfenbrenner described a microsystem as "the complex of relations between the developing person and environment in an immediate setting containing that person," (1977, p. 514) such as the home, and "a pattern of activities, roles, and interpersonal relations experienced by a developing person in a given face-to-face setting with particular physical and material features, and containing other persons with distinctive characteristics of temperament, personality, and systems of belief" (1986, p. 227). Consistent with this framework, the microsystem of the family is central to the complex layers of social contexts that influence and support children's development across multiple domains: cognitive, linguistic, social, emotional, and physical. The activities at this immediate microsystem are the foundation for subsequent interactions among other microsystems in children's lives, such as school and work. The interrelations among microsystems, or major settings that children directly experience, compose the next layer of this multi-level model, which is referred to as the mesosystem.

In this bi-directional process model, each system influences and is influenced by all other systems (Bronfenbrenner, 1979). Hence, the microsystem of the family is affected by activities in the exosystem, which is composed of social settings in which the child does not have an active role but is indirectly influenced. For example, the low wages and poor benefits at a mother's workplace can indirectly affect her child's development through the mother's psychological well-being and parenting skills. Moreover, the outer level of the macrosystem, which encompasses the broader society and culture in which the child lives, influences all other levels of the model. For example, political decisions are made regarding educational standards and welfare reform that indirectly influence a child's development through the activities at his or her school and the social services offered within the community. More specifically, a decrease in the amount of federal funding allotted for the Head Start program will reduce the quantity and quality of Head Start services provided in a child's community. A lack of quality services will directly lead to poorer child outcomes as well as indirectly affect the child through his or her parents' poorer well-being. Finally, these interactions among systems occur over time as a child develops, as reflected in the temporal layer of the chronosystem. The chronosystem centers on significant transitions that occur throughout the life span, such as a child's entrance into school (Bronfenbrenner, 1989).

A major tenet of the ecological systems theory is the concept of proximal processes, or complex, reciprocal interactions between children and persons, objects, and symbols in their immediate environments, through which children's "genetic potentials are actualized" (Bronfenbrenner & Ceci, 1994, p. 570). The hereditability, or extent to which children's genes contribute to their observed characteristics and abilities, is dependent on the effectiveness of the proximal processes, or rather the quality of children's interactions in their immediate environment. To be effective, these interactions, such as parent-child activities and children's learning of new skills, must occur on a regular basis. Therefore, when children are engaged in interactions with their caregivers, and proximal processes are strong, then heritability is higher and children are capable of meeting their full potential (e.g., high competence, low problem behaviors) (Bronfenbrenner & Ceci, 1994). However, when interactions are negative or absent, then children's capacities are not realized and they demonstrate more difficulties. Moreover, proximal processes demonstrate the greatest impact on children from disadvantaged environments, such that children of low socioeconomic status (SES) who experience "good" processes average significantly fewer problem behaviors and greater academic competence than their peers of low SES who experience "poor" processes. According to the main assumptions of the ecological systems theory, parents determine the quality of the proximal processes through their actions and beliefs. Parents choose the types of activities in which their children are engaged (or not engaged) and foster their children's early learning and development. The proximal processes children experience have a more powerful effect than the environment itself in which the processes occur (Bronfenbrenner & Ceci, 1994).

In sum, the ecological systems model describes the multiple social contexts that influence child development, while highlighting the importance of the immediate context of the child's family and home environment during the first few years of life. Through proximal processes, the family plays a crucial role in supporting and teaching the child, as well as protecting the child against negative influences. These interactions within the home environment are particularly important for low-income families who often face a variety of risk factors, neighborhood violence and poor quality schools (Brooks-Gunn, Duncan, & Maritato, 1997).

School Readiness

Definition and Components

The national goal to have all children "ready to learn" has spurred a growing body of research on what constitutes school readiness and how to support children's transition into kindergarten. Defining school readiness has been a difficult and controversial task, making the assessment of school readiness even more of a challenge (Love, 2001). Most researchers consider school readiness to be the skills and abilities that children should possess for a successful transition to and performance in kindergarten. Moreover, school readiness is viewed as a multidimensional concept that is shaped by many factors.

Under the National Education Goals Panel Goal 1 Technical Planning Group, school readiness is defined as encompassing a wide range of early developmental and learning skills, including five essential domains: (1) physical health and motor development; (2) emotional well-being and social competence; (3) approaches to learning; (4) communicative skills; and (5) cognition and general knowledge (Kagan, Moore, & Bredekamp, 1995). This definition has been widely accepted in the early childhood education field as it aligns with developmentally appropriate practice (DAP) (Kagan, 1992), under which school readiness is viewed from a "whole child" perspective (Bredekamp & Copple, 1997).

Varying Perspectives on School Readiness

Over the past two decades, varying opinions have developed on what school readiness means. Kagan (1990, as cited in Diamond, Reagan, & Bandyk, 2000) posited that readiness consists of two parts: *readiness for school*, which characterizes the specific set of skills or knowledge a child should have before he or she enters kindergarten (e.g., identifying colors, shapes, letters, and numbers) and *readiness for learning*, which stresses the developmental processes that form the basis for learning specific content (e.g., attention, motivation, and intellectual maturity). Early debates over the definition of school readiness often focused on these two distinct constructs. Soon thereafter, critics of the dual-perspective construct combined aspects of each into what is known as *maturational readiness* (Kagan, 1992). From the ready-for-school perspective, maturational readiness posits that there are fixed standards that should be met for entry into kindergarten, while from the ready-to-learn perspective, maturationalists acknowledge that "children should be given time to develop according to their individual time clocks" (Kagan, 1992, p. 48).

Supporters of the idea of maturational readiness typically believe it is better *not* to enroll children in kindergarten until they have matured developmentally and have attained the skills deemed necessary for a successful transition, rather than placing them in an overwhelming and advanced classroom environment, or adapting the curriculum to accommodate their individual needs. Opponents of maturational readiness disagree with this method of holding children back from kindergarten and, instead, advocate for a Vygotskian approach to early education (Vygotsky, 1978). They believe that learning precedes development and, therefore, children should be placed in stimulating learning environments that foster the growth of delayed skills. Under this "ready schools" perspective, Kagan (1992) explains that instead of delaying children's entry into kindergarten because of a possible maturational delay or a poor score on a readiness assessment, schools must be ready for all children regardless of their skills and abilities.

Others in the field believe that readiness includes not just children and schools but the ability of families, teachers, and communities to support children's transition into kindergarten (Ackerman & Barnett, 2005). Transitioning to kindergarten is a process which involves not only children, but their relationships with their surrounding contexts (Rimm-Kaufmann & Pianta, 2000). Successful transitioning, characterized by a child's adjustment to the social and academic demands of kindergarten, requires regular communication and the building of relationships among children and their teachers, parents and teachers, and children and their peers. Without these positive relationships, children tend to have a more difficult time adjusting, which may potentially lead to long-term problems in school (Pianta & Kraft-Sayre, 1999).

The period of transitioning to kindergarten "sets the tone and direction of a child's school career" (Pianta & Kraft-Sayre, 1999, p. 47). As maintained by Rimm-Kaufmann and Pianta's (2000) ecological perspective on kindergarten transition, "The early school transition period can be identified as a *sensitive period* for later school success…the transition into kindergarten is a period when a developing system…a child…is open to new influences. Thus minor adjustments in the trajectory of development in this period may have disproportionate effects on the direction of the child's school career" (Rimm-Kaufmann & Pianta, 2000, p. 494–495). Accordingly, factors that influence children's developmental trajectories during this period, including influences of the family and home environment, are worthy of examination.

Along this same line of thinking, the National School Readiness Indicators Initiative, a team of 17 states that worked to develop research-based indicators of school readiness to inform early education policy, created a "readiness formula" that acknowledged the various systems involved in the process of preparing children for school (Rhode Island Kids Count, 2005). The equation reads: “Ready Families + Ready Communities + Ready Services + Ready Schools = Children Ready for School.” The initiative aimed to improve school readiness by acknowledging not only children’s developmental skills and behaviors, but “the environments in which they spend their time” (p. 13), including the home environment.

State Definitions of School Readiness

The practical definition of school readiness also varies from state to state. For example, the State of Maryland recently established the *Maryland Model for School Readiness*, an assessment and instructional system designed to provide parents, teachers, and early childhood providers with a common understanding of what children should know and be able to do upon entering school (Maryland State Department of Education, n.d. a).

This system defines school readiness as:

> …the state of early development that enables an individual child to engage in and benefit from first grade learning experiences. As a result of family nurturing and interactions with others, a young child in this stage has reached certain levels of physical well-being and motor development, social and emotional development, language development, cognition and general knowledge. School readiness as a philosophy acknowledges individual approaches toward learning as well as unique experiences and backgrounds of each child (Maryland State Department of Education, n.d. b, para. 1).

Additionally, the State of Georgia, the first state in the nation to provide universal prekindergarten to all four-year-olds, has formulated a state definition of school readiness:

> We believe school readiness must be defined within the context of families and how they live. It must be defined within the context of communities and the services they provide. And, it must be defined within the context of schools and their readiness for children. A child's readiness for school is when: possible health barriers that block learning have been detected; suspected physical or mental disabilities have been addressed; enthusiasm, curiosity, and persistence toward learning is demonstrated; feelings of both self and others are recognized; social and interpersonal skills are emerging; communication with others is effective; early literacy skills are evident; and a general knowledge about the world, things, places, events, and people has been acquired (Georgia Department of Early Care and Learning, n.d., par. 1).

A key component of both these multidimensional definitions of school readiness is families. Maryland and Georgia, as well as many other states, recognize in their educational initiatives the influence of family nurturing and interactions in the home on young children's early development and learning. The link between the context of the family and school readiness presents further support for the underlying theoretical framework of the present study.

Effects of Poverty on the Development of School Readiness Skills

While school readiness for all children remains in the forefront of federal and state educational policies, the persisting "readiness gap" between low-income and high-income children is impeding the achievement of this goal. About 20% of children under the age of five in the United States are living in poverty (U.S. Census Bureau, 2006b), as defined by earning a household income below the national poverty threshold for the corresponding family size (e.g., $20,444 for a family of four with two children under the age of 18 in 2006) (U.S. Census Bureau, 2006c). The resulting consequences of poverty experienced during early development are profound. The extensive research of Brooks-Gunn and Duncan on the effects of poverty on children (e.g., Brooks-Gunn & Duncan, 1997) has revealed significant associations between family poverty and children's physical health, emotional and behavioral outcomes, cognitive abilities, and school achievement (i.e., grade repetition, school suspension, and high school drop-out rate); however, the measured effects of poverty on cognitive abilities and early academic achievement are notably larger than the effects on any other outcome (Duncan, Yeung, Brooks-Gunn, & Smith, 1998). The earliest significant differences in cognitive ability between poor and non-poor children have been seen at two years of age, with even greater differences at ages three through eight (Smith, Brooks-Gunn, & Klebanov, 1997). Additionally, children in severe poverty (i.e., those living in families with incomes below 50% of the national poverty threshold) demonstrate the lowest cognitive scores (Smith et al., 1997).

Evidence from Longitudinal Studies

To better understand the relationship between family income and child outcomes, researchers have analyzed data from several longitudinal studies of children and youth. The studies reported here were selected based on several criteria: (1) they were longitudinal studies; (2) they included data from the early childhood stage of development (birth through age 8); (3) they included measures of children's cognitive abilities and/or academic achievement; and (4) their data were subsequently analyzed to examine the associations between family income and child outcomes.

National Longitudinal Study of Youth (NLSY). The NLSY is a survey designed to gather information on the labor market activities and other significant life events of a nationally representative sample of approximately 9,000 men and women born between 1980 to 1984 (U.S. Department of Labor, 2007). Findings from the NLSY and the Children of the NLSY (NLSY-C), a subsequent study of the children of the original participants, revealed that early childhood is an important period for the development of fundamental cognitive abilities. Guo (1998) compared the effects of persistent poverty experienced from birth to age six years on cognitive ability at age six, poverty experienced only during adolescence on adolescent cognitive ability, and cumulative poverty experienced from birth through adolescence on adolescent cognitive ability. The results show that cognitive ability at age six was more sensitive to poverty than cognitive ability in adolescence. Moreover, Korenman, Miller, and Sjaastad (1995) found that participants in the NLSY who lived in persistent poverty throughout early childhood had significantly worse cognitive outcomes than children who experienced short-term poverty during a one-year span. The associations between family poverty and child IQ scores appeared to be just as large as those between family poverty and standardized assessment scores in reading and math (all measured in the NLSY), demonstrating that poverty status is associated with different areas of cognitive abilities (Smith et al., 1997).

Infant Health and Development Program. In a longitudinal study of low- and high-income families with low birth weight babies, Duncan, Brooks-Gunn, and Klebanov (1994) found that even after controlling for maternal education, ethnicity, and family structure, as well as baseline IQ scores at age three, average family income and poverty status significantly accounted for differences in children's IQ test scores on the Wechsler Preschool and Primary Scale of Intelligence (WPSSI) at age five. Compared to children who were never poor, children who experienced persistent poverty had IQ scores that were approximately 9 points, or three-fifths of a standard deviation, lower. The timing of poverty demonstrated to be nonsignificant, indicating that poverty experienced at any time prior to age five has equally detrimental effects on children's cognitive development. However, the effects of persistent poverty were twice that of transient poverty, or poverty experienced for only a period of time between birth to age five (i.e., during at least one, but not all four, data collection points).

National Institute of Child Health and Human Development Study of Early Child Care and Youth Development (NICHD SECCYD). The SECCYD is a comprehensive longitudinal study of 1,364 children from birth through 15 years that measured the associations between children's child care experiences and developmental outcomes. The NICHD Early Child Care Research Network (NICHD ECCRN, 2005) analyzed the effects of the duration and timing of poverty[2] on the cognitive and social skills of children in the NICHD SECCYD. The researchers compared child outcomes for children never in poverty, children who experienced early poverty between birth and three, children who experienced late poverty between age four and third grade, and children in persistent poverty from birth through third grade. They also found that the duration of

[2] Poverty was defined as having a family income-to-needs ratio of less than 2.0, whereas typically in the literature, poverty is defined as having an income-to-needs ratio of less than 1.0 (i.e., the family earns less than the federal poverty threshold for their given family size). Therefore, the term "poverty" should reflect "low family income." In the NICHD SECCYD, 64% of the sample never experienced poverty as they have defined it, which indicates that there are relatively few poor families in the sample—a noted limitation of this study.

poverty mattered significantly more than the timing of poverty in early childhood. Children in persistent poverty had significantly worse outcomes across groups and over time, and children never in poverty consistently outperformed their peers. However, comparisons between the two transient groups revealed that children who experienced poverty in preschool and early elementary school demonstrated less favorable outcomes than children who experienced poverty only during infancy, including decreased cognitive performance and increased internalizing and externalizing problems. It is likely that low family income during these early school years negatively influenced children's opportunities for learning and the development of important school readiness skills.

Early Childhood Longitudinal Study, Kindergarten Class of 1998-99 (ECLS-K). The ECLS-K is a multi-source, multi-method, longitudinal study of a nationally representative sample of approximately 22,000 children who began kindergarten in the fall of 1998. The study followed children from kindergarten through eighth grade to explore children's educational experiences and developmental outcomes, such as reading, math, and science achievement, social-emotional competence, and physical health (Tourangeau, Brick, Byrne, Le, & Nord, 2005). Many researchers have used these data to examine children's school readiness skills upon entrance to kindergarten and the variation in children's skills as a function of sociodemographic characteristics. Gershoff (2003) found that, on average, kindergartners from low-income families whose household incomes fell below 200 percent of the federal poverty level scored well below average on tests of reading, math, and general knowledge, compared to kindergartners from families with incomes over 300 percent of the federal poverty level who scored well above average across assessments. Looking specifically at those participants who were previously enrolled in Head Start, Jiang, Mok, and Weaver (2003) used a latent curve model to estimate the effect of income level (dummy coded '1' for below the poverty threshold and '0' for at or above poverty) on children's academic trajectories from kindergarten through first grade. Head Start participants living in poverty at the beginning of kindergarten demonstrated lower average baseline scores (i.e., intercepts) and lower average growth rates (i.e., slopes) in comparison to Head Start participants who lived at or above the poverty level during kindergarten, particularly in the area of reading.

To examine the development of reading skills through third grade, Foster and Miller (2007) divided children into three readiness groups—low, average, and high—based on their literacy skills in the fall of kindergarten. They found that the "low" readiness group (who scored one standard deviation below or lower on the reading assessment) consisted of a significantly greater number of children in poverty, compared to the "average" readiness group (who scored within one standard deviation) and the "high" readiness group (who scored one standard deviation above or higher). The achievement gap continued through third grade as the "average" and "high" readiness groups outperformed the "low" group on decoding skills at the end of first grade and on text comprehension at the end of third grade.

Similarly, findings from the fifth grade follow-up of the ECLS-K indicate that, on average, students living in poverty scored lower than students living at or above the poverty threshold on measures of reading, math, and science achievement (Princiotta, Denton Flanagan, & Germino Hausken, 2006). For example, only 25 percent of students with household earnings greater than the poverty threshold scored in the lowest third of the distribution of reading achievement scores, compared to an outstanding 61 percent of students living in poverty. Moreover, students who persistently lived in poverty from kindergarten through fifth grade consistently scored lower on achievement measures than students who never lived in poverty or who moved into and out of poverty during the study.

Panel Study of Income Dynamics. Duncan and colleagues (1998) further investigated the influence of being raised in poverty in early childhood on outcomes in young adulthood. Using longitudinal data from the Panel Study of Income Dynamics, a survey of a representative sample of approximately 5,000 families in the U.S. who have been followed since 1968, the researchers were able to measure the effects of changes in family income over time on changes in child outcomes. They found that a $10,000 increase in family income across the ages of 0 to 15 years was associated with a .14 increase in years of schooling, a 26% increase in the odds of graduating high school, and 35% decrease in the chances of having a nonmarital, teenage birth. However, when examining these relations separately for children with average family incomes less than $20,000 and children with average family incomes greater than $20,000, there was a nonlinear relationship for academic outcomes, such that the effects of an increase in family income on years of schooling and high school graduation rates were greater for poor children than non-poor children. When examining the effects by age, Duncan and colleagues found that an increase in family income between ages 0 to 5 had significantly greater effects on academic outcomes than an increase in income between ages 6 to 10 or 11 to 15. For low-income children, a $10,000 increase in average family income over the first five years of life was associated with an increment of .81 years of additional schooling and an outstanding 300% increase in odds of finishing high school.

In summary, family income has a large impact on academic outcomes; income during early childhood, and specifically, during the preschool and early school years, has a greater impact on academic outcomes than income during middle childhood or adolescence; and the effects of an increase in family income during early childhood on academic outcomes in young adulthood are largest for low-income children. These findings provide evidence that poor environmental factors begin to impact children's development very early in life. Consequently, these children are at a greater risk of failure in school and more likely to experience grade retention, receive special education services, and drop out of high school (Brooks-Gunn, Duncan, & Maritato, 1997; Jencks & Mayer, 1990; Leird, Lew, DeBell, & Chapman, 2006).

Mechanisms for Cognitive Disparities

There are many possible mechanisms for the disparity in the cognitive skills of poor and non-poor children. Some scientists argue that biology, or genetic influences, determine children's level of intelligence and cognitive abilities (Zhang & Li, 2005). Although that may in part be supported by genetic research, in a recent twin study that explored the etiology of cognitive school readiness skills researchers discovered that while genetics played an important role in the core abilities underlying school readiness, the environmental factors shared by twins of the same family contributed substantially to children's school readiness skills and later school achievement (Lemelin, Biovin, Forget-Dubois, Dionne, Seguin, Brendgen et al., 2007). In addition, Turkheimer, Haley, Waldron, D'Onofrio, and Gottesman (2003) reported that the proportion of variance in IQ explained by genes versus the environment varies nonlinearly with SES. Specifically, for children in lower SES families, environmental factors accounted for 60% of the total variation in IQ, while genetic factors accounted for almost zero; yet in children of high SES families, the opposite was found, with genetics playing a larger role than the shared environment. In other words, living in an impoverished environment may have a detrimental impact on children's cognitive abilities, above and beyond any genetic contribution of parents' level of intelligence.

Children's environments include numerous factors that influence their development of cognitive skills. Brooks-Gunn and Duncan (1997) discuss five potential pathways through which poverty affects children's development: (1) health and nutrition; (2) parental mental health; (3) parental interactions with children; (4) neighborhood conditions; and (5) the home environment. Subsequently, Duncan and Brooks-Gunn (2000) added a sixth pathway: quality of child care. More specifically, the nutritional diets of young children living in poor environments are often insufficient and lacking the proper nutrients for optimal development, causing hunger, health problems, and potential brain damage (Tanner & Finn-Stevenson, 2002). Also, poor children are more likely than their advantaged peers to be exposed to harmful lead paint toxins (Bellinger et al., 1987), which are associated with negative physical health and cognitive outcomes. Likewise, poverty largely influences parents' emotional well-being and parent-child interactions, which have been linked to children's learning experiences in the home (Brooks-Gunn, Klebanov, & Liaw, 1995). Living in a poor neighborhood with crime, safety hazards, fewer community resources, including high-quality child care centers, negatively impacts children's experiences and, in turn, their development; however, developmental outcomes have shown to be more strongly associated with family income than neighborhood income (Klebanov, Brooks-Gunn, McCarton, & McCormick, 1998). Moreover, the relationship between neighborhood poverty and IQ scores is mediated in part by children's experiences in the home learning environment (Klebanov, Brooks-Gunn, Chase-Lansdale, & Gordon, 1994). This last pathway is perhaps the most significant. The quality of the home learning environment is strongly positively influenced by family income level. As a result, children in poverty frequently experience a lack of cognitive stimulation in the home (Votruba-Drzal, 2003). In the following sections, I will review the current research on the construct of the home learning environment and its role in the development of fundamental cognitive skills.

The Home Learning Environment

Defining and Measuring the Home Learning Environment

The *home learning environment* describes the educational quality of the setting parents establish for their children, including access to learning materials (e.g., books and toys), engagement in learning activities in the home and community (e.g., shared reading; co-viewing educational television programs; trips to a museum or zoo), and modeling of positive learning behaviors (e.g., parent reading in front of child) (Foster, Lambert, Abbott-Shim, McCarty, & Franze, 2005; Hart & Risley, 1995; NICHD ECCRN, 2003). In a high-quality home learning environment, caregivers foster children's communication skills and cognitive development by providing them with educational play materials and engaging them in activities that facilitate learning.

According to the parent investment model (Mayer, 1997), children's success depends on the time, money, energy, and support their parents invest in the children's “human capital,” as well as cultural endowments, such as the value parents place on education through their modeling of learning behaviors and engagement in learning activities. From this perspective, family income influences children’s development by way of parents’ decisions about how to allocate their resources. The money families spend on their children through the purchasing of toys, books, and learning materials for the home, and the time spent engaging children in learning activities, are investments that contribute to a high-quality home learning environment.

To measure the home environment, many studies use the Home Observation for Measurement of the Environment (HOME; Caldwell & Bradley, 1984). The HOME evaluates the overall quality of the physical and social resources available to a child within the home and consists of both direct observation of the home (e.g., “At least 10 books are visible in the home.”) and a semistructured interview with the parent (e.g., “Do you talk to your child while you do housework?”). Several large scale studies, such as the NICHD SECCYD (NICHD ECCRN, 1993) and the Early Head Start Research and Evaluation Project (HHS, 2006b), have included the HOME as a measure of the quality of children’s experiences in the home.

Other scales that measure the home learning environment include the Home-Learning Environment Profile (HLEP; Heath, Levin, & Tibbetts, 1993) and the Family Involvement Questionnaire (FIQ; Fantuzzo, Tigue, & Childs, 2000). The HLEP was designed to measure a range of home learning activities practiced in families from diverse ethnic and economic backgrounds and does not include items reflective of socioeconomic status, such as material resources in the home. Examples include reading or looking at books with child and taking with child about how family members are related. The FIQ is a multidimensional scale of family involvement in early education and include home-based involvement, school-based involvement, and home-school conferencing. The home-based involvement items capture the ways in which family members promote children's learning in the home, such as working on numeracy, reading and writing skills, providing learning materials for the child, and going to places in the community to learn special things (i.e., zoo, museum).

Additionally, several nationally representative studies, including the Early Childhood Longitudinal Study Kindergarten Class of 1998-1999 (ECLS-K; National Center for Educational Statistics, 1999), the National Household Education Survey (NHES; NCES, 1993), and the Head Start Family and Child Experiences Survey (FACES; HHS, 1997), contain a family activities scale within their parent interview questionnaires to assess the various types of home and community activities in which the child has been engaged as well as the frequency of engagement in each activity. The items on these scales vary across studies and are referred to by slightly different names, such as "Activities with Your Child" (FACES) and "Home Environment, Activities, and Cognitive Stimulation" (ECLS-K). An example of an interview question is: "In the past week, how many times have you or someone in your family read to CHILD—never, once or twice, three or more times, or everyday?"

Each measure has its limitations; particularly, they all rely heavily on parental report of engagement in activities. Also, the HOME does not capture frequency data of engagement in daily home activities as do the HLEP, FIQ, and the family activities scales; rather it consists of a checklist of dichotomous "yes/no" items to provide a global measure of children's experiences in the home environment. What the HOME does offer that the other scales do not is an incorporation of multiple methods of observation and semi-structured interview to assess various characteristics of the home, including the physical environment, parental communication with the child, and the occurrence of activities and household routines. However, when examining engagement in family learning activities, a parent questionnaire that assesses a variety of activities in both the home and community may provide a more valid measure than the HOME; moreover, while this method may not be as reliable, it is much more cost-effective than home observations for large-scale, national studies.

The Home Learning Environment and Associated Child Outcomes

The quality of the home learning environment has been found to be a significant predictor of children's school readiness skills. Specifically, children with high-quality home learning environments demonstrate higher cognition, language, social competence, motivation to learn, attention, and task persistence than children with low-quality home environments (Fantuzzo, McWayne, Perry, & Childs, 2004; NICHD, 2003).

In the NICHD SECCYD (2003), a higher quality home learning environment, greater maternal sensitivity, and greater cognitive stimulation experienced from the age of 6 months to 54 months (averaged across five waves of data collection) positively predicted children's cognition, achievement, language, and social competence, and negatively predicted externalizing behaviors, at 54 months and in first grade. Similarly, Fantuzzo, McWayne, Perry, and Childs (2004) observed that, in a low-income and urban sample, home-based family involvement in the fall of preschool, characterized by actively promoting a home learning environment for children (e.g., creating a space for learning activities at home and providing learning opportunities for the child in the community), strongly predicted children's motivation to learn, attention, task persistence, receptive vocabulary skills, and low conduct problems later in the spring of preschool. In that study, home-based involvement had stronger associations with later child competencies than did school-based involvement, characterized by actively participating in school functions (e.g., volunteering in the classroom; participating in PTA meetings). These results provide evidence of the importance of engaging young children in home learning activities, particularly young children living in poverty who are more likely to be at risk of academic problems in school.

Home Learning Environments of Children in Poverty

Poor children tend to have less stimulating home learning environments than do children from non-poor families, as indicated by lower scores on the HOME (Bradley, Corwyn, McAdoo, & Garcia Coll, 2001; Brooks-Gunn, Klebanov, & Liaw, 1995; NICHD ECCRN, 2001). They tend to have fewer toys and books in the home and fewer out-of-home learning experiences, such as trips to the zoo, museums, or musical performances (Bradley et al., 2001), perhaps due to the high costs of such learning materials and activities and a lack of transportation to access such activities outside the home. According to Klebanov, Brooks-Gunn, McCarton, and McCormick (1998), the difference in the quality of home learning environments of poor and non-poor preschoolers accounts for up to half of the effect of family income on cognitive development scores.

Additionally, poor children typically do not experience shared reading with their parents to the same degree as their more advantaged peers (Gregory & Morrison, 1998). In one study, only 13% of low-income, Head Start families had regular storybook reading time, a significantly lower amount than their middle-class peers (Robinson, Larsen, & Haupt, 1995). Previous estimates show that low-income children spend an average total of only 25 hours in lap-reading experiences during the preschool years, while their middle-class peers spend 1000-1700 hours in lap-reading experiences (Adams, 1990). The lack of such stimulation greatly affects children's acquisition of language and emergent literacy skills, which are critical components of school readiness and highly predictive of children's academic performance throughout school (Baydar, Brooks-Gunn, & Furstenburg, 1993).

In fact, Noble, Tottenham, and Casey (2005) found that SES (i.e., a measured composite of family income-to-needs, level of parental education, and parental employment status) accounted for the majority of variance in language performance beyond other measured child and family characteristics. Complexity of speech, receptive and expressive vocabularies, and phonological awareness differed greatly across the socioeconomic gradient. These skills are highly related to word reading ability, which also has been shown to strongly correlate with SES (White, 1982). Children in high SES families tend to live in literacy-rich environments, and consequently, have more extensive vocabularies and learn to read earlier and with greater proficiency than children in low SES families (Whitehurst & Fischel, 2000).

Moreover, Noble, Farah, and McCandliss (2006) reported that living in a low SES environment intensifies cognitive risk factors for poor reading ability, whereas living in a higher SES and literacy-rich environment buffers children's reading ability against any preexisting cognitive weaknesses. Children with weak decoding skills are more vulnerable to failure when not provided access to supportive resources, but the benefits of a high-quality home learning environment may lessen the effects of weaker skills on the ability to read. Consequently, impoverished home environments have a detrimental impact on children's emergent literacy.

The Home Learning Environment as a Mediator of Poverty

The research findings I have described highlight that low family income alone does not promote negative outcomes for children, but rather family income influences the home learning environment, which, in turn, mediates the relationship between family income and child outcomes (Duncan, Brooks-Gunn, & Klebanov, 1994; Klebanov, Brooks-Gunn, McCarton, & McCormick, 1998). As Duncan and colleagues described, "In the case of the cognitive development of preschoolers, income matters to a substantial degree because it is associated with a richer learning environment for the children" (Duncan, Yeung, Brooks-Gunn, & Smith, 1998, p. 409). For example, in the NICHD SECCYD (NICHD ECCRN, 2001), children in poverty had significantly lower quality home environments than children living above poverty, and correlatively, scored significantly below national norms on cognitive measures. When family income dropped below poverty between infancy and the preschool years, the quality of the enrichment children experienced in the home environment also declined over time, which was associated with decreased performance (NICHD ECCRN, 2005).

Nevertheless, Poresky and Morris (1993) demonstrated that the extent of the mediating effect of the home learning environment on cognitive development actually varies as a function of SES. They found a "threshold effect" for family income and parent education, such that in low SES families, these sociodemographic factors had a strong direct effect on the quality of the home environment, but in higher SES families, income and parent education reached a level beyond which they no longer made a significant difference in the quality of the home environment. This study underscores the extent of the direct impact low family income and parental education have on the quality of the home environment.

In addition to mediating the relationships between SES and child outcomes, the home environment also mediates health-related covariates of poverty. Caughy (1996) found that the negative effects of a child's low birth weight and number of hospital visits during the first year of life were associated with reading and mathematics achievement in kindergarten by way of the context of the home environment. This finding suggests that poor health in infancy is related to poor achievement during the early school years due to the fact that children with poor health are more likely to come from impoverished, low-quality homes. Additionally, in that study, the quality of home environment had a stronger positive effect on hospitalized children than non-hospitalized children; specifically, hospitalized children with high-quality home environments had significantly higher mathematics scores than hospitalized children with low-quality home environments, indicating that the home environment can serve as a protective factor against early developmental risks.

Home Learning Activities as a Protective Factor

Recent literature suggests that a positive home learning environment, characterized by engagement in home learning activities, may serve as a protective factor against socioeconomic risks. Low-income children who participate in home learning activities with their families have better school readiness skills than their peers who are not engaged in such activities (Beasley, 2002; D'Elio et al., 2003; Parker et al., 1999).

For example, D'Elio and colleagues (2003) found that, in the Head Start Family and Child Experiences Survey of 2000 (FACES 2000), low-income children in the Head Start program who were more frequently engaged in family activities, including reading books, learning letters and numbers, helping with household chores, and going on trips outside the home, had greater parent-reported emergent literacy skills and positive social behaviors.

Similarly, Parker and colleagues (1997; 1999) found that low-income and poorly educated Latina-immigrant mothers who demonstrated greater parent involvement in Head Start (e.g., volunteering; attending workshops) showed improvements in the parent-child relationship and the quality of the home learning environment over time (Parker, Piotrkowski, Kessler-Sklar, Baker, Peay, & Clark, 1997), which predicted improvements in school readiness skills (Parker et al., 1999). Children whose mothers learned how to facilitate learning at home and the importance of learning through play demonstrated higher overall cognitive and language competencies and classroom behavior, indicated by higher task orientation, independence, and creativity. Additionally, in another study of low-income, Latina mothers, parents' literacy involvement with their preschool-aged children was positively related to their children's receptive language skills and social functioning (Farver, Xu, Eppe, & Lonigan, 2006).

Klebanov and colleagues (1998) showed that of the two types of family learning activities, those occurring in the actual home environment and those occurring in the community, activities in the home tend to have a greater association with children's cognitive development scores. Using data from the National Household Education Survey of 1993, Beasley (2002) also found that parent involvement in activities in the home contributed more to the variance in children's cognitive readiness skills (e.g., counting to 20; identifying letters and colors) than did cultural-related activities in the community (e.g., library, museum, art gallery, theater). However, for high-risk children—those with unwed mothers who did not attend center-based preschool—engagement in cultural-related out-of-home activities was related to higher cognitive readiness, over and above learning activities in the home. Engagement in cultural-related activities reduced the variability in children's skills, indicating that these types of activities may potentially be more beneficial to children faced with risk factors.

Furthermore, previous research with the FACES 2000 data set revealed that, for low-income Head Start children, both home and community activities were related to school readiness skills prior to kindergarten, including receptive vocabulary, early reading and writing, and numeracy skills (see See, 2007; See & West, 2007). An exploratory factor analysis resulted in distinct types of activities in which children were engaged with their families. A subsequent cluster analysis of those activity factors and salient sociodemographic characteristics showed that children who were highly engaged in direct instruction activities (e.g., teaching colors, letters, numbers), public entertainment activities (e.g., movies, theater performance, sporting event), and community and church activities were more likely to have young, Black, unmarried, and employed mothers, live in severe poverty, and share a household with other children. These children performed better then their peers on a letter and word identification task and scored higher on parents' report of emerging literacy skills. Children who were engaged in literacy activities (e.g., reading, telling stories, going to the library), games and toys, errands, chores, and talking about their day at Head Start were more likely to have slightly older, White, more educated mothers, live above poverty, and share a household with fewer children. Children in this cluster performed better than their peers on receptive vocabulary, story and print concept knowledge, and slightly better on numeracy skills. Additionally, children who had unemployed, less educated, married, Latina mothers, spoke a non-English home language, and lived in poverty were less engaged in all activities and performed significantly lower on all assessments. This final result provided further support for the engagement in home learning activities to promote school readiness.

While improving low-income children's academic and social skills, positive stimulation in the home environment may also protect children against grade retention. Specifically, Blair (2001) found that low-income African American children receiving inadequate stimulation in the home environment were almost three times more likely to be retained during the first three years of school than their matched peers living in more stimulating home environments. This association is above and beyond the influence of low IQ, externalizing problems, and low birth weight, which are risk factors commonly exhibited by children in poverty.

These results further illustrate that what takes place in the context of the family—in both the physical home and community settings with family members—has a significant influence on low-income children's early learning skills and academic success. The home learning environment is extremely vulnerable to social risk factors. However, the negative conditions associated with poverty can be ameliorated through intervention by educating parents about how to facilitate learning at home and improve the quality of the home learning environment.

Increases in Family Income and the Quality of the Home Learning Environment

With a significant increase in household income level over time, often as a result of a higher paying job and dual income from two working parents, the quality of the home learning environment can significantly improve. According to data from the National Longitudinal Survey of Youth (NLSY), an increase in household income from birth to age four significantly improved the quality of the home environment, even after accounting for salient child and family characteristics; yet this effect was most significant for children who lived in persistent poverty throughout early childhood (Garrett, Ng'andu, & Ferron, 1994). When the family income-to-needs ratio increased over time, HOME scores increased at a faster rate for those children who were born into poverty than children who were not. Subsequently, Votruba-Drzal (2003) concluded similar results using the NLSY data from age four to eight: an increase in family income was associated with an increase in cognitive stimulation in the home, with low-income households being most sensitive to the increase in finances.

Likewise, using national data from the NICHD SECCYD, Dearing and Taylor (2007) found that increases in family income from 1 to 54 months were positively associated with improvements in both the physical quality of the home environment (e.g., safety and building structure; presence of learning materials) and psychosocial quality of the home environment (e.g., parental warmth; engagement in stimulating activities). The greatest improvements were seen in families that had low income and low-quality home environments in early infancy. Connecting these findings to child outcomes, Dearing, McCartney, and Taylor (2001) found that a change in income-to-needs from the age of 1 month to 36 months mattered little to non-poor children, but significantly related to poor children's cognitive and language scores. Son (2007) found similar results also using the NICHD Study data. The quality of the home learning environment during the preschool years improved for over 30% of families (and very few families experienced a decrease in the quality), and this improvement was positively related to the increase in children's literacy and language competencies over time.

Summary

In summary, living in poverty has negative consequences for the development of young children's school readiness skills. The sensitive period for the development of fundamental cognitive skills appears to occur between birth and age six. Additionally, the home learning environment mediates the relationship between family income and children's developmental outcomes, such that low-income children have less stimulating learning materials and learning experiences than do high-income children, and consequently, perform lower on tests of knowledge and developmental skills; however, engagement in home learning activities can serve as a protective factor against risks associated with poverty. Both in-home and cultural-related, community-based learning activities are beneficial to children's development of important cognitive readiness skills. Families who involve their children in activities that stimulate communication and learning, regardless of setting, positively influence their children's developing skills and readiness for school. Engagement in such activities is particularly important for low-income children at risk of academic failure. Lastly, a natural increase in family income over time may also significantly improve children's academic and cognitive functioning, most likely due to the enrichment of the home learning environment and the increase in cognitive stimulation in the home.

Rationale for Proposed Study

The existing studies previously mentioned highlight the tremendous influence family income has on children's cognitive development, and in particular, how income seems to matter more for children with low family means than children from middle-class families. Many researchers have compared the cognitive skills of low-income and non-low-income children (e.g., Gershoff, Raver, Aber, & Lennon, 2007; NICHD ECCRN, 2005; Noble, Norman, & Farah, 2005), but few researchers have examined the diversity of characteristics, experiences, and skills of a sample composed exclusively of low-income children. Low-income children are often grouped together under one category when in fact there exists a large amount of variance in their experiences in the home and in their school readiness skills. Even fewer researchers have used modeling techniques to estimate low-income children's academic trajectories over time. Studies that have reported the associations between school readiness and later academic achievement typically relied on regression analyses (e.g., Downer & Pianta, 2006; Duncan et al., 2007; Foster & Miller, 2007), with time 1 predicting to time 2, to analyze cross-sectional data; however, these statistical techniques fail to account for differences in variance at each time point and do not account for individual growth patterns, only group effects. Given the abundance of scientific evidence that indicates the significant impact of low family income on children's cognitive and language skills beyond any other child outcome (e.g., social, emotional, physical), it is of particular importance to examine these skills in particular.

While previous literature suggests that home learning activities experienced in early childhood may serve as a protective factor against socioeconomic risks, such as low family income, few researchers have examined the lasting effects of home learning activities in preschool on the growth of academic skills over time. Many existing studies use cross-sectional data or non-experimental pre-test–post-test designs, which do not allow for an accurate study of longitudinal impacts of home learning activities. Specifically, there exists little evidence of the growth in cognitive school readiness skills over time as a function of engagement in home learning activities in preschool. Additionally, there exists little literature on how home learning environments vary across a low-income population. We do not have a clear understanding of the ways low-income families are encouraging their children's early learning in the home and the areas where there could be improvement. It is necessary to conduct this type of research to better inform the design of effective, evidence-based family intervention programs for low-income and at-risk children.

Overview of Current Study

In this study, I addressed these gaps in the literature by using a latent growth model to estimate the contribution of early engagement in home learning activities to the growth of Head Start children's cognitive readiness skills, and the moderating effect of home learning activities on family income. The cognitive readiness skills included vocabulary, numeracy, and writing skills. These skills were selected for two specific reasons.

First, the focus of the study was on children's developing "academic" skills, or otherwise described as cognitive readiness skills, which included children's receptive vocabulary knowledge, knowledge of numbers and ability to perform basic mathematical computations, and knowledge of letters and sentence construction and ability to write letters, words, and punctuation. These fundamental skills have been linked to children's later reading and mathematics abilities. Specifically, in a meta-analysis of 6 longitudinal data sets (including the previously cited NLSY, ECLS-K, NICHD SECCYD, and Infant Health and Development Program), Duncan and colleagues (2007) found that the strongest predictors of later academic achievement were children's reading and mathematics at school entry.

Second, the goal of the study was to estimate children's growth trajectories from Head Start through first grade. In order to accomplish this goal, child assessment data from each wave of data collection, or each grade level (Head Start, kindergarten, first grade), were required. Consequently, some measures that were only measured during Head Start (e.g., the Woodcock-Johnson Letter-Word Identification) or during kindergarten and first grade (e.g., ECLS-K Reading) were not able to be included in the analyses. Even though social and emotional skills were assessed throughout the FACES study, different instruments were used during Head Start and kindergarten than in first grade. Growth trajectories cannot be estimated unless the same measure is repeated continuously. Thus, only the three selected cognitive measures, which were administered at each wave of the study, were included in the analyses.

The following research questions and corresponding hypotheses were addressed:

Research Question 1: How do Head Start children's vocabulary, numeracy, and writing skills develop from Head Start through first grade? What are the average growth rates and variances in growth rates?

Hypothesis: Head Start children will score significantly below national norms on standardized measures of vocabulary, numeracy, and writing skills; however, there will be significant variances in the skills that they possess during Head Start and the rates at which their skills develop from Head Start through first grade.

Research Question 2: How does family income influence the growth of children's vocabulary, numeracy, and writing skills from Head Start through first grade?

Hypothesis: Children with lower family income-to-needs will demonstrate significantly weaker vocabulary, numeracy, and writing skills during Head Start and significantly smaller growth rates in these skills from Head Start through first grade than will children who have higher family income-to-needs.

Research Question 3: How do child and family characteristics, specifically child gender, race and ethnicity, home language, disabilities and special needs, number of years in Head Start, and number of hours in Head Start per week; parent age and level of education; and number of children age five and under in the household, influence the growth of children's vocabulary, numeracy, and writing skills from Head Start through first grade?

Hypothesis: Child and family demographic characteristics will have significant associations with children's average vocabulary, numeracy, and writing skills during Head Start and the growth in those skills through first grade. Being male and a racial/ethnic minority, and having a non-English home language, a disability or special need, one year of Head Start, few hours in Head Start per week, young parents, parents with fewer years of education, and multiple children age five or younger in the household will each be associated with weaker skills in Head Start and smaller growth rates in skills through first grade. Conversely, being female and White, and having English as a primary home language, no disabilities or special needs, two years of Head Start, a greater number of hours in Head Start per week, older parents, parents with more years of education, and fewer children age five or younger in the household will each be associated with greater skills during Head Start and larger growth rates in these skills through first grade.

Research Question 4: How does engagement in home learning activities vary across child and family characteristics, specifically child gender, age at baseline, race and ethnicity, home language, and disabilities and special needs; parent age and level of education; number of children age five and under in the household; and family income-to-needs?

Hypothesis: Child and family demographic characteristics will have significant associations with engagement in home learning activities. Being male, older, and a racial or ethnic minority, and having a non-English home language, a disability or special need, young parents, parents with fewer years of education, multiple children age five and younger in the household, and lower income-to-needs will be associated with lower engagement in home learning activities. Conversely, being female, younger, and White, and having English as a primary home language, no disabilities or special needs, older parents, parents with more years of education, fewer children age five and younger in the household, and higher income-to-needs will be associated with higher engagement in home learning activities.

Research Question 5: How does engagement in home learning activities during Head Start influence the growth of children's vocabulary, numeracy, and writing skills from Head Start through first grade?

Hypothesis: Children who have higher engagement in home learning activities will have significantly greater vocabulary, numeracy, and writing skills during Head

Start and significantly larger growth rates in these skills through first grade than will children who have lower engagement in home learning activities.

Research Question 6: Does engagement in home learning activities during Head Start moderate the influence of family income-to-needs on children's vocabulary, numeracy, and writing skills?

Hypothesis: Children with low family income-to-needs who have high engagement in home learning activities will have significantly greater vocabulary, writing, and numeracy skills and significantly larger growth rates in these skills than their peers with low family income-to-needs who have low engagement in home learning activities.

Chapter 3: Method

Participants

Data from the Head Start Family and Child Experiences Survey (FACES) 1997 Cohort, a national, longitudinal study of the federal Head Start program, were used to study these research questions.[3] According to its mission, Head Start is "a national program that promotes school readiness by enhancing the social and cognitive development of children through the provision of educational, health, nutritional, social and other services to enrolled children and families" (HHS, 2007, p. 1). The program serves three-to-five-year-old children at risk of failure in school, including: low-income children whose families earn less than the federal poverty threshold; children with disabilities; English language learners; and American Indians, Alaskan natives, and children of migrant families. In 2007, the program had a budget of $3,980,546,000 and served 793,809 children and their families across all 50 States and territories (HHS, 2008).

FACES 1997 is the first of four cohort studies (followed by FACES 2000, FACES 2003, and FACES 2006[4]) launched as part of the Head Start Program Performance Measures Initiative, in accordance with the recommendations of the 1993 Advisory Committee on Head Start Quality and Expansion, the Head Start Act as reauthorized in 1994, and the Government Performance and Results Act (HHS, 2003).

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[3] The FACES 1997 Cohort database is published by the Inter-university Consortium for Political and Social Research at the University of Michigan and is available through the Child Care and Early Education *Research Connections*.

[4] Data from FACES 1997 and 2000 are currently available for analysis. Data collection for FACES 2003 was completed in the spring of 2006, but the data have not yet been released for public use. Data collection for FACES 2006 will continue until 2009.

The FACES sample is nationally representative of programs, centers, classrooms, children and families who participated in Head Start in 1997 (HHS, 2001). The study followed children from their entrance into the program through the end of first grade. This first FACES cohort is unique in that it is the only FACES study to follow children longitudinally past the spring of kindergarten, allowing for a more accurate analysis of the growth in children's skills over time.

The purpose of FACES is to gather descriptive information on the children and families that Head Start serves (HHS, 2005a). The data set includes information about Head Start children's home and school experiences, their family and teacher characteristics, and their school readiness skills. A variety of data collection methods were used, including direct child assessments, classroom observations, teacher interviews and reports of children's behaviors, and parent interviews and reports of children's behaviors. Unlike the Head Start Impact Study (which began in 2000 and whose data is not yet available to the public), FACES was non-experimental and did not have a randomized control group; therefore, the study did not examine the causal effects of participating in Head Start. However, some child cognitive assessments were norm-referenced instruments (e.g., Peabody Picture Vocabulary Test-III), which allow for the comparison of the scores of the FACES participants to national norms established for children of the same age.

Procedures

Sampling Design

The FACES sample was designed to provide information at the national level on Head Start children and families, the programs servicing these children and families, and their classrooms and teachers. In order to create a nationally representative sample, the sampling approach was based on a three-stage design: (1) selection of Head Start programs as the Primary Sampling Units; (2) sampling of Head Start centers within selected programs; and (3) the actual sampling of children within Head Start centers (HHS, 2005a).

First, data on all existing Head Start programs were gathered from the Head Start Program Information Report from 1995-1996, resulting in a universe of 1,734 Head Start programs from all 50 States, Puerto Rico, and U.S. Territories (excluding Migrant and American Indian programs). The program universe was stratified into 16 strata on the basis of three variables: region (Northeast, Midwest, South, and West), Metropolitan Statistical Area status (rural or urban), and percent minority enrollment (above 50% or below 50%). Stratification ensured that the programs that were selected were well distributed geographically to accurately represent the children being served in Head Start. Within each of the 16 stratum, Head Start programs were randomly selected using probability proportional to size (PPS) sampling. The number of programs selected was based on the total number of children enrolled in Head Start in that particular stratum, giving each family an equal probability for selection for the final sample. For example, there were nine programs in the strata characterized as "South, Urban, Over 50% Minority," as there was a proportionately higher number of children being served by Head Start in these areas, whereas there was one program in the strata characterized as "Northeast, Rural, Under 50% Minority," since there were fewer children in programs that fit that description. A total of 40 programs were selected. A "program" was typically a community-based organization which oversaw the operations of Head Start in local centers. From a hierarchical perspective, programs consisted of centers which consisted of Head Start classrooms.

Second, four centers were randomly selected from each of the 40 programs, with several exceptions. In some cases, a program had fewer than four centers; therefore, all centers were included in the sample. In other cases, programs had a relatively large enrollment of children, so additional centers were selected to reflect the size of the program. Across all programs, a total of 180 centers were selected, with an average of four centers in each program.

Class rosters were collected from each center to create a complete list of Head Start children in each classroom, with three- and four-year-old children listed separately within each class. Rosters identified two targeted groups: children who were enrolled in Head Start in Spring 1997 and who had participated in the FACES field test[5] and children who had enrolled in Head Start for the first time in Fall 1997. The number of three-year-olds (and likewise for four-year-olds) selected from each program was based on the number of three-year-olds in the corresponding sampling stratum, so that the probability of selection was equal across all three-year-olds (and four-year-olds). As a final step, 3,200 children were randomly selected from the lists, with a proportional number of three- and four-year-olds (n = 1200 and n = 2,000, respectively). The sample included 30% of the children who participated in the Spring 1997 field test (n =720). The remainder of sampled children were first-time Head Start participants. Of the 3,200

[5] In Spring 1997, a FACES field test was conducted to assess the feasibility of instruments and research protocol. The same sampling design described above was used to create a nationally representative, random sample of 2,400 children from 160 centers in 40 Head Start programs. The same 40 programs selected were used for the full-scale study in Fall 1997; however, a new sample of centers were randomly selected accounting for program size. Random selection resulted in 180 centers, some of which participated in the field study. Field test data are not included in the FACES data set and will not be discussed in the current study.

children selected for participation in FACES, 3,006 children received parental consent to participate in the study (94% response rate) (HHS, 2005a).

Waves of Data Collection

The full-scale FACES study included five waves of data collection from Fall 1997 through Spring 2001 (see Figure 2). In Spring 1999, 62.5% of children in the sample were enrolled in kindergarten, while 37.5% of children in the sample were enrolled in Head Start for a second year as they did not meet age eligibility requirements for kindergarten.

Children who had parental consent to participate in the study were assessed by a trained evaluator on various cognitive, social-emotional, and physical measures from the time they entered the Head Start program through the end of first grade (see Appendix A for a list of child assessment instruments). In Fall 1997, direct child assessment data were obtained for 2,451 children of the 3,006 children with consent (82% completion rate). In Spring 1998, child assessment data were obtained for 2,183 children, representing 93% of the children remaining in the program and 73% of the original sample of 3,006 children. After their first year of Head Start, participating children were followed if they had data from either Fall 1997 or Spring 1998. In Spring 1999, child assessment data were collected on 989 of the 1,412 children in kindergarten (70% of followed children) and 965 of the 1,304 children still in Head Start (74%) (HHS, 2001). Those children were then followed through their first grade year: Spring 2000, if they were in Head Start for only one year, or Spring 2001, if they were in Head Start for two years.

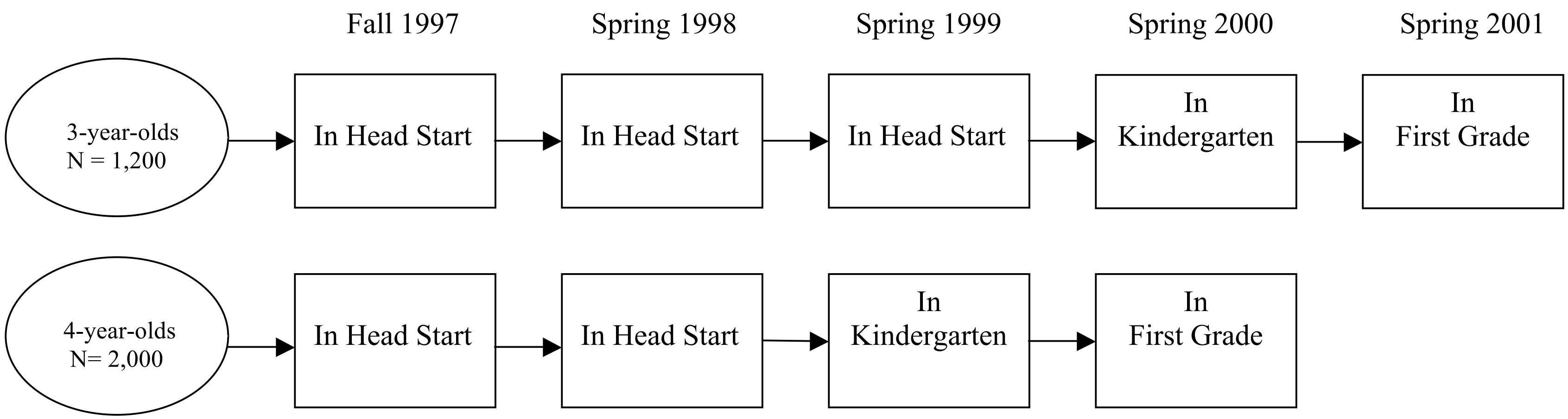

Figure 2. Timeline demonstrating grade levels for three-year-olds and four-year-olds at each of the five waves of data collection. Adapted from the *Head Start FACES: Longitudinal Findings on Program Performance, Third Progress Report* (HHS, 2001, p. 8).

Note: A field test was conducted in Spring 1997 (not shown) to assess the feasibility of the assessment protocols. Therefore, technically there were six waves of data collection, but only the five waves shown above are included in the FACES dataset.

Children's teachers and primary caregivers completed interviews at each wave of data collection, and teachers rated their targeted students' skills and abilities along various developmental domains. In Fall 1997, 2,424 parent interviews were completed out of 3,006 families (81% completion rate). Respondents to the parent interview were mostly mothers (88%), followed by fathers (5%), grandmothers (4%), and foster mothers (1%) (see Appendix B for sources of items in parent interview). Approximately 82% (n =1541) of parent interviews from Fall 1997 were conducted in English and 17% (n = 321) were conducted in Spanish by trained bilingual assessors. Language interpreters were used when parents spoke a language other than English and Spanish (e.g., Vietnamese, American Sign Language), which occurred in less than 1% of cases (n = 9). Child assessment, parent, or teacher data were obtained for a total of 2,657 of the 3,006 participating children in Fall 1997 (88% completion rate).

Language Screener

As part of a language screening process, during the Fall 1997 wave of data collection, teachers indicated if the target children in their classrooms were English-language learners, and if so, were asked to provide information about each child's English language ability and home language. That information, combined with information from the assessor, was used to determine whether or not a child received the direct child assessment battery in English or Spanish (HHS, 2005a). The child assessment battery was only available in English and Spanish, thus children who had another primary language and did not qualify for either of these batteries were not administered the direct child assessment battery in Fall 1997. However, on all follow-up assessments, they received the English version of the battery.

Approximately 20% of the 2,451 children assessed in Fall 1997 (*n* = 500) spoke a non-English home language. Children who did not possess sufficient English proficiency to qualify for the battery in English and whose native language was Spanish were administered a Spanish version of the child assessment battery in Fall 1997 (*n* = 345, or 14% of children assessed). Of those 345 children, 299 were reassessed in Spring 1998; 179 of the 299 children received the child assessment in English plus the Spanish versions of the PPVT and the Woodcock-Johnson Letter-Word ID for the sake of comparison. The remaining 120 children were from Spanish-speaking areas (e.g., Puerto Rico) and continued to receive only the Spanish version of the battery throughout the study. Ninety of those 120 Spanish-speaking children were assessed in kindergarten and 86 were assessed in first grade.

In my study, I analyzed scores on only the English version of the assessments, as my interest was in the development of English language skills for school readiness in the U.S.. Spanish assessment data were excluded, yet all other data (i.e., parent interview data) for children given the Spanish battery were included in the analyses. In other words, no participants were dropped from the sample due to language, but at least 14% of participants did not have child outcome data from Fall 1997 due to a lack of English proficiency and about 5% were missing outcome data on the English version of the measures thereafter. By limiting the analysis to data from English language assessments, the results of my study are not reflective of the skills of all English language learners. Specifically, children's skills from Fall 1997 may be overestimated as they only included children with sufficient proficiency in English and not all sampled children.

Longitudinal Data Set

The FACES data set includes both cross-sectional data files for each wave of data collection as well as a longitudinal data file composed of data merged across all five waves. Only children who had data from at least three waves of data collection, including the fall of 1997, and for whom a parent interview was conducted in the fall of 1997 or spring of 1998, were included in the FACES longitudinal data set. This restriction eliminated participants who dropped out of the study after the first year, thus decreasing the amount of missing data. The longitudinal data set has a working sample size of 1,968 participants—74% of the 2,667 participants in the fall 1997 cross-sectional data file (HHS, 2005a).

Sample Weights

Since FACES has a nationally representative sample of Head Start children, the FACES data must be weighted in order to reflect the true population. Also, weighting the data helps to reduce bias associated with participant non-response. Both cross-sectional and longitudinal weight variables are available in the FACES data set. For the purposes of this study, data were weighted using the fall 1997-spring 2001 longitudinal weight, which summed to the population of Head Start children who completed at least one year of Head Start and who attended first grade in Spring 2000 or Spring 2001. The summed weights resulted in a representation of 699,626 Head Start children.

Each participant in the data set was assigned a particular weight. For example, a child may have had a weight of 300, which means that that sampled child represented 300 children in the population of all Head Start children. Another child may have had a larger weight of 500 or a smaller weight of 50. The mean weight for children in the longitudinal sample was 356 (*SD* = 326), with a range of 39 to 2,031. For each child, the final weight was calculated by the following formula:

> Final weight = (program weight) x (center weight) x (child weight), or "the inverse of the product of probabilities of selection at each stage of sampling" (HHS, 2005a, p. 6).

The value of the weight depends on a number of factors resulting from the sample design, including the number of three- and four-year-olds in each stratum, program, and center; the number of programs in each stratum; the number of centers in each sampled program; the number of new Head Start children in a center; and the number of returning field test children in a center. Additionally, longitudinal weights were adjusted for non-response by multiplying the final weight by a factor that accounted for the number of families in a program who had different parent respondents over time or who did not complete the parent interviews during Head Start.

Weights are calculated and used for several reasons (HHS, 2005a). The first is to adjust for differential probabilities of selection due to sampling design. Head Start children were not selected for participation in the study at an equal rate; children in larger Head Start programs were sampled at a higher rate than children in smaller Head Start programs, and likewise at the center level, children in larger centers within a given program were sampled at a higher rate than children in smaller centers. Since there may be differences in program and center characteristics as a function of their size, unweighted sample estimates may not accurately represent the true Head Start population. Weighting the data to account for sampling design adjusts the estimates, so that statistical findings are generalizable to the whole population and not the selected sample.

Another important reason for weighting data is to account for non-response bias. As with any large-scale survey study, some respondents to the FACES measures (i.e., parents, teachers, and children) have missing data. To reduce the possibility of bias on particular measures due to participant non-response, the sample weights were created in a manner to adjust for non-response.

Additionally, the weights account for attrition, or participant fall-out. The FACES data were collected over the course of five years, during which time some participants dropped out of the study for a variety of reasons (e.g., family moved and was unable to be located for follow-up; family no longer desired to participate in the study). A participant received a positive, non-zero weight, and were thus included in the longitudinal data set, if they were assessed at least three times (including Fall 1997) and had a parent interview from either Fall 1997 or Spring 1998.

Measures

Home Learning Activities

Engagement in home learning activities was measured with the *Activities with Your Child* scale from the FACES baseline parent interview (HHS, 1997), which was adapted from the National Household Education Survey of 1993 (NCES, 1993) (see Appendix C for copy of instrument). The scale contained 22 items that assessed the occurrence and frequency of routines activities within the past week, as well as the occurrence of less common activities within the past month. Examples of weekly home activity included: "In the past week, have you or someone in your family told a story to CHILD? How many times—never, once or twice, or three or more times?" and "In the past week, have you or someone in your family involved CHILD in chores? How many times—never, once or twice, or three or more times?" All items were scored on a 3-point scale except for one item that assessed the frequency of reading to child, which was scored on a 4-point scale and included the response option of "everyday." Monthly activity items included: "In the past month, did you visit a library with CHILD?" and "In the past month, did you visit an art gallery, museum, or historical site with CHILD?" Items were scored on a 2-point scale ("no" = 0, "yes" = 1).

The items from the fall 1997 parent interview (baseline of study) had a Cronbach's alpha of .739, which indicated good reliability among the variables. Therefore, children who were highly engaged in one activity were likely to be highly engaged in other activities, and vice versa.

School Readiness

Fundamental cognitive skills that have demonstrated to be critical to school readiness were measured with standardized assessments at each wave of data collection (see Table 1). These instruments have demonstrated strong reliability and validity with a diverse population of children (HHS, 2005a) and are widely used in research on young children's early skills and abilities (e.g., Fantuzzo et al., 2004; Farver et al., 2006; Foster et al., 2005; NICHD ECCRN, 2003, 2005).

Receptive vocabulary skills were measured with the Peabody Picture Vocabulary Test-III (PPVT-III; Dunn, Dunn, & Dunn, 1997). On the PPVT, participants were presented with a series of spoken words of increasing difficulty (including nouns, verbs, adjectives, and adverbs) along with cards displaying four pictures. Participants were asked to point to the picture that matched the spoken word that they heard (e.g., camera).

Numeracy skills were measured with the Applied Problems subtest of the Woodcock-Johnson Psycho-Educational Battery–Revised. Children were asked to solve practical problems in mathematics, such as relatively simple counting, addition or subtraction operations.

Early writing skills were assessed with the Woodcock-Johnson Dictation subtest (Woodcock & Mather, 1989, 1990). Children were asked to draw lines, copy letters, as well as write specific upper- or lower-case letters of the alphabet, words and phrases, punctuation, and capitalization (HHS, 2005a).

Table 1. *Child Assessment Measures Administered During Each Wave of FACES*

Measure	Age Group	Fall 1997[1]	Spring 1998	Spring 1999	Spring 2000	Spring 2001[2]
PPVT	3-year-olds	X	X	X	X	X
	4-year-olds	X	X	X	X	
Applied Problems	3-year-olds		X	X	X	X
	4-year-olds	X	X	X	X	
Dictation	3-year-olds		X	X	X	X
	4-year-olds	X	X	X	X	

[1] The Woodcock-Johnson Psycho-Educational Battery is appropriate for children 48 months and older. If three-year-olds turned 48 months by the Spring 1998 assessment, they were administered the W-J subtests. If not, they were given the W-J subtests the following Spring once they were age eligible.
[2] Only the cohort of 3-year-olds were assessed in Spring 2001 when the majority of children were entering first grade.

Children's scores on the PPVT and the Woodcock-Johnson subtests were based on the number of correct responses; raw scores were then converted to standard scores and ability scores, known as Growth Scale Values (GSV) scores on the PPVT and W scores on the Woodcock Johnson (W = 9.1024 logits + 500) (Woodcock, 1999). Since the instruments are normed to the general population of children, a child who was performing on average for his or her age received a standardized score of 100. Ability scores of an average-performing individual vary by age and grade level. A person's ability level and test item difficulty are calibrated on a common scale allowing for the comparison of a target child's abilities to the normal range of ability levels of children his or her age. When item difficulty is at the same level as a child's ability level, the child has a 50% chance of responding correctly to the item; when the item difficulty is higher than the child's ability level, the chance of a correct response is less than 50%; and when the item difficulty is lower than the child's ability level, the chance of a correct response is greater than 50%. The GSV score on the PPVT for a four-year-old child (48 months) is 76 (Dunn, Dunn, & Dunn, 1997). *W* scores are centered at 500, which represents the performance of a typical 10-year-old child, or fourth grader. The norm score for a four-year-old child is 413 on the Applied Problems subtest and 364 on the Dictation subtest (Woodcock & Johnson, 1990).

Ability scores are advantageous as they create an equal interval scale recommended for statistical analysis and for measuring growth. For the purposes of the current study, ability scores were used in the analyses, as they better demonstrated a change in ability over time, unlike standardized scores whose mean is centered at 100. Specifically, if a child's skills are developing on average, he or she would have an increase in ability scores but a standardized score of 100 at each time point (i.e., would have a flat standardized trajectory line); thus, the ability scores allowed for the estimation of children's growth rates.

Reliability of standardized measures. Internal consistency of the items on the PPVT, as measured by Cronbach's alpha, ranges from .92 to .98, with a median of .95 (Dunn, Dunn, & Dunn, 1997). When tested with the FACES sample, internal consistency was estimated to be .97 (HHS, 2005a). Internal consistency for preschool-aged children on the Woodcock-Johnson averages .91 on the Applied Problems subtest and .90 on the Dictation subtest (Woodcock & Mather, 1989). With the FACES sample, Cronbach's alphas were .90 on the Applied Problems subtest and .77 on the Dictation subtest (HHS, 2005a).

Validity of standardized measures. Both concurrent and predictive validity of the standardized measures were tested with the FACES sample using comparable measures from the Early Childhood Longitudinal Study—Kindergarten Class of 1998-99 (ECLS-K) (HHS, 2005a), a national longitudinal study of children who entered kindergarten in the fall of 1998 and were followed through eighth grade (NCES, 1998). There were significant correlations between the PPVT scores and the ECLS-K Reading and General Knowledge scale scores at the end of the kindergarten year (r = .54 and .77, respectively). Moreover, there were correlations between the Woodcock-Johnson subtest scores and the ECLS-K Reading and General Knowledge scale scores at the end of the kindergarten year (r = .62 for Applied Problems with ECLS-K Reading; r = .64 for Dictation with ECLS-K Reading; r = .59 for Applied Problems with ECLS-K General Knowledge; r = .48 for Dictation with ECLS-K General Knowledge).

The PPVT demonstrated strong predictive validity, such that there was a significant correlation between the PPVT scores at the end of Head Start and the ECLS-K Reading scale scores at the end of kindergarten (r = .42), as well as a significant correlation between the PPVT scores at the end of Head Start and the ECLS-K General Knowledge scale scores at the end of kindergarten (*r* = .79). The Woodcock-Johnson subtests also exhibited strong predictive validity with the ECLS-K Reading scale, such that there were significant correlations between the Woodcock-Johnson subtest scores at the end of Head Start and the ECLS-K Reading scale scores at the end of kindergarten (*r* = .52 for Applied Problems; *r* = .42 for Dictation), in addition to significant correlations between the Woodcock-Johnson subtest scores at the end of Head Start and the ECLS-K General Knowledge scale scores at the end of kindergarten (*r* = .62 for Applied Problems; *r* = .46 for Dictation). Table 2 displays a summary of correlations.

Table 2. *Correlations among Child Measures from FACES and the ECLS-K*

FACES Measure	ECLS-K Reading: Kindergarten	ECLS-K General Knowledge: Kindergarten
Kindergarten		
Peabody Picture Vocabulary Test-III	.54	.77
Woodcock-Johnson Applied Problems	.62	.59
Woodcock-Johnson Dictation	.64	.48
End of Head Start		
Peabody Picture Vocabulary Test-III	.42	.79
Woodcock-Johnson Applied Problems	.52	.62
Woodcock-Johnson Dictation	.42	.46

Family Income

Family income was represented in the form of an income-to-needs ratio. The definition of "family" that I used included all persons living in the same household as the target Head Start children who were either supported by the parent(s) or guardian(s) of the children enrolled in Head Start or contributed income to the household. Members of the same household were not necessarily related, but their presence contributed to the home experience of the sample children. An income-to-needs ratio is a more accurate estimate of a family's income level than total household income, as these ratios adjust for the household's need for economic resources. Baseline monthly gross household income and the number of individuals (adults and children under the age of 18) living in the household were reported by the child's primary caregiver during the parent interview. To create an income-to-needs ratio in preparation for the proposed study, the following formula was used:

$$\text{Income-to-needs} = \frac{\text{Total monthly household income}}{\text{(Poverty threshold for corresponding family size and number of children/12)}}$$

First, the poverty threshold for each participant was calculated using the available information about family size and number of children under 18 living in the household (see Appendix D for the 1997 poverty thresholds established by the U.S. Census Bureau). Since the poverty threshold value represents yearly household income, this value was divided by 12 in order to obtain an estimate for each participant's monthly poverty threshold. Then, each participant's monthly household income was divided by their corresponding monthly poverty threshold to derive an income-to-needs ratio composite.

Covariates of Engagement in Home Learning and School Readiness

The FACES parent interview assessed various family and child sociodemographic characteristics. The covariates I selected for inclusion in my model were factors that may have influenced parents' decisions about engagement in certain types of activities, or factors that potentially limited children's opportunities for learning in the home and community, thereby inhibiting their development of school readiness skills (Farver, Xu, Eppe, & Lonigan, 2006). While indirectly influencing the development of school readiness skills through engagement in home learning activities, these factors were also predicted to have a direct influence on school readiness, and therefore, were controlled for in the model. These data were reported by the child's primary caregiver during the baseline parent interview.

Child characteristics. Child characteristics included child gender, race and ethnicity, disabilities and special needs, age, number of years in Head Start, and number of hours in Head Start each week. Child gender was dummy-coded with females equal to "1." Child race and ethnicity was dummy-coded into four categorical variables representing the largest racial/ethnic groups in the sample: White non-Hispanic, Black non-Hispanic, Hispanic, and Asian/Pacific Islander.[6] White non-Hispanic was used as the reference category in the model. Disability/special needs status was a dichotomous categorical variable coded "1" when parents reported that their children had a disability or special need, such as a physical, emotional, language, hearing, or learning difficulty.

A continuous baseline child age variable was created by determining child age in months at the beginning of the baseline school year—set to August 31, 1997—based on

[6] The names for the child race and ethnicity categories are based on terminology used in the FACES dataset and reports.

their date of birth. This variable was used as a covariate of engagement in home learning activities only. In addition, child age in months at the time of each assessment, which was calculated by the assessor at the time of data collection, was added to the model as a time-varying covariate to control for differences in assessment scores as a result of child age.

Additionally, I added the number of years in Head Start and number of hours spent in Head Start per week to the model as covariates of children's growth rates (i.e., latent factor slopes), as the level of participation in Head Start might have influenced children's development of cognitive readiness skills.

Family characteristics. Family characteristics included home language, primary caregiver's age and education at the beginning of Head Start, and number of children in the household five years of age and under. Home language was a dichotomous categorical variable coded "1" when the primary home language, as reported by parents (not teachers or assessors), was not English and "0" when English was the primary language spoken in the home. The respondent to the parent interview reported their own age, the number of years of school they completed, and any college degrees they earned. For parents who did not graduate high school, the highest grade of school completed was used (i.e., "11" for 11th grade). Those who attended some college but did not obtain a degree were coded "13"; those with an Associates degree ""14"; a Bachelor's degree "16"; and a Master's degree "17." If the respondent to the parent interview was not the biological mother or father, the primary caregiver was questioned about the child's biological mother and father's levels of education in addition to their own, although this information was not always known by the respondent; hence, there was more missing data on these variables. As a result, I only included demographic information on the primary caregiver, who was the respondent to the baseline parent interview, in the analyses.

Parent interview respondents also reported the number of residents in their household and their ages. With this information, I created a composite variable to represent the total number of children age five years and younger, which served as an indicator of crowding and sharing of resources in the home. Large family size is often viewed as a risk factor as it leads to overcrowding and unfavorable conditions in the home (Farver et al., 2006). However, in this study, given that the focus was on the development of school readiness, I included only the number of children in the home of non-school age who were potentially competing for parental attention and resources (e.g., time, money, materials) when it came to engagement in learning activities.

Chapter 4: Results

Data Analytic Plan

The goal of the current study was to examine the influence of engagement in home learning activities on Head Start children's development of cognitive readiness skills. In order to analyze the data longitudinally and estimate developmental trajectories, I utilized latent growth modeling. I selected Mplus 5.1 (Muthén & Muthén, 1998-2007) to run my analyses as it is one of the only statistical modeling programs that can handle latent variables, missing data, and complex survey data. More traditional methods of analyzing longitudinal data include multiple linear regression and repeated measures analysis of variance (ANOVA); however, such analyses have their limitations. In particular, they account for changes in group mean scores at different points in time and not individual rates of change. Since not all individuals change at the same rate (i.e., some children develop skills at a faster rate than others), there is often a violation of sphericity—the assumption that variation among individuals is homogenous across time (Hancock & Lawrence, 2006). When examining development across multiple time points, it is important to utilize a statistical method that does not constrain variance, but rather acknowledges group variation as an interesting parameter worthy of estimating and a valuable portion of a longitudinal model.

Latent growth modeling is a structural equation modeling technique that simultaneously analyzes means, variances, and covariances of observed variables to estimate individual growth on a particular variable across time. This technique is termed "latent" such that individuals' measured scores on a given assessment (e.g., PPVT) reflect an underlying factor that is unobserved and not directly measurable (e.g., receptive vocabulary). The "growth" portion of the model describes individuals' abilities or behaviors in terms of their initial baseline level (i.e., intercept) and their developmental trajectories from the baseline to the final measurement point (i.e., slope). Likewise, an individual's rate of change on their measured scores (i.e., the amount by which scores increase or decrease from time 1 to time 2) is treated as a latent factor (e.g., growth in math ability) since true growth is not directly observable. Observed scores on an assessment do not capture an individual's true underlying ability; therefore, a latent growth model also accounts for measurement error. An individual's score can be expressed as:

Score at Time *t* = (initial score) + (change in score per unit time) (time elapsed) + error

(e.g., Math score at Time 2 = intercept + (slope) (1) + error, where 1 equals the time interval between Time 1 and Time 2) (Hancock & Lawrence, 2006).

The results of a basic latent growth model will provide the following information:

- *intercept factor mean*—the average initial score across individuals;
- *slope factor mean*—the average rate of growth across individuals, which can be positive or negative;
- *intercept factor variance*—the amount of variation that exists among individuals' initial scores;
- *slope factor variance*—the amount of variation that exists among individuals' growth rates; and
- *factor covariance*—the extent to which initial scores are related to change in scores across time.

To clarify, a large intercept factor variance would indicate that the initial skills or behaviors individuals possess vary greatly, while a large slope factor variance would indicate that individuals develop at very different rates—some may have a dramatic increase in scores, some may have a slow, but steady increase, while others may demonstrate a decrease over time. A positive factor covariance would indicate that those individuals who start with higher scores grow at a faster rate over time than those who start with lower scores, whereas a negative factor covariance would signify that individuals who start with higher scores grow at a slower rate over time, while initially low-scoring individuals grow at a faster rate (Hancock & Lawrence, 2006). Additionally, predictors and covariates may be added to a model to measure the association of a given variable (e.g., maternal education) to the intercept (e.g., average baseline receptive vocabulary) and slope (e.g., average rate of growth in vocabulary skills from preschool through first grade).

Handling Missing Data

Like all longitudinal data sets, the FACES data presents some missing data on the variables of interest (see Table 3). Missing data occurs for a variety of reasons, such as participant non-response to an item and interviewer error (e.g., failing to assess the participant on a particular scale) (McCartney, Burchinal, & Bub, 2006). Ignoring the presence of missing data may lead to skewed or biased estimates and incorrect interpretations of results. There are several methods of handling missing data. In structural equation modeling, classic missing data techniques (e.g., listwise or pairwise deletion, mean substitution) are considered inadequate (Enders, 2006), as they alter the integrity of the data and cause estimates to regress towards the mean. Instead, multiple imputation (MI) and full-information maximum likelihood (FIML) techniques are preferred. These two methods assume that data are missing at random (MAR), meaning that data on a particular variable are missing independent of that variable (e.g., a child's missing score on the PPVT is unrelated to his vocabulary skills), but that the missingness is related to the values of observed variables (Enders, 2006). Hence, observed variables that are related to a dependent variable with missing data that may contribute to, or correlate with, the missingness should be included in the model (i.e., covariates, such as parental education level and child race/ethnicity; McCartney, Burchinal, & Bub, 2006).

Table 3. *Percentage of Missing Data for Model Variables*

Covariates and Predictors	Percent Missing	Child Outcome Variables	Percent Missing
Child age	0.10	PPVT	
Child gender	0.00	Baseline Head Start	18.08
Child race/ethnicity	3.20	Spring of Head Start	17.56
Home language	4.91	Spring of Kindergarten	19.53
Disability/special needs	5.63	Spring of First Grade	25.23
Age of respondent to parent interview	3.77	Applied Problems	
		Baseline	32.18
Primary caregiver's level of education	3.60	Spring of Head Start	17.88
		Spring of Kindergarten	18.65
Number of children in home	3.85	Spring of First Grade	24.77
		Dictation	
Family income-to-needs	9.30	Baseline	34.56
Engagement in home learning activities	9.58	Spring of Head Start	17.20
		Spring of Kindergarten	20.98
		Spring of First Grade	25.54

The MI procedure produces multiple data sets with imputed data for missing values that differ across data sets to determine the average parameter estimates. While this procedure is preferred for data sets with extreme missing data for independent variables, it can often be tedious and prone to error, as at least 5 to 10 complete data sets are recommended for estimation (McCartney et al, 2006). Conversely, FIML directly fits the model to the non-missing values for each observation, while disregarding any missing data on dependent or endogenous variables (i.e., missing data are labeled as system missing [e.g., "MISSING=all(-9)], but are not imputed). Even without imputation, FIML parameter estimates are unbiased under the MAR assumption. More specifically, unknown parameters and standard errors are estimated directly from the observed data by "applying iterative computational algorithms to the sample log-likelihood" (Enders, 2006, p. 325). This method "implicitly allows differing patterns of available data (subgroups of individuals) to contribute to those parameters' estimation which their data are able to inform" (Mueller & Hancock, 2007, p. 8).

In SEM, FIML is the maximum likelihood estimator for missing data. Maximum likelihood (ML) estimators test which underlying population parameters would have the greatest statistical likelihood of yielding the observed correlation matrix for the given sample data. The ML function reflects the discrepancy between the observed and reproduced covariance matrices (Enders, 2006). Additionally, FIML is a useful technique as it allows for not only missing data, but also both continuous and categorical outcomes, random intercepts and slopes, and with longitudinal data, the modeling of individually-varying times of observation (Muthén & Muthén, 1998-2007). Hence, a growth curve can be modeled irrespective of the number of observations each participants has (i.e., missing data on the dependent variables).

In the FACES database, participants must have data from at least three waves of data collection, including baseline child assessment data and a parent interview from either Fall 1997 or Spring 1998, to be included in the longitudinal data set. In latent growth modeling, it is recommended that the model has at least three points of data.

However, with FIML, the parameters may be estimated regardless of whether all children have assessment data for all time points, or if some only have three points of data. Accordingly, since there was not a significant amount of missing data for the exogenous variables and the FIML procedures could handle missing data on the endogenous variables, I implemented FIML in my analyses. In Mplus, maximum likelihood procedures for missing data is the default; however, with complex data sets such as FACES, the numerical integration algorithm required to estimate the parameters is the maximum likelihood estimator with robust standard errors (MLR), which I obtained by specifying "ESTIMATOR=MLR" in the model syntax (Muthén & Muthén, 1998-2007).

Controlling for Sampling Error

FACES consists of complex survey data obtained through stratification (by geographic areas) and clustering (i.e., children nested within centers, which are nested within programs). The sampling design led to an unequal probability of selection into the study. The estimated variance obtained from the sampled children may differ from the true population parameters, because they are based on a selected subset of the population, rather than a complete census of all Head Start children (HHS, 2005a). The sampling error must be accounted for in all analyses in order to eliminate selection bias and obtain accurate estimates of the population, otherwise the variance may be miscalculated and *p*-values in hypothesis testing may be incorrect. Stratification reduces the variance of estimates by dividing the population into more homogeneous groups, or strata. If the sample is stratified but stratification is not taken into account, then the standard errors will be overestimated. Clustering, on the other hand, increases the variance of the estimates by grouping together various participants, or sampling units (e.g., classrooms, centers), as part of the sampling design. If cluster sampling is used, but clustering is not taken into account in the analyses, the standard errors will be underestimated (Asparouhov, 2005). Likewise, weights are used to adjust for an unequal probability of selection. If data are not weighted, the estimated variance will not reflect that of the population, and the standard errors will be underestimated.

The recommended approach is to adjust the standard errors to account for the complex sampling design. In Mplus, this is accomplished by specifying a complex survey data model in the analysis command syntax ("TYPE=COMPLEX") and adding weight, stratum, and cluster variables to the model (Muthén & Muthén, 1998-2007). The FACES data set provides a pre-calculated longitudinal weight variable, as well as a stratum number variable and a program number variable to reflect stratification and clustering. I included these three variables in the model syntax to account for the complexity of the data and to achieve more accurate results (see Appendix E for full model syntax).

The clustering in the FACES data occurs as a result of the sampling design, since programs, not children, were the sampling unit in the first round of sampling procedures. Programs were clustered within the 16 strata (i.e., areas determined by geographic location within the country, urban/rural status, and percent minority within program); selected centers were clustered within programs, and children were clustered within centers. A hierarchical linear model (HLM), or multi-level model as it is known in Mplus, could have been used to analyze differences in child outcomes as a result of this clustering effect; however, that was not the goal of the present study. Estimating the differences in child outcomes across programs was not necessary to answer the research questions. Although the estimated model was not multi-level, I acknowledge the existence of multiple levels of data, including available teacher- and classroom-level data, and therefore took into account the strata and clustering at the program level to control for any nesting effects. In other words, home learning activities may have had a varying effect on child outcomes as a function of stratum characteristics, but the complex survey data option controlled for these design effects.

Data Management

As an initial procedure, I created two SPSS data files using syntax provided on the FACES 1997 database CD. One file contained longitudinal data from the fall of 1997 through the spring of 2001. The second file contained the corresponding longitudinal weight, stratum, and cluster variables. I then merged the two files matching cases on participant identification numbers (i.e., “child ID”) to create one complete longitudinal data file.

In SPSS, I cleaned the data in preparation for data analysis. I recoded variables as necessary (e.g., weekly home activities were scored: 0 = never, 1 = once or twice, 2 = three or more times), dummy-coded demographic variables for categorical covariates (e.g., Black, Hispanic, and Asian = 1, with White as the reference group), and set all missing data to the missing value of -9. I also created the income-to-needs composite variable based on the U.S. Census Bureau’s poverty thresholds from 1997 and 1998 and parent-reported family size and household income.

Next, I ran descriptive statistics on the variables in my model to check for skewness and significant outliers. Since family income level was of particular interest, participants whose families reported a significantly high monthly income at baseline (Fall 1997) that resulted in a high income-to-needs ratio of 3.00 or greater, which is uncharacteristic of the sample, were removed from the data set. Such outliers composed 0.2% of the weighted sample. Additionally, since the focus of the study was on the development of school readiness skills, I restricted the baseline age range of the sample. Children younger than 36 months and older than 59 months at the beginning of the study (cutoff date August 31, 1997) were removed from the sample (approximately 4% of sample). These ages were selected in particular since children are typically required to be at least 36 months to be eligible for Head Start and 60 months for kindergarten (depending on the state). After the removal of outliers, the analytic sample size was 1,930.

Even after the removal of outliers by child age, the children in the sample presented a large age range of two years at baseline. Since approximately 36% the sample were three-year-olds at baseline and remained in Head Start for two years, while the other 64% were four-year-olds at baseline and moved on to kindergarten the following year, the data presented two "cohorts" of children who were one grade level apart in kindergarten and first grade. Accordingly, children under the age of 48 months were not given the Woodcock-Johnson subtests in Fall 1997, as they were not age eligible, resulting in four waves of child assessment data for these participants. Older children who were eligible for the Woodcock-Johnson subtests in Fall 1997, for the majority, were only in Head Start for one year and, thus, were also assessed only four times—fall and spring of Head Start, spring of kindergarten, and spring of first grade.

After exploring several statistical options, it was decided that the best method for adjusting for the differences in grade levels and resulting child age range was to reorganize the data so that the trajectories would not be estimated across chronological time (Fall 1997 to Spring 2001) but across grade levels (see Table 4).

Table 4. *Merging of Data Waves by Grade Levels*

Number of years of Head Start data[1]	Head Start: Baseline	Head Start: Spring before K	Kindergarten	First Grade
One year of Head Start data	Spring 1998	Spring 1999	Spring 2000	Spring 2001
Two years of Head Start data	Fall 1997	Spring 1998	Spring 1999	Spring 2000

[1] Indicates number of years between beginning of study in Fall 1997 and entrance into kindergarten. Children in field test in Spring 1997 participated in Head Start for two years but were included in the "One year of Head Start data" group, as they had data from only one year of Head Start.

Consequently, "baseline" assessment data were merged: Fall 1997 data for older children who were in Head Start during one year of the study and were assessed at that point, and Spring 1998 data for younger children who were in Head Start during two years of the study and, for the majority, were not age eligible for assessment until that time. The "Head Start: Baseline" data represented the skills children possessed just prior to or at the beginning of their four-year-old Head Start program. Next, Head Start assessment data from the spring before kindergarten were merged: Spring 1998 data for those who entered kindergarten in Fall 1998 and Spring 1999 data for those who entered kindergarten in Fall 1999. Kindergarten assessment data from Spring 1999 and Spring 2000 were merged, and first grade assessment data from Spring 2000 and Spring 2001 were merged. Consequently, four assessment points were analyzed: Head Start–Baseline, Head Start–Spring before Kindergarten, Kindergarten, and First Grade. Reorganizing the data in this manner reduced the age range at each time point, as participants were in the same grade level, and supported the overall goal of the study to estimate the growth in skills across development from Head Start through first grade. Table 5 displays the unweighted descriptive statistics for these measures.

Table 5. *Means, Standard Deviations, Minimums, and Maximums for Child Outcome Variables—Ability Scores*

Measure	*M*	*SD*	Min	Max
Head Start: Baseline				
Peabody Picture Vocabulary Test (PPVT)	67.32	10.69	6.00	103.00
Woodcock-Johnson Applied Problems	399.71	23.02	332.00	451.00
Woodcock-Johnson Dictation	347.01	35.20	186.00	430.00
Head Start: Spring before Kindergarten				
Peabody Picture Vocabulary Test (PPVT)	74.39	10.50	35.00	107.00
Woodcock-Johnson Applied Problems	414.22	21.22	332.00	461.00
Woodcock-Johnson Dictation	373.75	35.81	186.00	435.00
Kindergarten				
Peabody Picture Vocabulary Test (PPVT)	85.77	9.15	46.00	115.00
Woodcock-Johnson Applied Problems	439.50	16.98	332.00	492.00
Woodcock-Johnson Dictation	426.43	23.66	186.00	465.00
First Grade				
Peabody Picture Vocabulary Test (PPVT)	92.84	7.90	64.00	119.00
Woodcock-Johnson Applied Problems	461.75	15.00	332.00	492.00
Woodcock-Johnson Dictation	450.76	17.89	186.00	474.00

Preliminary Analyses

As a preliminary step, I ran unweighted descriptive statistics on both my analytic sample and the FACES baseline sample to test for differences in sample demographic characteristics as a result of attrition and cleaning the data (see Table 6). Using the calculated sample estimates, I ran independent t-tests for unequal sample sizes and unequal variances. The results indicated one small significant difference between the original sample at baseline and the analytic sample. Mothers in the analytic sample were more often employed than mothers in baseline sample ($t(3{,}940) = 1.81$, $p < .05$). Since maternal employment was not a variable in the hypothesized model, and no other significant differences were found, there was sufficient support for the use of the analytic sample.

Then, I applied the child longitudinal weight to the data to estimate the weighted population statistics, also displayed in Table 6. According to weighted estimates, approximately 53% of Head Start children were male. Child race/ethnicity was diverse with 35% White, 30% Black, 29% Hispanic, and 2% Asian. Thirty-three percent of children lived in a home where another language other than English was spoken. Families were composed of an average of 2 or 3 children and 2 adults. The average household income at the beginning of Head Start was $14,722 and approximately 71 percent of families were living in poverty. Eighteen percent of children had a parent-reported disability or special need ranging from physical disabilities, such as asthma, vision problems, and hearing problems, to an emotional-behavioral disorder. The most common disability or special need was a speech impairment (11% of those with a disability/special need).

Table 6. *Descriptive Statistics for Child and Family Sociodemographic Variables: Baseline versus Analytic Sample, Unweighted and Weighted*

	Unweighted Baseline Sample (*N*= 2,513)		**Unweighted Analytic Sample (*N*=1,930)**		**Weighted Analytic Sample (*N*=686,685)**	
Variable	***M*/%**	***SD***	***M*/%**	***SD***	***M*/%**	***SD***
Child age in months at Fall 1997 child assessment	49.13	6.40	49.09	6.311	48.30	6.32
Male	50.58		51.19		52.51	
White	29.66		28.13		34.80	
Black	36.81		38.70		30.03	
Hispanic	29.36		28.60		28.63	
Asian	1.49		1.26		1.88	
Non-English home language	32.50		32.17		33.21	
Disability/special needs	16.90		16.76		18.05	
Mother's Education						
8th grade or less	7.33		7.41		7.04	
Less than high school diploma	21.44		20.01		19.32	
High school diploma/GED	36.62		36.43		39.36	
Some college/2-year degree	32.12		33.55		31.35	
4-year college degree or more	2.48		2.60		2.93	
Mother employed	50.84		53.65		53.04	
Father's education						
8th grade or less	8.86		8.66		8.74	
Less than high school diploma	23.07		23.10		22.19	
High school diploma/GED	49.05		49.08		49.87	
Some college	15.20		15.30		15.42	
4-year college degree or more	4.00		3.87		3.79	
Father employed	78.31		78.94		78.98	
Age of parent respondent	29.77	8.16	29.97	8.24	30.11	8.31
Parents Married	43.36		43.57		44.10	
Total number of children in household (< 18 years old)	2.64	1.31	2.61	1.293	2.59	1.26
Total number of adults in household (>=18 years old)	2.01	1.01	2.00	.96	2.00	.94
Annual household income	$14,675	$9,086	$14,431	$8,4956	$14,722	$8,752
Living in poverty	71.71		71.72		70.68	
Urban neighborhood	69.56		69.38		65.36	

Next, I ran descriptive statistics on the home learning activities to examine the variance in parental responses. Estimates revealed that children were engaged in a variety of learning activities both within the home and the community and at varying frequencies (see Table 7).

Table 7. *Weighted Item Response Percentages for Home Learning Activities in Fall 1997*

In the past week, how many times have you or someone in your family…?	% Never	% Once or twice	% 3 or more times	% Everyday
Read to child	7.45	25.87	29.25	37.43

	% Never	% Once or twice	% 3 or more times
Told child story	26.41	35.57	38.01
Taught child letters/numbers	13.46	29.31	57.23
Taught child songs/music	26.44	26.14	47.42
Worked on arts/crafts	40.22	35.55	24.23
Played with toys or games indoors*	6.62	16.18	77.20
Played games, sports, or exercised	24.70	27.38	47.92
Taken child on errands*	5.65	26.66	67.69
Involved child in chores*	9.80	21.89	68.31
Talked about what happened in Head Start*	4.88	10.18	84.95
Talked about TV program	26.31	26.65	47.04
Played counting games	23.90	30.29	45.81

In the past month, has anyone in your family______ with child?	% No	% Yes
Visited a library	74.68	25.32
Gone to a movie	66.46	33.54
Gone to a play, concert, or other live show	88.33	11.67
Gone to a mall*	21.77	78.23
Visited an art gallery, museum, or historical site	89.48	10.52
Visited a playground, park, or gone on a picnic*	17.52	82.48
Visited a zoo or aquarium	81.68	18.32
Talk about his/her family history or ethnic heritage	58.50	41.50
Attended an event sponsored by a community, ethnic, or religious group	52.46	47.54
Attended an athletic or sporting event in which CHILD was not a player	67.81	32.19

* Indicates variable with high skewness that was consequently dropped from the analyses.

In general, weekly activities, which mostly took place in the home, were negatively skewed (i.e., fewer low values) and monthly activities, which mostly occurred outside the home, were positively skewed (i.e., fewer high values). Items with significantly high negative skewness ($\gamma1 < -1.00$) were dropped from the analyses. Six items fell into this category: playing with toys or games indoors; running errands; doing chores; talking about Head Start; going to the mall; and visiting a playground or park. Two community variables demonstrated significant positive skewness ($\gamma1 > 1.00$): attending a play or concert, and visiting a museum or art gallery, with fewer children participating in those activities. I decided to keep these two variables in the model since at least 10% of parents responded affirmatively, indicating that a subgroup of children were engaged in these activities. This additional engagement in enriching community activities may have provided children with a benefit over their peers who did not experience such enrichment activities. The resulting scale included 16 items with a Cronbach's alpha of .712 (.686 for 8 weekly/in-home activities; .498 for 8 monthly/community activities).

In order to obtain a single variable that represented children's engagement in learning activities, I conducted an exploratory factor analysis on the 16 items to test whether there existed one underlying factor or more than one factor, or in this case, type of activity (such as home and community). A principal components analysis (PCA) method with varimax rotation was used. Instead of the supposed one-factor solution representing engagement in home learning activities, three independent factors were extracted (eigenvalues > 1.00). Factor loadings ranged from .337 to .665, with all but one factor loading above the recommended criterion of .04 (see Table 8). The factors accounted for approximately 35 percent of the variance in responses.

Table 8. *Results of Factor Analysis on Learning Activities*

Factor	Activity	Factor Loading
Academic Stimulation	Read to child	.637
	Told child story	.605
	Taught child letters/numbers	.571
	Taught child songs/music	.447
	Worked on arts/crafts	.571
	Played counting games	.654
Community Enrichment	Visited a library	.407
	Gone to a play, concert, or other live show	.544
	Visited an art gallery, museum, or historical site	.615
	Visited a zoo or aquarium	.665
Family Entertainment	Played games, sports, or exercised	.337
	Talked about TV program	.419
	Gone to a movie	.410
	Talk about his/her family history or ethnic heritage	.489
	Attended event for community/ethnic/religious group	.645
	Attended an athletic or sporting event	.540

The factors can be described as Academic Stimulation, Community Enrichment, and Family Entertainment. Academic Stimulation consisted of six activities that had a specific academic focus (e.g., teaching letters and numbers) or an underlying element of cognitive stimulation (e.g., telling a story) that directly exercised children’s language, literacy, numeracy, writing, fine motor, and/or artistic skills. Community Enrichment included four activities that took place outside of the home and in public settings that fostered learning through prepared exhibitions grounded in literature, history, science, and visual and performance arts (e.g., museums, zoo, and theater). Family Entertainment consisted of six activities, some of which were measured on the weekly scale and occurred within the home, and some of which were measured on the monthly scale and occurred outside the home. These activities were more social and cultural in nature (e.g., attending community/religious group event), and did not have an explicit academic learning component as did the activities in the other two factors. Family Entertainment was characterized by sports, media (e.g., movies, television), and shared "family fun" activities. These three activity factors subsequently served as latent factor indicators of a higher order latent factor, referred to as Engagement in Home Learning Activities, in the full latent growth model, as I will later discuss.

Once descriptive statistics of the sample characteristics and home learning activities had been run, and the selection of variables for the data set was complete, I ran weighted means, standard deviations, and intercorrelations on all 41 variables in my model to test for the significance of the relationships among variables (see Table 9). Of the 820 correlations, 99.99% were significant with p-values less than .05 and with the majority of *p*-values less than .01. Since even the smallest of correlations often achieve significance when the sample size is large, it is understood that some of these relationships are not as strong as others; however, the relatively strong average correlation among variables, $r(820) = 0.13$, and still stronger average correlation among the main predictors (i.e., home learning activities and income-to-needs) and child outcomes, $r(406) = 0.20$, provide substantial evidence of some underlying relationships among the variables in the predicted model, which is fundamental to structural equation modeling.

Table 9. *Means, Standard Deviations, and Intercorrelations of Weighted Variables*

Variable	*M*	*SD*	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1 Gender (1 = female)	.47	.50	1																			
2 Black	.30	.46	0.02	1																		
3 Hispanic	.29	.45	0.02	-0.41	1																	
4 Asian or Pacific Islander	.02	.14	-0.07	-0.09	-0.10	1																
5 Age in months as of 8/31/1997	46.31	6.20	-0.04	-0.07	0.07	0.01	1															
6 Disabilities/ special needs	.18	.39	-0.10	-0.07	-0.05	-0.05	-0.07	1														
7 Home language (1=non-English)	.33	.47	-0.04	-0.38	0.77	0.15	0.07	-0.02	1													
8 Parent age	30.12	8.31	0.04	0.00	-0.05	0.07	0.03	0.05	0.02	1												
9 Parent education	11.65	1.96	-0.06	0.13	-0.23	0.01	0.00	0.08	-0.19	0.02	1											
10 Number of other children five and under	.70	.83	-0.02	0.09	-0.02	0.01	-0.06	0.06	0.01	-0.15	-0.10	1										
11 Number of years in Head Start	1.56	.50	0.06	0.11	-0.10	-0.03	-0.67	0.12	-0.09	-0.04	-0.04	0.07	1									
12 Hours per week in Head Start	21.84	8.91	0.02	0.20	0.08	0.03	-0.01	-0.01	0.08	-0.06	0.03	-0.06	0.08	1								
13 Income-to-needs	.90	.54	-0.06	-0.19	-0.04	0.03	-0.01	0.05	-0.05	0.01	0.08	-0.11	0.02	-0.09	1							
14 Read to child	1.97	.96	0.04	-0.07	-0.18	-0.03	-0.08	0.06	-0.20	0.01	0.10	-0.04	0.09	-0.11	0.16	1						
15 Told child story	1.12	.80	-0.03	-0.02	-0.14	-0.01	-0.04	0.06	-0.12	-0.01	0.09	-0.03	0.03	-0.01	0.12	0.42	1					
16 Taught child letters/numbers	1.44	.72	-0.01	0.07	-0.11	-0.02	-0.01	0.05	-0.07	-0.10	0.03	-0.02	0.01	-0.07	0.05	0.21	0.17	1				
17 Taught child songs/music	1.21	.83	0.04	0.04	-0.06	0.04	-0.09	0.03	-0.04	0.02	0.10	0.00	0.07	0.01	0.05	0.19	0.23	0.20	1			
18 Worked on arts/crafts	.84	.79	0.00	-0.05	-0.06	0.01	-0.02	0.08	-0.03	0.02	0.09	-0.05	0.02	-0.07	0.02	0.23	0.23	0.23	0.20	1		
19 Played games, sports, or exercised	1.23	.82	-0.10	0.03	-0.10	0.02	-0.08	0.03	-0.08	0.00	0.07	-0.07	0.05	0.03	0.02	0.16	0.19	0.12	0.15	0.15	1	
20 Discussed what is on TV/video	1.21	.83	-0.02	0.09	-0.07	0.05	0.03	-0.02	-0.06	0.03	0.05	-0.05	-0.04	-0.01	0.04	0.17	0.18	0.15	0.19	0.16	0.20	1

Note: Average Weighted N = 621,634. For child race/ethnicity dummy-coded categorical variables, “White, non-Hispanic” was used as the reference category.

Variable	*M*	*SD*	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
21 Played counting games	1.22	.81	0.03	0.12	-0.16	0.02	-0.07	-0.02	-0.14	-0.01	0.06	0.03	0.04	-0.06	-0.01	0.28	0.29	0.31	0.32	0.27	0.24	0.25
22 Visited library	.25	.44	0.00	0.00	-0.05	0.02	0.06	0.02	-0.02	0.04	0.10	-0.06	-0.07	-0.14	0.05	0.18	0.14	0.11	0.07	0.15	0.09	0.11
23 Went to movie	.34	.47	-0.02	0.18	-0.01	0.00	-0.06	-0.01	0.04	-0.09	0.16	-0.08	0.02	0.19	0.01	0.03	0.10	0.05	0.12	0.09	0.11	0.13
24 Went to play, concert, live show	.12	.32	0.01	0.06	-0.01	0.01	-0.02	-0.03	0.04	-0.06	0.07	0.00	0.05	0.05	0.07	0.06	0.09	0.03	0.05	0.06	0.09	0.02
25 Visited art gallery/ museum/historical site	.11	.31	-0.03	0.00	0.07	0.05	-0.04	0.00	0.11	-0.01	0.06	0.01	0.04	0.01	0.04	0.10	0.08	0.06	0.09	0.14	0.10	0.05
26 Visited zoo or aquarium	.19	.39	-0.04	0.09	-0.05	0.00	-0.05	0.02	0.01	-0.03	0.04	-0.01	0.04	0.04	0.04	0.08	0.10	0.09	0.09	0.06	0.11	0.08
27 Discussed family history/ethnic heritage	.41	.49	0.08	0.05	-0.01	0.09	0.02	-0.07	0.03	0.01	0.06	-0.05	-0.05	0.05	0.02	0.15	0.11	0.13	0.18	0.12	0.15	0.20
28 Went to community/ religious event	.47	.50	0.03	0.15	-0.06	0.03	-0.07	-0.03	-0.04	0.08	0.12	-0.03	0.02	0.10	0.04	0.09	0.12	0.03	0.13	0.06	0.06	0.13
29 Went to sporting event	.32	.47	-0.05	0.08	-0.04	-0.01	-0.03	0.03	-0.06	-0.03	0.09	-0.08	0.03	0.05	0.05	0.12	0.11	0.11	0.13	0.07	0.18	0.09
30 PPVT Baseline Head Start	67.82	11.03	-0.03	-0.23	-0.21	-0.07	0.26	-0.04	-0.27	0.01	0.05	-0.14	-0.11	-0.18	0.21	0.19	0.10	0.07	0.01	0.11	0.04	0.03
31 PPVT End of Head Start	75.48	10.37	-0.03	-0.19	-0.30	-0.06	0.11	0.02	-0.32	0.03	0.03	-0.14	0.06	-0.18	0.20	0.21	0.13	0.09	0.01	0.14	0.08	0.03
32 PPVT Kindergarten	86.21	9.60	-0.03	-0.14	-0.30	0.00	0.01	-0.01	-0.30	0.00	0.02	-0.10	0.18	-0.14	0.21	0.28	0.11	0.06	0.04	0.07	0.08	0.02
33 PPVT First Grade	93.33	8.31	-0.04	-0.17	-0.30	0.03	0.04	0.00	-0.29	0.03	0.04	-0.09	0.08	-0.11	0.22	0.26	0.12	0.06	0.07	0.12	0.06	0.03
34 WJ Numeracy Baseline Head Start	399.40	24.23	0.05	-0.13	-0.12	-0.08	0.09	-0.05	-0.19	-0.06	0.01	-0.09	-0.01	-0.09	0.14	0.12	0.01	0.16	-0.03	0.08	-0.04	-0.09
35 WJ Numeracy End of Head Start	415.09	21.23	0.06	-0.10	-0.16	0.01	0.01	-0.07	-0.18	-0.06	0.01	-0.08	0.14	-0.07	0.18	0.15	0.05	0.06	0.01	0.11	0.06	-0.03
36 WJ Numeracy Kindergarten	439.99	17.69	0.03	-0.12	-0.10	0.05	-0.04	-0.04	-0.11	-0.03	-0.02	-0.08	0.23	-0.01	0.10	0.15	0.05	0.05	0.03	0.08	0.04	-0.03
37 WJ Numeracy First Grade	462.17	15.35	-0.03	-0.11	-0.12	0.03	0.03	-0.07	-0.11	0.00	-0.01	-0.08	0.03	0.02	0.12	0.11	0.05	0.05	0.03	0.02	0.02	0.00
38 WJ Dictation Baseline Head Start	347.53	35.46	0.14	-0.10	0.05	0.01	0.09	-0.05	0.04	-0.06	-0.02	-0.08	0.01	-0.03	0.08	0.06	-0.04	0.11	-0.01	0.07	-0.06	-0.02
39 WJ Dictation End of Head Start	374.19	35.82	0.15	-0.03	-0.02	-0.03	0.08	-0.15	-0.04	-0.02	0.01	-0.10	0.07	-0.03	0.12	0.06	0.04	0.08	-0.05	0.08	0.00	0.00
40 WJ Dictation Kindergarten	425.89	24.61	0.10	0.01	-0.08	0.07	0.04	-0.11	-0.08	0.02	0.00	-0.10	0.13	-0.02	0.02	0.07	0.00	-0.02	0.03	0.00	-0.04	0.02
41 WJ Dictation First Grade	450.77	17.18	0.08	-0.02	-0.19	0.07	-0.07	-0.02	-0.16	0.03	0.03	-0.01	0.07	0.01	0.05	0.07	0.01	0.03	0.00	0.02	0.05	0.03

	21	22	23	24	25	26	27	29	29	30	31	32	33	34	35	36	37	38	39	40	41
21 Played counting games	1																				
22 Visited library	0.17	1																			
23 Went to movie	0.11	0.09	1																		
24 Went to play, concert, live show	0.10	0.09	0.10	1																	
25 Visited art gallery/ museum/historical site	0.07	0.13	0.12	0.13	1																
26 Visited zoo or aquarium	0.11	0.15	0.15	0.17	0.17	1															
27 Discussed family history/ethnic heritage	0.16	0.09	0.09	0.11	0.09	0.10	1														
28 Went to community/ religious event	0.08	0.12	0.12	0.12	0.07	0.04	0.16	1													
29 Went to sporting event	0.12	0.11	0.12	0.11	0.07	0.04	0.10	0.16	1												
30 PPVT Baseline Head Start	0.01	0.12	-0.07	-0.04	0.00	-0.06	-0.04	0.00	0.00	1											
31 PPVT End of Head Start	0.05	0.12	-0.04	-0.01	-0.01	-0.06	0.00	0.05	0.05	0.75	1										
32 PPVT Kindergarten	0.04	0.08	-0.06	0.01	-0.02	-0.02	0.01	0.04	0.06	0.70	0.77	1									
33 PPVT First Grade	0.05	0.07	-0.04	-0.02	0.01	-0.03	0.05	0.06	0.03	0.65	0.71	0.77	1								
34 WJ Numeracy Baseline Head Start	0.07	0.06	-0.02	0.01	-0.02	-0.09	-0.04	-0.03	0.05	0.54	0.56	0.49	0.44	1							
35 WJ Numeracy End of Head Start	0.08	0.05	-0.04	-0.05	-0.03	-0.11	0.06	0.02	0.04	0.46	0.59	0.58	0.53	0.58	1						
36 WJ Numeracy Kindergarten	0.03	0.03	-0.08	-0.06	-0.01	-0.08	-0.06	-0.04	0.00	0.38	0.44	0.53	0.43	0.50	0.57	1					
37 WJ Numeracy First Grade	0.03	0.03	-0.07	-0.06	-0.06	-0.10	-0.02	0.00	0.00	0.37	0.39	0.45	0.45	0.48	0.53	0.60	1				
38 WJ Dictation Baseline Head Start	0.06	0.00	0.00	-0.03	0.01	-0.03	0.02	-0.02	-0.07	0.29	0.31	0.31	0.27	0.39	0.39	0.40	0.37	1			
39 WJ Dictation End of Head Start	0.06	0.04	-0.02	0.00	0.00	-0.01	0.05	0.02	0.00	0.32	0.37	0.36	0.31	0.43	0.48	0.44	0.40	0.51	1		
40 WJ Dictation Kindergarten	0.00	0.03	-0.03	-0.03	0.01	-0.01	0.05	0.00	0.03	0.22	0.29	0.41	0.30	0.31	0.37	0.54	0.32	0.34	0.36	1	
41 WJ Dictation First Grade	-0.01	0.02	0.01	-0.02	-0.06	-0.04	0.03	0.03	0.01	0.24	0.29	0.37	0.40	0.27	0.36	0.37	0.42	0.27	0.29	0.39	1

Modeling Results

To answer the proposed research questions, I tested a latent growth curve model (see Figure 3) using Mplus 5.1 software (Muthén & Muthén, 1998-2007). This model represents the predictive role of the Engagement in Home Learning Activities latent factor on the growth in vocabulary, numeracy, and writing from Head Start through first grade, controlling for income-to-needs and other child and family characteristics. Intercept loadings on measured outcome variables were set equal to 1. Slope loadings on measured outcome variables varied as a function of time in years from baseline: Baseline = 0; Spring Head Start = 1; Kindergarten = 2; First Grade = 3. This analytic technique estimated the mean scores on the baseline assessments in Head Start (i.e., intercepts) and children's individual growth rates from Head Start through first grade (i.e., slopes). Given this structure, a child's assessment score at baseline was based on: 1 (intercept) + 0 (slope) + error. The factor variances explain how much diversity there was in children's development of the school readiness skills of interest, and factor covariances explain the degree of association among factor intercepts and factor slopes across skills (e.g., children's early vocabulary skills were related to their early reading skills).

In the hypothesized model, Engagement in Home Learning Activities was a predicted higher order latent variable with three latent factor indicators: Academic Stimulation, Community Enrichment, and Family Entertainment. Engagement in Home Learning Activities was estimated to be a direct predictor of factor intercepts and slopes, as well as a moderator of the effect of income-to-needs, as represented by the latent interaction variable "Activities X Income."

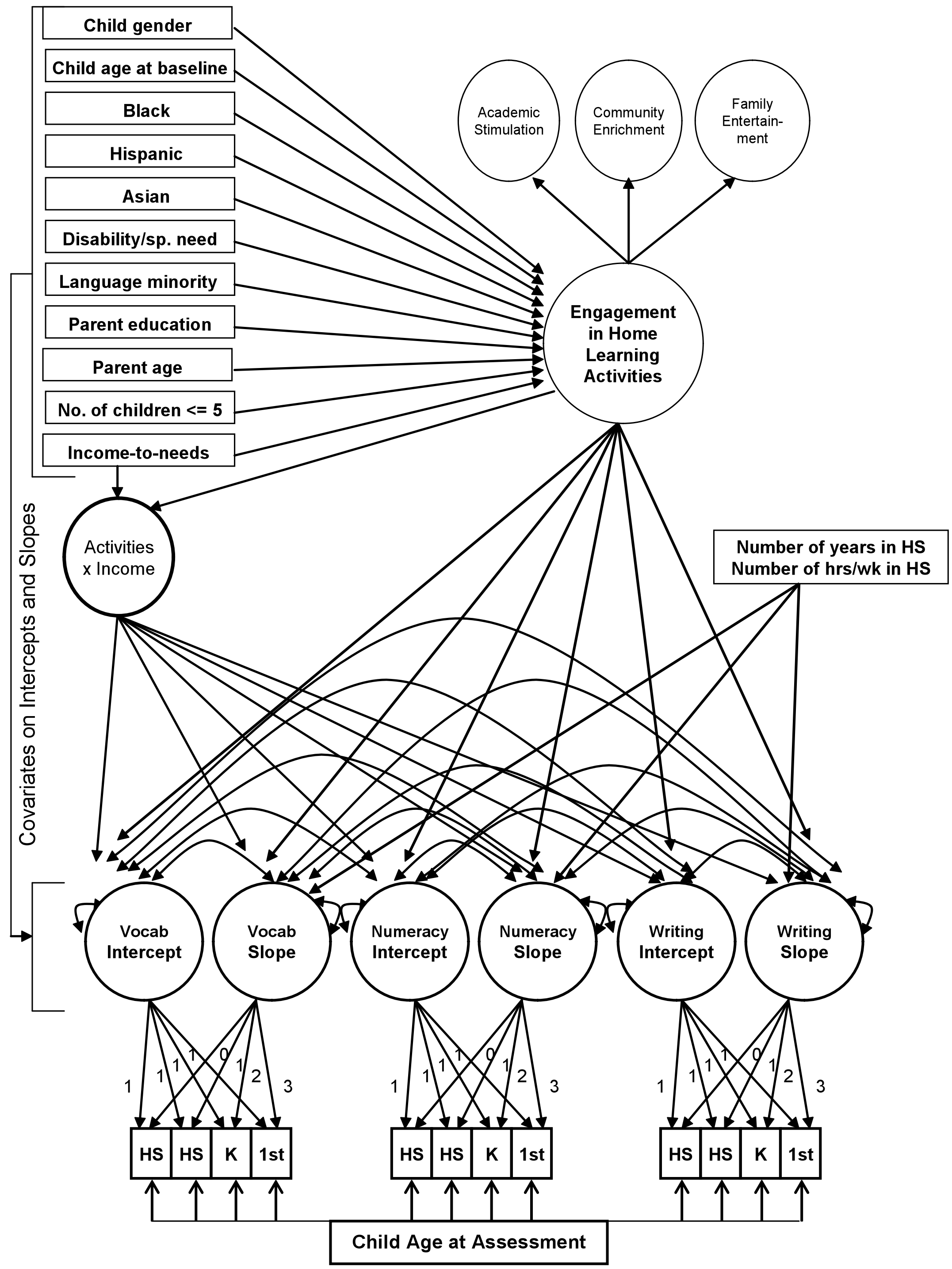

Figure 3. The hypothesized latent growth model with the latent predictor variable of engagement in home learning activities moderating the effect of family income-to-needs on the development of cognitive readiness skills.

Model Fit Indices

In structural equation modeling, model fit indices are used to determine the overall fit of a proposed model given the data provided. Although significance levels are provided for each estimated parameter, the model as a whole is not retained or rejected based on a single significance test. In general, if two of the three model fit criteria are met, the predicted model is considered to have good model fit and may be retained as one possible model that represents the relationships among the given variables. With large sample sizes, the recommended model fit indices include the Comparative Fit Index (CFI), the Root Mean Square Error of Approximation (RMSEA), and the Standardized Root Mean Square Residual (SRMR) (Hu & Bentler, 1999). The recommended indices are .95 and above for the CFI, .06 and below for the RMSEA, and .08 and below for the SRMR. The standardized path coefficients (i.e., "regression weights," "betas," "loadings") estimated by the model are the effect sizes for the independent variables. The sizes and significance levels of the coefficients are examined to determine the strength of the effects on the dependent variables.

Generally, the Chi-Square Test of Model Fit does not respond well to large sample sizes as the chi-square value becomes inflated, thus rejecting a plausible model; however, the value is typically reported to compare the fit across models since chi-square values decrease in relation to the degrees of freedom as model fit improves. In this study, I conducted chi-square difference tests to compare the fit of nested models. As new variables were added in each step to build the full structural model, the fit indices of the simpler model were compared to the more complex model to see if model fit improved. Since the MLR estimator (i.e., the maximum likelihood estimator for complex data) was used to estimate the model, a traditional chi-square difference test could not be conducted as the chi-square values are scaled and not normally distributed as chi-square. The Satorra-Bentler scaled chi-square difference test (TRd) was required to correct the scaled chi-square (Muthén & Muthén, 2008). The formula for the scaled chi-square difference test is:

$$TRd = \frac{T0 - T1}{(d0 * c0 - d1*c1)/(d0 - d1)}$$

, where T0 = chi-square value for the more complex nested model, T1 = the simpler comparison model, d0 = degrees of freedom of nested model, c0= scaling factor for nested model, d1 = degrees of freedom for comparison model, and c1 = scaling factor for comparison model.

For each model step discussed, corresponding model fit indices (CFI, RMSEA, and SRMR) and chi-square difference test results will be given.

Measurement Models

Before testing the complete structural model with predictors and covariates, I ran a series of measurement models. In SEM, measurement models are tested to measure the strength of latent variables, and specifically, to confirm that the factor indicators are statistically related and load properly onto the hypothesized latent variable(s). The latent variables of interest in latent growth modeling are the latent intercept and slope factors. A measurement model tests whether there is indeed a significant growth slope or pattern of change in assessment scores over time. In the case of more than one latent outcome variable, as in the current study, measurement models are established independently for each outcome, then a complete measurement model is run with all outcome variables simultaneously to estimate the factor covariances, or relationships among the intercept and slope factors across outcomes. Once a measurement model evidences good model fit, the structural model may be tested. The goal in SEM is to achieve model fit indices for the full structural model as strong as the model fit indices of the full measurement model; this would indicate that the predicted paths are supported by the data.

First, I ran a separate measurement model for each hypothesized latent factor: Vocabulary intercept and slope; Numeracy intercept and slope; Writing intercept and slope; and Engagement in Home Learning Activities with its three latent factor indicators (Academic Stimulation, Community Enrichment, and Family Entertainment). Then, I ran a full measurement model in which all latent factors were covaried (see Figure 4).

Table 10 displays the summary of unstandardized estimates from each measurement model, while Table 11 presents the model fit indices for each model (i.e., CFI, RMSEA, SRMR, and x^2) and changes in model fit indices after the addition of new variables in each step. The measurement model for Vocabulary (Measurement Model 1) demonstrated good model fit, while Numeracy (Measurement Model 2) showed a trend toward good model fit. Writing alone (Measurement Model 3), however, showed poor model fit. It was determined that the large variance in writing skills as a function of child age caused the developmental slope to appear nonsignificant. Thus, I tested this model controlling for child age at assessment, which improved model fit. Finally, I ran two additional measurement models: one with all three outcomes covarying (Measurement Model 4) and the second with all three outcomes covarying, controlling for child age (Measurement Model 5). The estimates from these models indicated that the age of the child at assessment significantly influenced assessment scores, therefore adding child age at each assessment to the model as a time-varying covariate accounted for a significant percentage of the variance thereby dramatically improving model fit.

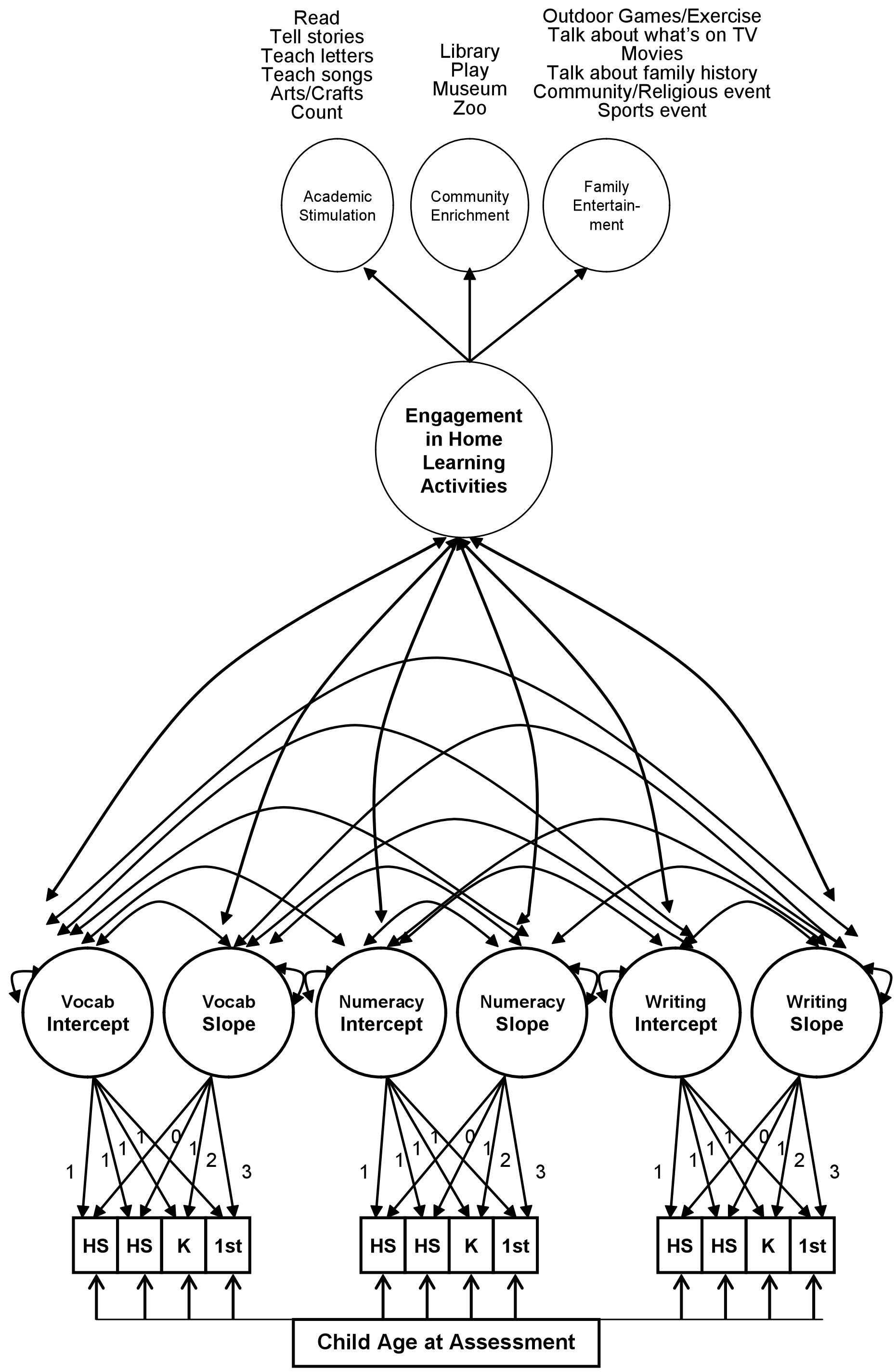

Figure 4. Final measurement model with covarying latent factors for Vocabulary, Numeracy, Writing, and Engagement in Home Learning Activities.

Table 10. *Summary of Unstandardized Estimates from Measurement Models*

	Intercept Factor Means	Intercept Factor Variances	Slope Factor Means	Slope Factor Variances	Factor Covariances (i, s)
Measurement Model 1: Vocabulary	66.563	118.618	9.088	3.384	-15.826
Measurement Model 2: Numeracy	394.602	369.734	22.455	18.043	-63.215
Measurement Model 3: Writing	345.347	830.941	35.555	74.436	-221.965
Measurement Model 4: All outcomes	V: 66.432 N: 393.527 W:343.915	V: 121.364 N: 412.685 W: 797.248	V: 9.153 N: 22.875 W: 36.273	V: 3.049 N: 20.921 W: 60.637	V: -15.976 N: -75.312 W: -202.512
Measurement Model 5: All outcomes controlling for child age	V: 34.815 N: 301.065 W: 293.372	V: 111.277 N: 377.010 W: 808.669	V: 6.685 N: 25.617 W: 32.982	V: 2.981 N: 20.078 W: 71.263	V: -14.523 N: -68.419 W: -212.460

V= Vocabulary, N = Numeracy, W = Writing

Table 11. *Model Fit Indices for Measurement Models*

	CFI	RMSEA	SRMR	x^2	*df*	ΔCFI	ΔRMSEA	ΔSRMR	$\|x^2_{difference}\|$	$\|df_{difference}\|$
Measurement Model 1: Vocabulary	.994	.092	.059	83	5	–	–	–	–	–
Measurement Model 2: Numeracy	.931	.054	.148	32	5	–	–	–	–	–
Measurement Model 3: Writing	.326	.086	.562	72	5	–	–	–	–	–
Controlling for child age	.990	.012	.070	12	9	**+.664**	**-.074**	**-.492**	35***	4
Measurement Model 4: Outcomes only	.886	.060	.217	390	51	–	–	–	–	–
Measurement Model 5: Outcomes only controlling for child age at assessment	.972	.029	.078	166	63	**+.086**	**-.031**	**-.139**	616***	12
Measurement Model 6: Engagement in Home Learning Activities only	.924	.023	.031	198	101	–	–	–	–	–
Final Measurement Model with all latent outcome factors plus the latent factor for Engagement in Home Learning Activities (compared to Measurement Model 5)	.939	.022	.056	790	410	-.033	**-.007**	**-.022**	361***	347

Note: The recommended indices: CFI >= .95; RMSEA <= .06; and SRMR <= .08.

The measurement model for the Engagement in Home Learning Activities latent factor (Measurement Model 6) was a confirmatory factor analysis model (rather than a latent growth model as were Measurement Models 1-5). This model tested the existence of a higher order latent factor underlying the three factors that resulted from the exploratory factor analysis (discussed in the preliminary analyses section). The analysis produced good model fit confirming that underlying the three factors, or types of activities, there exists a latent factor of overall engagement in home learning activities (see Table 11). All factor loadings were significant with standardized factor loadings of .770 for Academic Stimulation, .666 for Community Enrichment, and .949 for Family Entertainment.

As a last step, I ran the final measurement model composed of all latent variables covarying (i.e., latent factor intercepts and slopes for Vocabulary, Numeracy, and Writing, and Engagement in Home Learning Activities), which also demonstrated good model fit. The results from the measurement models provide the foundation for the full structural model by supporting the existence of significant relationships among these variables.

Research Question 1

Once the measurement models for child outcomes were established, the first research question regarding Head Start children's developmental trajectories could be addressed. The results of Measurement Models 1-3 revealed the individual skills that children possessed during Head Start and how their skills grew over time. I compared the estimates of children's average scores at each time point, controlling for child age at assessment, to the established test manual norms for the PPVT-III (Dunn, Dunn, & Dunn,

1997) and Woodcock-Johnson Psycho-Educational Battery-Revised (Woodcock & Johnson, 1990) to determine whether children were performing on average for their age, and if not, the age equivalents of their ability scores. At an average age of 52 months at the baseline assessment, children's demonstrated skills were well below average ($M_{\text{Vocabulary}}$ = 66.59, M_{Numeracy} = 395.20, and M_{Writing} = 341.47). According to test norms, the referenced ability score for children of 52 months is 78 for the PPVT, 420 for the Woodcock-Johnson Applied Problems, and 378 for the Woodcock-Johnson Dictation. The age equivalents for the demonstrated ability scores were 36 months on the PPVT, 39 months on the Applied Problems subscale, and 41 months on the Dictation subscale. Although children displayed below average abilities, there were significant variances in skills (intercept factor variances for Vocabulary = 118.618, Numeracy = 369.734, and Writing = 830.941, $p < .001$).

Language delays have been defined in research as 2 standard deviations between the means, or a standardized score of 70 or below (Stockman, 2000; Qi, Kaiser, Milan, & Hancock, 2006). Thus, as a follow-up step, I ran frequencies on children's baseline standardized assessment scores to determine the percentage of children with scores in this "delayed" category. In the study sample, 18.7% of children fell in this category for vocabulary skills, 16.3% for numeracy skills, and 10.1% for writing skills.

All factor slopes were positive indicating positive growth over time. Moreover, there was a linear curve, which meant that children gained skills at the same average rate between each time point. From Head Start through first grade, children developed at an average rate each year of 9.088 points for Vocabulary, 22.455 points for Numeracy, and 35.555 points for Writing (with points being unstandardized ability score points). For example, a child who had a PPVT ability score of 67 in Head Start had an ability score of 94 three years later in first grade [67 + 3(9.088)] = 94). There were also significant variances in growth rates (slope factor variances for Vocabulary = 3.384, Numeracy = 18.04, and Writing = 74.44). On average, children consistently performed below the norm; however, the achievement gap—or distance between the estimated means and the test norms—decreased through first grade (see Figure 5). There were no statistically significant difference between the estimated mean for Numeracy, controlling for child age, and the corresponding norm score in first grade, which indicated that, on average, Head Start children eventually reached the norm ability level for their age on basic numeracy skills; however, they did not surpass the norm. Conversely, the estimated means for Vocabulary and Writing remained significantly lower than the norm scores over time, signifying that vocabulary and writing are areas in need of improvement.

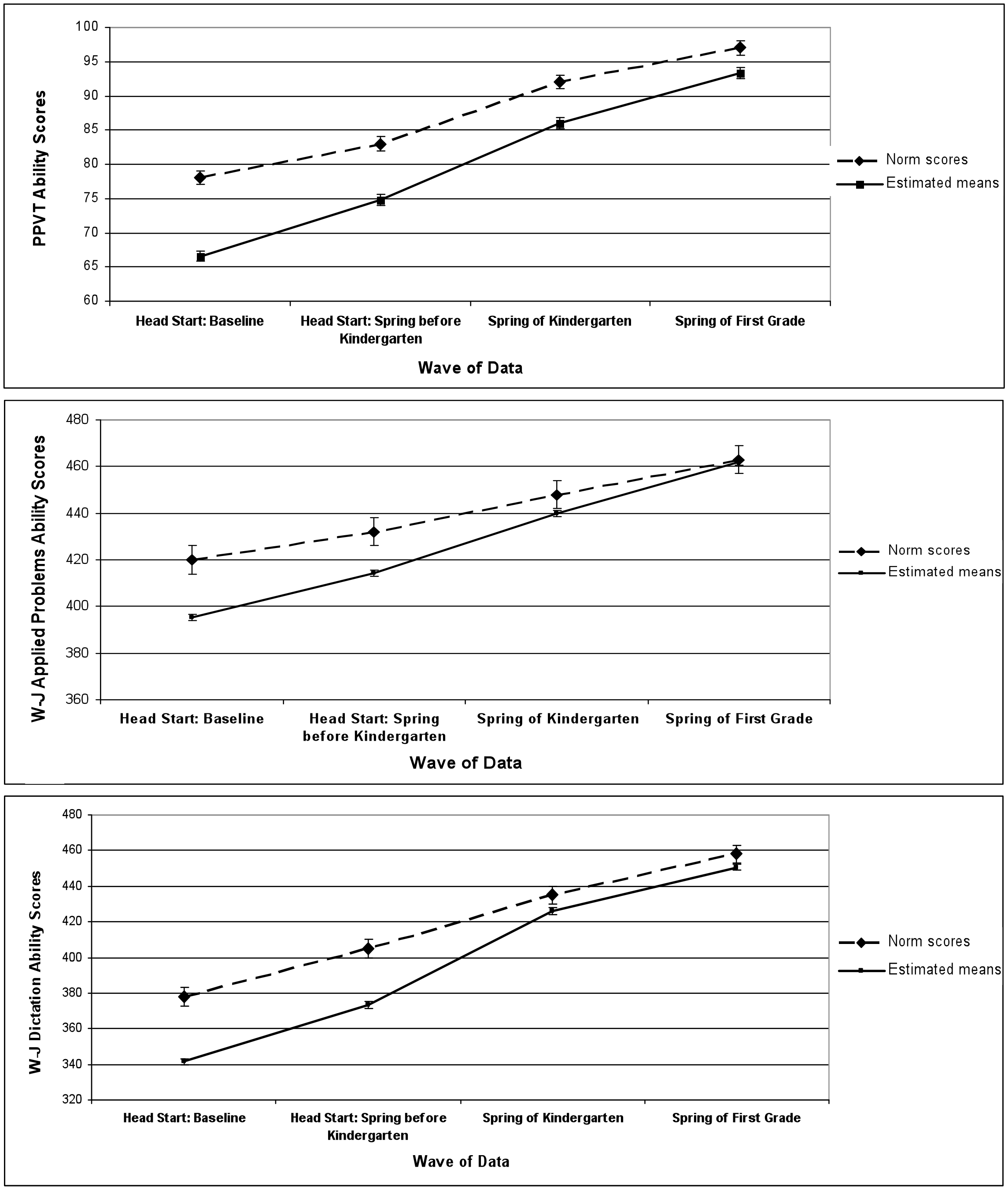

Figure 5. Estimated ability score means for vocabulary, numeracy, and writing compared to norm scores from Head Start through first grade. Note: Time elapsed between waves varies from 9 months to 13 months. Average child age equaled 52 months for Head Start: Baseline, 61 months for Head Start: Spring before Kindergarten, 74 months for Spring of Kindergarten, and 86 months for Spring of First Grade.

In Measurement Model 5, I entered all three child outcomes and allowed them to covary in order to compare the standardized estimates across outcomes and to determine the between-factor covariances. When the model results were standardized (i.e., when the factor variances were set to 1), the factor intercept and factor slope for Numeracy were the largest of the three outcomes and the Vocabulary intercept and slope were the smallest (see Figure 6 for standardized estimates). This signifies that children's early numeracy skills were the strongest of the three skills and their rates of growth in numeracy skills were larger than their rates of growth in writing and vocabulary.

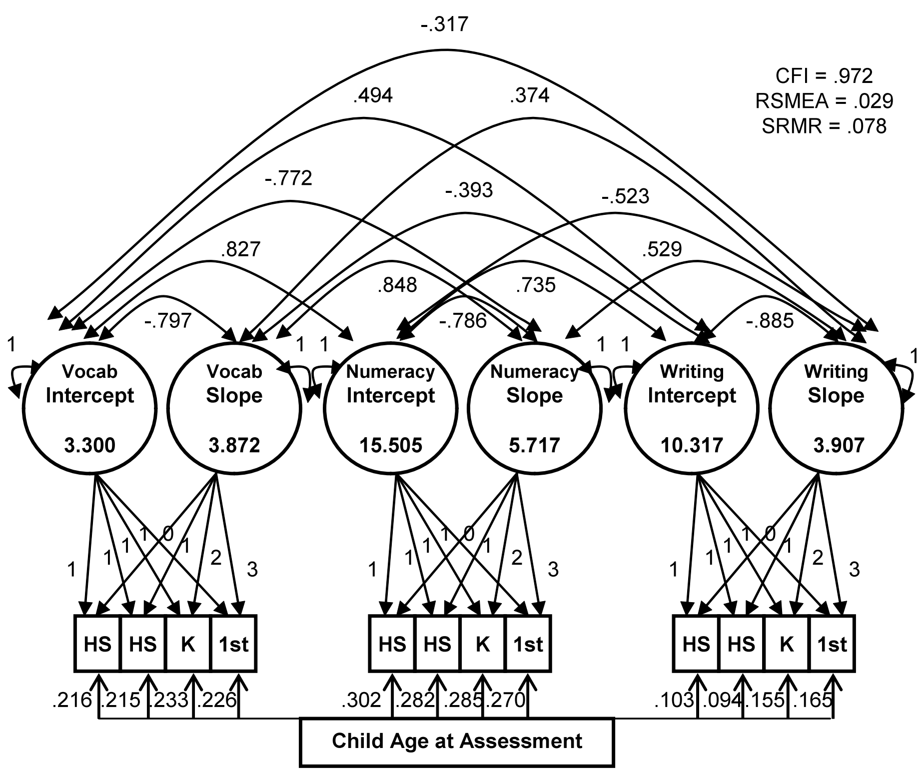

Figure 6. Standardized estimates of latent growth model controlling for child age. Standardized intercept and slope factor means displayed within circles. Error terms not shown.

All factor covariances had a negative value indicating that factor intercepts and factor slopes were negatively related (see Figure 7). Children with higher initial scores grew at a slower rate over time (i.e., deceleration in skill attainment). In terms of standardized units, a one standard deviation increase in the corresponding intercept was associated with a .797 standard deviation decrease in the slope for Vocabulary, a .786 standard deviation decrease in the slope for Numeracy, and a .885 standard deviation decrease in the slope for Writing.

Factor intercept covariances were significant and positive. Children's initial skills in one area were positively related to their initial skills in other areas. Likewise, factor slope covariances were significant and positive, indicating that children's growth in one area was related to growth in other areas. Conversely, factor intercepts and factor slopes between skills were negatively related, such that higher initial scores in one area were associated with smaller growth rates in other areas. Vocabulary and Numeracy were most highly related for both latent factor intercepts and slopes.

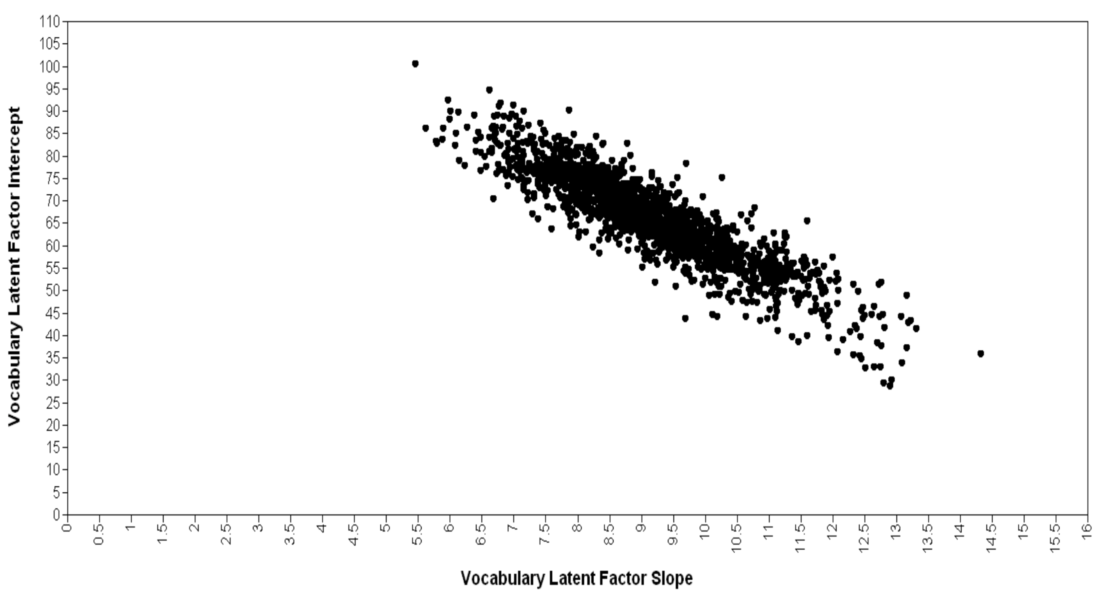

Figure 7. Inverse relationship between Vocabulary intercept and slope factor means.

Research Question 2

Once the latent growth portion of the model was established, I added predictors to create the structural portion of the model in order to estimate the effect on the latent growth factors. First, I added family income-to-needs at baseline as a predictor of the latent factor intercepts and slopes (Structural Model 1). The "baseline" income-to-needs variable depended on the wave of data used for children's "Head Start: Baseline" child assessment. If Fall 1997 data were used (for those children in Head Start for only one year of the study), the income-to-needs variable from the Fall 1997 was used to match baseline income and family size to children's baseline assessment. If Spring 1998 child assessment data were used for the "Head Start: Baseline" wave (for those in Head Start for two years of the study), then the Spring 1998 income-to-needs variable was used, which was composed of household income and family size reported during the Spring 1998 parent interview.

The model demonstrated good model fit, CFI = .963, RMSEA = .028, and SRMR = .095. Income-to-needs positively influenced children's initial skills, β = .223 for Vocabulary intercept, β = .200 for Numeracy intercept, β = .142 for Writing intercept, yet negatively related to their growth rates, β = -.134 for Vocabulary slope, β = -.183 for Numeracy slope, β = -.145 for Writing slope (see Figure 8). Children with lower income-to-needs performed at a significantly lower ability level compared with children with higher income-to-needs, however, they developed at a faster rate over time (see Figure 9). I conducted an *R*-square test to estimate the percentage of variability in the dependent variables accounted for by the independent variable of income-to-needs. Income-to-needs accounted for a significant amount of variance in all three factor intercepts (R^2 = .05, p <

.001 for Vocabulary; R^2 = .04, p < .001 for Numeracy; R^2 = .02, p < .05 for Writing), but did not account for a significant amount of unexplained variance in the factor slopes (R^2 = .02 for Vocabulary, .03 for Numeracy, and .02 for Writing, p = n.s.). The latter finding indicated that the growth in children's skills is a result of external variables not included in the model (i.e., Structural Model 1) and not income only.

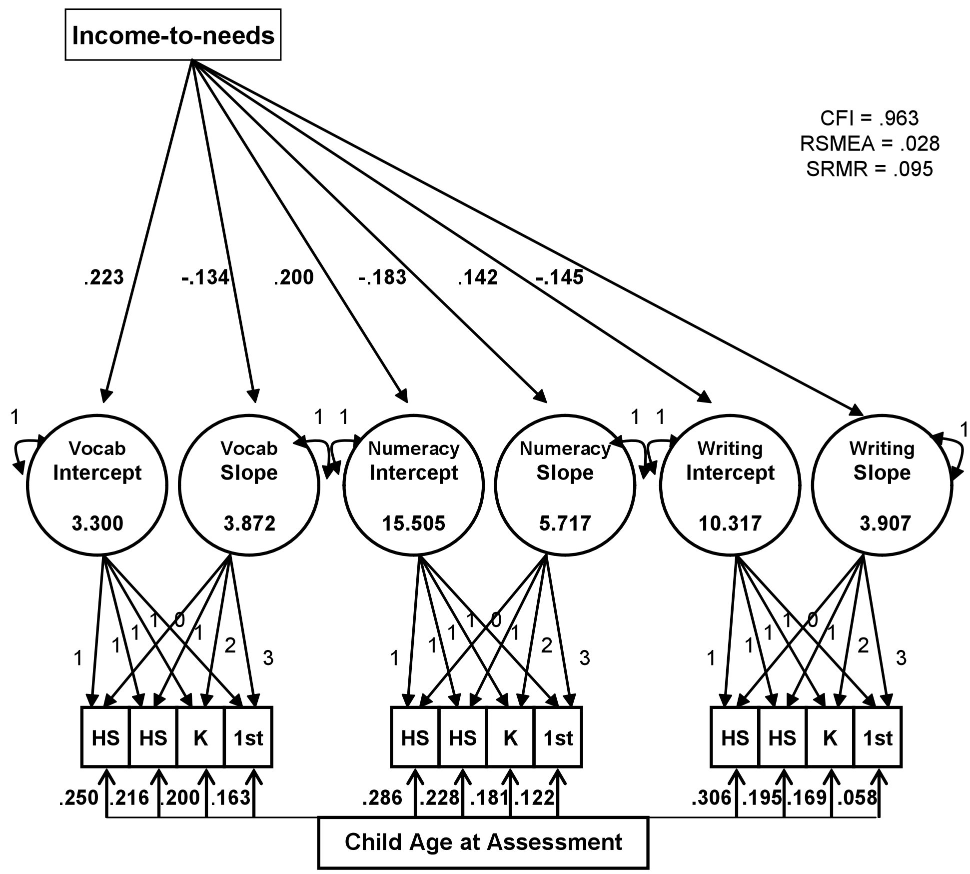

Figure 8. Structural model 1: Standardized estimates of the associations between income-to-needs and latent growth factors controlling for child age. All paths significant at *p*-value of .05. Latent factor covariances and error terms not shown.

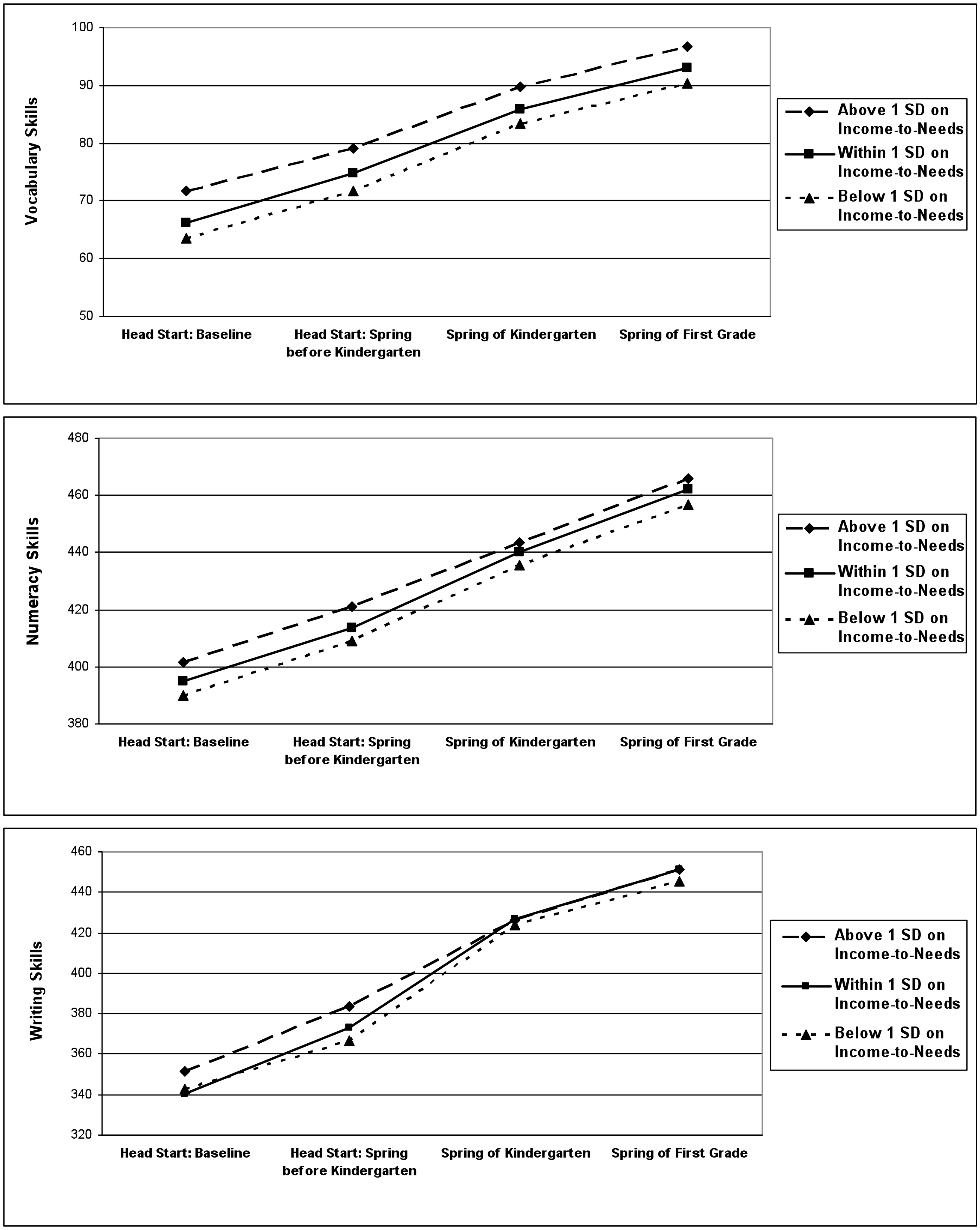

Figure 9. Growth trajectories on vocabulary, numeracy, and writing skills from Head Start through first grade by level of income-to-needs, controlling for child age.

Research Question 3

Next, I added salient sociodemographic variables, specifically, child gender, race/ethnicity (i.e., “Asian,” “Black,” “Hispanic”), disability/special needs status, home language, parent age and years of education, and number of children age five years and under in the household to the model as covariates of the latent factor intercepts and slopes (Structural Model 2). I hypothesized that these covariates would account for a proportion of the variance in children’s skills, and therefore, expected that adding the covariates to the model would control for this unexplained variance, thus increasing the total amount of variance explained by the model and improving model fit. Additionally, I added the number of years in Head Start and number of hours per week in Head Start as covariates of the latent factor slopes. Since these were not stable demographic characteristics that the children possessed at the beginning of Head Start, but rather characteristics of the children’s experiences during Head Start, I hypothesized that these variables would only relate to the growth in skills.

The results demonstrated that the model with covariates had a significantly better fit than the model with only income-to-needs as a predictor, CFI = .958, RMSEA = .026, SRMR = .066, x^2difference = 91, *df* = 72, $p < .05$. The associations among covariates and each of the three child outcomes are identified in Table 12.

Table 12. *Structural Model 2: Standardized Path Loadings between Covariates and Latent Growth Factors*

	Vocabulary		Numeracy		Writing	
Variable	Intercept	Slope	Intercept	Slope	Intercept	Slope
Income-to-needs	.102***	-.046	.149***	-.162*	.140***	-.168**
Gender (1=Female)	.005	-.077†	.094**	-.193***	.201***	-.180***
Black	-.336***	.223***	-.192***	.043	-.051	-.005
Hispanic	-.292***	.253*	-.165*	.065	-.084	.021
Asian	-.076†	.195**	-.019	.080	-.006	.078
Home language (1=non-English)	-.314***	.325**	-.253***	.341***	.026	-.114
Disabled/special needs	-.043	-.049	-.088*	.001	-.127**	.081
Parent age	-.001	.039	-.088*	.117	-.075†	.108*
Parent education	.204***	-.174*	.069	-.070†	.019	.071
Number of children <= 5	-.080**	.115*	-.049	.010	-.139*	.164**
Number of years in HS	–	-.020	–	.003	–	.017
Hours per week in HS	–	-.019	–	.108*	–	.021

*** $p < .001$ ** $p < .01$ * $p < .05$ † $p < .10$

Vocabulary. According to the model results, minority race/ethnicity (Black, Hispanic, and Asian), a non-English home language, and the number of children in the home significantly and negatively influenced the Vocabulary factor intercept (β = -.336, -.292, -.076, -.314, -.080, respectively), yet these same variables positively influenced the Vocabulary factor slope (β = .345, .186, .205, .203, .112, respectively). Children who were Black, Hispanic, or Asian, whose primary home language was not English, or who lived with other children age five and under demonstrated weaker vocabulary skills during Head Start compared to White children, native English speakers, and children with fewer or no other children age five and under in their household. However, these children who presented potential risk factors, in particular children with a non-English home language, grew at a faster rate over time.

Conversely, income-to-needs and parent education significantly and positively influenced the Vocabulary factor intercept (β = .102 and .204, respectively). Children with higher family incomes in relation to their family sizes and more educated parents demonstrated greater skills during Head Start than children with lower family income-to-needs and less educated parents. However, parent education negatively related to the Vocabulary factor slope (β = -.174); children with more educated parents grew at a slower rate over time than children with less educated parents. Income-to-needs did not significantly relate to the Vocabulary factor slope (β = -.046, n.s.). Adding the covariates increased the R^2 values and the total amount of variance in the Vocabulary factor intercept and slope (R^2 = .41 and .40, respectively, $p < .001$).

Numeracy. Minority race/ethnicity (Black and Hispanic), a non-English home language, disability/special needs, and parent age negatively predicted the Numeracy factor intercept (β = -.192, -.165, -.253, -.088, -.088, respectively). A non-English home language also positively predicted the Numeracy factor slope (β = .341). Specifically, children who were Black or Hispanic, whose primary home language was not English, who had a disability or special need, or who had older parents ($M_{\text{parent age}}$ = 30.11, *SD* = .83) had less developed numeracy skills during Head Start. Although speaking a non-English language in the home had a negative effect on initial skills, non-native English speakers had a significantly larger rate of growth in numeracy skills than did native English speakers.

Conversely, income-to-needs and gender (1 = female) were positively related to the Numeracy factor intercept (β = .149 and .094, respectively), yet both negatively related to the Numeracy factor slope (β = -.162 and -.193, respectively). Even though children with higher family income-to-needs and female children demonstrated greater numeracy skills during Head Start, they grew at a slower rate through first grade in comparison to children with lower income-to-needs and male children. Lastly, the number of hours per week spent in Head Start positively related to the Numeracy factor slope (*β* = .108); children who spent a greater number of hours per week in Head Start gained numeracy skills at a faster rate than children who spent fewer hours per week in Head Start. Adding the covariates to the model also increased the R^2 values for the Numeracy factor intercepts and slopes (R^2 = .21 and .28, respectively, $p < .001$).

Writing. Disability/special needs status, parent age, and the number of children in the home were negatively associated with the Writing factor intercept (*β* = -.127, -.075, and -.139, respectively), while income-to-needs and gender (1 = female) were positively associated (*β* = .140 and .201, respectively). Parent age and number of children in the home were positively related to the Writing factor slope (*β* = .108 and .164, respectively), while income-to-needs and gender were negatively related (-.168 and -.180, respectively).

In other words, children began Head Start with less developed writing skills when they were male, when they had low income-to-needs, when they lived with other children age five or younger, or when they had older parents. However, these same children developed their writing skills at a faster rate in comparison to children who were female, who had high income-to-needs, who lived with fewer or no other children, or who had younger parents. Children with a disability or special need also began Head Start with weaker writing skills, but grew at the same rate as children without disabilities or special needs. Adding these covariates to the model also increased the R^2 values for the Writing factor intercepts and slopes (R^2 = .11, $p < .001$, and R^2 = .12, $p < .05$, respectively).

Research Question 4

Before adding the Engagement in Home Learning Activities latent variable and its three latent factors to the structural model, I first conducted a series of analyses to find out how engagement in different types of home learning activities varied by child and family sociodemographic characteristics. In Mplus, I ran separate latent models on each home learning activity factor: Academic Stimulation, Community Enrichment, and Family Entertainment. Each model contained only one latent factor, its corresponding indicators (i.e., activity items), and the 11 selected covariates (income-to-needs, gender, age at baseline, home language, Asian, Black, Hispanic, disability/special needs, number of children age 5 and under, parent age, and parent education). The results of these models explained how sociodemographic characteristics were associated with engagement in each of the three types of activities (see Table 13).

Table 13. *Standardized Path Loadings between Covariates and Learning Activity Factors*

Variable	Academic Stimulation	Community Enrichment	Family Entertainment
Income-to-needs	.101**	.140**	.101*
Gender (1=Female)	.041	-.025	-.025
Child age	-.083***	-.041	-.064
Black	-.080†	.168*	.321***
Hispanic	-.172**	-.113	.041
Asian	-.003	.018	.113***
Home language (1=non-English)	-.084	.283**	.047
Disabled/special needs	.052	.002	-.019
Parent age	-.030	-.061	-.039
Parent education	.083	.141*	.197***
Number of children <= 5	-.021	-.033	-.180***

*** $p < .001$ ** $p < .01$ * $p < .05$ † $p < .10$

The first model included 6 items (read; tell stories; teach letters, numbers, colors; sing songs; do arts and crafts; and play counting games) loading onto the latent factor Academic Stimulation. The model demonstrated decent model fit (CFI = .846, RMSEA = .031, SRMR = .029) and a significant R^2 value (R^2 = .10, $p < .001$) signifying that the covariates explained a significant amount of variance in Academic Stimulation. Of the 11 covariates three were statistically significant, specifically income-to-needs (β = .101), age at baseline (β = -.083), and Hispanic (β = -.172), and one was approaching significance, Black (β = -.080). Having higher family income-to-needs ratios, being younger (M_{age} = 46.30, *SD* = 6.20), and being White were each associated with higher engagement in academically stimulating activities, while having lower income-to-needs, being an older child, and being Black or Hispanic were each associated with lower engagement in academically stimulating activities.

The second model included 4 items (visiting a library, seeing a play or concert, visiting a museum, and going to a zoo or aquarium) loading onto the latent factor of Community Enrichment. This model also had good model fit (CFI = .887, RMSEA = .014, SRMR = .019) and the covariates explained a significant amount of variance in Community Enrichment (R^2 = .09, $p < .001$). Of the 11 covariates of the latent factor, four were significant: income-to-needs (β = .138), Black (β = .149), home language (β = .339), and parent education (β = .132). However, all four covariates had a positive influence on engagement in Community Enrichment activities, such that having higher family income-to-needs, having more educated parents, speaking a non-English home language, and being Black were each associated with higher engagement in learning activities in community settings, while having lower family income-to-needs, having less educated parents, being a native English speaker, and being a White child were each associated with lower engagement in enriching activities in community settings.

The third latent model tested included 6 items (play outdoor games, sports, or exercise; discuss TV programs; go to movies; discuss family heritage; attend community or religious events; and attend sporting event) loading on the latent factor for Family

Entertainment. The model demonstrated decent model fit (CFI = .727, RMSEA = .027, SRMR = .028) and a significant R^2 value ($R^2 = .18$, $p < .001$). Five of the 11 covariates had a significant influence on the level of engagement: income-to-needs ($\beta = .101$), Asian ($\beta = .113$), Black ($\beta = .321$), number of children in the home ($\beta = -.180$), and parent education ($\beta = .197$). Being Asian or Black, and having higher income-to-needs ratios, more educated parents, and fewer or no other children age five and younger in the home were each associated with higher engagement in activities surrounding family entertainment; whereas, being White and having lower income-to-needs ratios, less educated parents, or other young children in the home were each associated with lower engagement in family entertainment activities. Across these three latent models, none of the latent activity factors varied by gender, disability/special need status, or parent age.

Research Question 5

Once income-to-needs and child and family covariates were added to the model, the next step was to add the Engagement in Home Learning Activities latent variable as a predictor of the factor intercepts and factor slopes. The estimated path coefficients identified the strength of the relationships between early engagement in home learning activities and the development of school readiness skills, over and above the effect of child age and family characteristics on children's development. The results indicated adequate model fit (CFI = .900, RMSEA = .023, SRMR = .057) suggesting that Engagement in Home Learning Activities significantly added to the variance explained by the model. A chi-square difference test produced significant results in favor of the more complex model with the Engagement variable, $x^2_{\text{difference}} = 615$, $\Delta df = 527$, $p < .001$.

The results also indicated, however, that the correlation between Family Entertainment and Engagement in Home Learning Activities was greater than one (r = 1.04, p < .001). When such a case occurs in SEM, it signifies that a higher order latent factor is not supported by the data, but rather the first level of latent factors exist independent of a higher order latent factor. In other words, when all other variables in the model were accounted for, the Engagement in Home Learning Activities latent variable did not hold up properly, or did not statistically exist as a higher order latent factor underlying the three types of activities. The three latent factor indicators of Engagement in Home Learning Activities—Academic Stimulation, Community Enrichment, and Family Entertainment—existed independent of a higher order latent factor.

As a follow-up to this step, I ran the model with the three activity factors covarying, but without the higher order latent factor of Engagement in Home Learning Activities (Structural Model 3). Each latent factor had its own set of paths predicting the latent factor intercepts and slopes of the outcome variables. This model then allowed for comparisons among the three types of activities and their influence on the latent growth factors across outcomes. The results demonstrated better model fit than the higher order model with the Engagement in Home Learning Activities latent factor (CFI = .918, RMSEA = .022, SRMR = .048), further indicating that the three activity factors are related but distinct, and are not representative of an underlying factor of overall engagement. Specifically, the latent activity factors were positively related at a p-value of .001: r = .50, for Academic Stimulation and Community Enrichment; r = .75, for Academic Stimulation and Family Entertainment; and r = .71, for Community Entertainment and Family Entertainment. Adding the activity factors to the model significantly improved model fit over the simpler model that controlled for the effects of covariates only, $x^2_{\text{difference}} = 522$, $\Delta df = 483$, $p < .001$. The activity factors significantly increased the total amount of variance accounted for in all three factor intercepts (R^2 = .50 for Vocabulary, .39 for Numeracy, and .29 for Writing) and all three factor slopes (R^2 = .62 for Vocabulary, .61 for Numeracy, and .44 for Writing).

However, without controlling for the effects of sociodemographic characteristics on the activity factors, none of the relationships between the activity factors and the factor intercepts and slopes were significant. Thus, as a final step, I added paths from the model covariates shown to be related to each of the activity factors (see Research Question 4) to each of the corresponding factors (e.g., number of young children in home and Family Entertainment) (Structural Model 4). Adding these covariate paths controlled for any variance across activity factors as a function of sociodemographic characteristics in order to determine the unique contribution of the activities to children's skills. The subsequent model also demonstrated good model fit (CFI = .913, RMSEA = .022, SRMR = .053). While not significantly better than the comparison model ($x^2_{\text{difference}} = 42$, Δdf = 63, n.s.)—indicating that the covariates did not account for a sufficient amount of variance in the activity factors to improve the overall fit of the model—the addition of the covariates controlled for any confounding influence on the parameter estimates, hence revealing significant relationships among the activity factors and children's skills. Table 14 summarizes the parameter estimates.

Table 14. *Structural Model 4: Standardized Path Loadings between Learning Activity Factors and Child Outcomes*

	Vocabulary		Numeracy		Writing	
Latent Variable	Intercept	Slope	Intercept	Slope	Intercept	Slope
Academic Stimulation	.252*	-.390*	.511**	-.518*	.491*	-.674**
Community Enrichment	.072	-.196	.038	-.273	.125	-.250
Family Entertainment	-.170	.436	-.476*	.612	-.546*	.824*

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

Academic Stimulation had a significant, positive association with the factor intercepts and negative associations with factors slopes. Children who were highly engaged in academically-focused activities had stronger skills during Head Start in comparison to their less engaged peers, with standardized betas ranging from .252 to .511 for intercepts, but grew at a slower rate through first grade, with standardized betas ranging from -.390 to -.674. Community Enrichment was not significantly related to any of the measured child outcomes. Conversely, Family Entertainment was negatively related to the Numeracy and Writing factor intercepts (β = -.476 and -.546, respectively) and positively related to the Writing factor slope (β = .824). Children who were highly engaged in entertainment-based activities began Head Start with poor numeracy and writing skills, but their writing skills grew faster over time than their peers who were less engaged in Family Entertainment (see Figure 10).

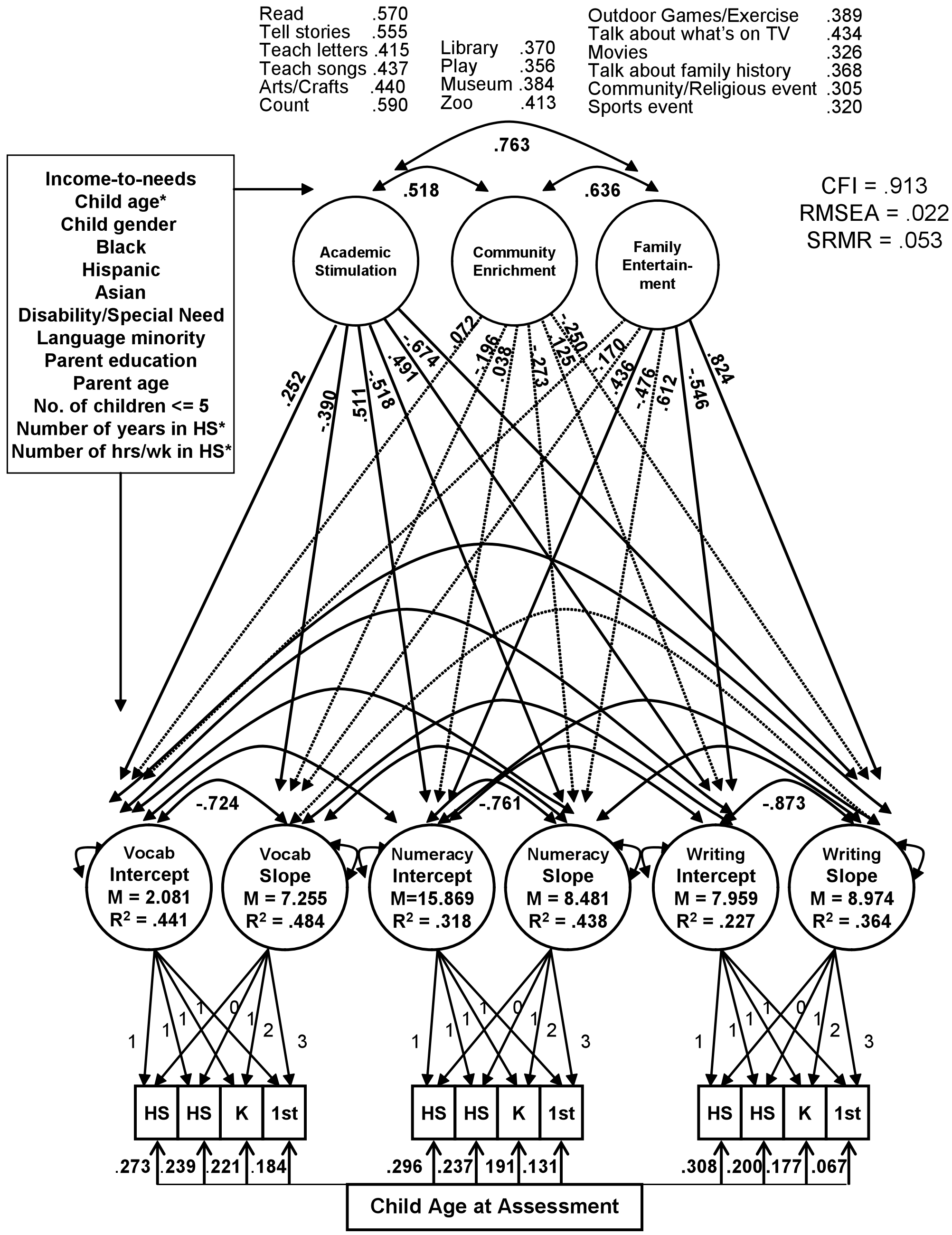

Figure 10. Structural model 4 with three latent factors of home learning activities predicting children's latent factor intercepts and slopes, controlling for sociodemographic characteristics.

* Child age at beginning of study was set as a covariate to latent activity factors only (as child age at assessment was already controlled for in growth model). Number of years in Head Start and number of hours per week in Head Start were covariates of latent slope factors only (as they were experienced post baseline assessment). Dotted lines indicate nonsignificant paths; all other paths are significant at $p < .05$ level. Estimates for latent factor covariances and effects of covariates not shown (see Table 16 for full results).

In a follow-up analysis, I compared low engaged children, who were one standard deviation below the mean for Academic Stimulation, to high engaged children, who were one standard deviation above the mean, to determine if the effect of Academic Stimulation on children's skills persisted over time. By the end of first grade, the mean differences between low engaged and high engaged children were reduced, but the average skills for children who were high on Academic Stimulation were consistently significantly higher than the mean scores for low engaged children.

Research Question 6

Lastly, I created latent variable interaction terms (e.g., "Academic Stimulation X Family Income-to-Needs") to estimate the moderating effect of each of the three activity factors on the association between baseline family income-to-needs and children's initial skills and growth in skills. This step tested whether the influence of family income on children's skills varies or is moderated by engagement in home learning activities.

Due to the complexity of the model, adding interaction terms for all three activity factors into one model created an unidentified model (i.e., a model with more parameters to be estimated than pieces of information to estimate them). Therefore, I tested the interactions separately by running three models each containing one latent activity factor, one interaction term between the activity factor and income, and paths from the interaction term to each of the latent factor intercepts and slopes. However, because the activity factors were separated, the subsequent models were no longer nested and, thus, model fit indices could not be compared. Additionally, model fit indices for interaction effects in Mplus are distinct from those used for latent growth modeling, as interaction effects require a random estimator and estimates are unable to be standardized.

These limitations aside, the results of each moderation model demonstrated nonsignificant interaction effects. None of the estimated paths from the interaction terms to the outcome variables (i.e., latent factor intercepts and slopes) were significant at a *p*-value of .05. The associations between income and the activity factors (see Table 15), and income and children's skills, were so strong that activities did not moderate the effect of income on children's skills. Instead, the results suggest that the activity factors partially mediate the effect of income on children's skills—as noted by an improved model fit and an increased amount of explained variance in the model when the activity factors were added (as addressed under Research Question 5). Since the interaction terms were nonsignificant, the comparison model from the preceding step (Structural Model 4) was accepted as the final structural model.

Table 15. *Activity Factor Means by Level of Income-to-needs*

	Income-to-needs		
Activity Factor	*Below 1 SD*	*Within 1 SD*	*Above 1 SD*
Academic Stimulation			
Standardized Mean	-.07	-.02	.22
Mean number of activities of out 6 (SD)	4.54 (1.44)	4.61 (1.39)	4.95 (1.09)
Community Enrichment			
Standardized Mean	-.09	.02	-.01
Mean number of activities of out 4 (SD)	.63 (.90)	.65 (.85)	.81 (.93)
Family Entertainment			
Standardized Mean	-.07	-.01	.09
Mean number of activities of out 6 (SD)	2.83 (1.47)	3.06 (1.50)	3.10 (1.36)

Final Model Results

Table 16 summarizes the estimated parameters for the final structural model. The effect sizes for significant effects were mostly small (.2 – .3) by Cohen's standards (Cohen, 1988), with the exception of the significant effects of Academic Stimulation and Family Entertainment, which were medium to high (.5 – .8). Table 17 summarizes the fit indices for the structural models and compares the final structural model estimates to those of the final measurement model. The CFI for the final structural model is below the recommended cut-off, but the RMSEA and the SRMR are equal to or approaching the corresponding indices for the final measurement model, which signifies that the final structural model effectively captured the underlying relationships in the data. Lastly, Table 18 compares the hypothesized and estimated relationships among predictors and child outcomes.

Table 16. *Standardized Estimated Parameters for Final Structural Model*

Estimated Paths	Standardized Betas
Academic Stimulation BY[1]	
Read to child	.570***
Told child story	.555***
Taught child letters/numbers	.415***
Taught child songs/music	.437***
Worked on arts/crafts	.440***
Played counting games	.590***
Community Enrichment BY	
Visited a library	.370***
Gone to a play, concert, or other live show	.356***
Visited an art gallery or museum	.384***
Visited a zoo or aquarium	.413***
Family Entertainment BY	
Played games, sports, or exercised	.389***
Talked about TV program	.434***
Gone to a movie	.326***
Talk about his/her family history or ethnic heritage	.368***
Attended community, ethnic, or religious group event	.305***
Attended an athletic or sporting event	.320***
Academic Stimulation ON	
Child age	-.089**
Income-to-needs	.127***
Black	-.054
Hispanic	-.245***
Community Enrichment ON	
Income-to-needs	.158**
Black	.168*
Home language (1=non-English)	.197**
Respondent years of education	.138*
Family Entertainment ON	
Income-to-needs	.097*
Black	.273***
Asian	.113*
Respondent years of education	.138**
Number of children under five	-.155***
Academic Stimulation WITH Community Enrichment	.518***
Academic Stimulation WITH Family Entertainment	.763***
Community Enrichment WITH Family Entertainment	.636***
Vocabulary Intercept WITH Vocabulary Slope	-.724***
Numeracy Intercept WITH Numeracy Slope	-.761***
Writing Intercept WITH Writing Slope	-.873***
Vocabulary Intercept WITH Numeracy Intercept	.840***
Vocabulary Intercept WITH Writing Intercept	.552**
Numeracy Intercept WITH Writing Intercept	.801***
Vocabulary Intercept WITH Numeracy Slope	-.847***
Vocabulary Intercept WITH Writing Slope	-.397***
Numeracy Intercept WITH Vocabulary Slope	-.635***
Numeracy Intercept WITH Writing Slope	-.590***
Writing Intercept WITH Vocabulary Slope	-.316***
Writing Intercept WITH Numeracy Slope	-.515***

[1] "BY" = "defined by"; "ON" = "regressed on"; "WITH" = "correlates with"

Vocabulary Slope WITH Numeracy Slope	.903***
Vocabulary Slope WITH Writing Slope	.335
Numeracy Slope WITH Writing Slope	.462*
Vocabulary Intercept ON	
Academic Stimulation	.252**
Community Enrichment	.072
Family Entertainment	-.170
Income-to-needs	.072**
Gender (female =1)	-.001
Black	-.290***
Hispanic	-.241***
Asian	-.061
Home language (1=non-English)	-.332***
Disability/special need	-.053
Number of children <=5	-.107***
Respondent age	-.003
Respondent years of education	.203***
Vocabulary Slope ON	
Academic Stimulation	-.390*
Community Enrichment	-.196
Family Entertainment	.436†
Income-to-needs	-.001
Gender (female = 1)	-.075†
Black	.120†
Hispanic	.192†
Asian	.165*
Home language (1=non-English)	.330**
Disability/special need	-.050
Number of children <=5	.186*
Respondent age	.047
Respondent years of education	-.199*
Number of years in Head Start	-.011
Hours/week in Head Start	-.011
Numeracy Intercept ON	
Academic Stimulation	.511**
Community Enrichment	.038
Family Entertainment	-.476*
Income-to-needs	.132***
Gender (female = 1)	.081**
Black	-.033
Hispanic	-.059
Asian	.037
Home language (1=non-English)	-.246***
Disability/special need	-.105*
Number of children <=5	-.122*
Respondent age	-.094*
Respondent years of education	.108*
Numeracy Slope ON	
Academic Stimulation	-.518*
Community Enrichment	-.273
Family Entertainment	.612†
Income-to-needs	-.123*
Gender (female = 1)	-.183***
Black	-.113
Hispanic	-.049
Asian	.005

Home language (1=non-English)	.387***
Disability/special need	.025
Number of children <=5	.095
Respondent age	.119†
Respondent years of education	-.093
Number of years in Head Start	-.001
Hours/week in Head Start	.108*
Writing Intercept ON	
Academic Stimulation	.491*
Community Enrichment	.125
Family Entertainment	-.546*
Income-to-needs	.122***
Gender (female = 1)	.180***
Black	.110
Hispanic	.017
Asian	.057
Home language (1=non-English)	.018
Disability/special need	-.154***
Number of children <=5	-.226**
Respondent age	-.086*
Respondent years of education	.056
Writing Slope ON	
Academic Stimulation	-.647**
Community Enrichment	-.250†
Family Entertainment	.824**
Income-to-needs	-.141*
Gender (female = 1)	-.158**
Black	-.229*
Hispanic	-.132
Asian	.015
Home language (1=non-English)	-.075
Disability/special need	.113*
Number of children <=5	.288**
Respondent age	.113**
Respondent years of education	.013
Number of years in Head Start	-.001
Hours/week in Head Start	.015
PPVT Baseline ON Age Baseline	.273***
PPVT Head Start ON Age Head Start	.239***
PPVT Kindergarten ON Age Kindergarten	.221***
PPVT First Grade ON Age First Grade	.184***
Applied Problems Baseline ON Age Baseline	.296***
Applied Problems Head Start ON Age Head Start	.237***
Applied Problems Kindergarten ON Age Kindergarten	.191***
Applied Problems First Grade ON Age First Grade	.131***
Dictation Baseline ON Age Baseline	.308***
Dictation Head Start ON Age Head Start	.200***
Dictation Kindergarten ON Age Kindergarten	.177***
Dictation First Grade ON Age First Grade	.067*
Age Baseline WITH Age Head Start	.710***
Age Baseline WITH Age Kindergarten	.691***
Age Baseline WITH Age First Grade	.675***
Age Head Start WITH Age Kindergarten	.902***
Age Head Start WITH Age First Grade	.930***
Age Kindergarten WITH Age First Grade	.908***

Table 17. *Model Fit Indices for Structural Models*

	CFI	RMSEA	SRMR	x^2	*df*	ΔCFI	ΔRMSEA	ΔSRMR	$\lvert x^2_{difference} \rvert$	$\lvert df_{difference} \rvert$
Final Measurement Model	.939	.022	.056	790	410	–	–	–	–	–
Structural Model 1: Income-to-needs predicting latent growth factors controlling for child age	.963	.028	.095	234	93	–	–	–	–	–
Structural Model 2: Addition of covariates	.958	.026	.066	374	165	-.005	**-.002**	**-.029**	91*	72
Structural Model 3: Addition of 3 home learning activities factors	.918	.022	.048	1253	648	-.040	**-.004**	**-.018**	522***	483
Structural Model 4/Final Structural Model: Addition of paths from covariates to 3 home learning activities factors	.913	.022	.053	1338	711	-.005	.000	+.005	42 n.s.	63

Note: The recommended indices: CFI >= .95; RMSEA <= .06; and SRMR <= .08.

Table 18. *Comparison between the Hypothesized Direction of Relationships and the Resulting Direction of Relationships between Predictors and Outcome Variables*

Outcome	Vocabulary				Numeracy				Writing			
	Intercept		Slope		Intercept		Slope		Intercept		Slope	
Predictor	H_1	β	H_1	β	H_1	β	H_1	β	H_1	β	H_1	β
Academic Stimulation	+	+	+	–	+	+	+	–	+	+	+	–
Community Enrichment	+	n.s.	+	n.s.	+	n.s.	+	n.s.	+	n.s.	+	n.s.
Family Entertainment	+	n.s.	+	n.s.	+	–	+	n.s.	+	–	+	+
Income-to-needs	+	+	+	n.s.	+	+	+	–	+	+	+	–
Gender (1=female)	+	n.s.	+	n.s.	+	+	+	–	+	+	+	–
Black	–	–	–	n.s.	–	n.s.	–	n.s.	–	n.s.	–	–
Hispanic	–	–	–	n.s.	–	n.s.	–	n.s.	–	n.s.	–	n.s.
Asian	–	n.s.	–	+	–	n.s.	–	n.s.	–	n.s.	–	n.s.
Home language (1=non-English)	–	–	–	+	–	–	–	+	–	n.s.	–	n.s.
Disabled/special needs	–	n.s.	–	n.s.	–	–	–	n.s.	–	–	–	+
Parent age	+	n.s.	+	n.s.	+	–	+	n.s.	+	–	+	+
Parent education	+	+	+	–	+	+	+	n.s.	+	n.s.	+	n.s.
Number of children <= 5	–	–	–	+	–	–	–	n.s.	–	–	–	+
Number of years in HS			+	n.s.			+	n.s.			+	n.s.
Hours per week in HS			+	n.s.			+	+			+	n.s.

H_1 = Hypothesized direction of relationship. β = Direction of standardized path loading.
+ = Positive Relationship – = Negative Relationship

Chapter 5: Discussion

My dissertation study addresses a timely issue concerning the development of Head Start children's cognitive school readiness skills. The main goal of the study was to examine the influence of engagement in home learning activities on children's vocabulary, numeracy, and writing skills and to test whether high engagement in home learning activities acts as a protective factor by weakening the negative effects of low family income and boosting children's skills. This study is unique in that I examined a nationally representative sample of Head Start children, thus allowing for an investigation into the daily home experiences of a diverse group of children who may be at risk for academic difficulties. In the following chapter, I will summarize the key research findings within the context of Bronfenbrenner's ecological systems theory and relate them to existing literature. Finally, I will discuss implications for early education research and policy, and address study strengths and limitations, including measurement issues.

Overview of Results

Using data from the Head Start Family and Child Experiences Survey from 1997 (FACES) and latent growth modeling techniques, I estimated Head Start children's growth trajectories on fundamental cognitive readiness skills from the beginning of Head Start through first grade. The results support previous research findings that have identified engagement in cognitively stimulating home learning activities as a significant predictor of children's school readiness, specifically language skills. The study extended this knowledge by examining Head Start children's development of school readiness skills from the time they were four-year-olds and enrolled in Head Start through the end of their first grade year. These analyses allowed for a better understanding and interpretation of how different types of home learning activities contribute to the development of different school readiness skills.

On average, Head Start children performed significantly below the national norm for their age, yet there was a large variation in the vocabulary, writing, and numeracy skills that children possessed early on in Head Start. Some children demonstrated skills that were at or above national norms while others severely lacked basic skills. By first grade, the gap between Head Start children's average skills and national norms decreased substantially. Most children caught up in basic skills in numeracy and writing; however, on average, children consistently performed below the norm for vocabulary skills. Those children who began Head Start with stronger skills continued to perform at a higher level through first grade in comparison to their peers who began Head Start with weaker skills. Children who lacked basic skills early on improved over time, but many remained well below average through first grade. The children who performed at the lowest level often displayed a variety of sociodemographic risk factors: they lived in severe poverty with a greater number of young children in the home, had parents with lower levels of educational attainment, and/or spoke English as a second language.

Children engaged in a variety of early learning activities both inside and outside of the home—some with an educational focus and others for family entertainment; however, families with low household incomes (i.e., in more severe poverty) engaged in fewer learning activities with their children than did families with relatively higher incomes (i.e., at or above poverty). Those children who were highly engaged in activities that stressed early language, literacy, math, and art skills, such as reading, counting, singing songs, and doing arts and crafts, demonstrated the greatest cognitive readiness skills during Head Start and, on average, continued to demonstrate stronger skills than their peers who were not engaged in many academically stimulating activities in the home. Since income level and engagement in activities were so highly positively related, there was not a discernible subgroup of children who were in severe poverty but also highly engaged in learning activities. Therefore, there was not a significant interaction between income and engagement, or in other words, engagement did not demonstrate to be a significant moderator of the effect of income level on children's school readiness skills. However, the results suggest that engagement in home learning activities partially mediated the effects of income-to-needs on children's outcomes.

Consideration of Key Findings

Underdeveloped School Readiness Skills of Head Start Children

Decades of research have highlighted the disparities in the cognitive skills and academic achievement of low-income children and their more economically advantaged peers (e.g., Brooks-Gunn & Duncan, 1997; Noble, Norman, & Farah, 2005). The effects of living in poverty are tremendous across all domains of development, but some of the most detrimental effects are seen in children's cognitive development (Duncan, Yeung, Brooks-Gunn, & Smith, 1998). Poor children often exhibit delayed language skills, smaller vocabularies, and weaker problem solving skills than non-poor children. Those children who begin school with weak skills are likely to experience academic problems throughout school. Thus, efforts to close the economic achievement gap—such as preschool intervention programs—are typically designed to promote children's acquisition of fundamental school readiness skills. However, by the time children enroll in preschool, much of early development has already occurred making preschool a time for “catching-up” rather than expanding on fundamental skills.

The results of the current study support these findings. On average, children displayed below-average skills at the beginning of their four-year-old Head Start program. However, there was a significant variance in children’s abilities, with some children showing very underdeveloped skills for their age, and others performing on or above average on standardized assessments of vocabulary, numeracy, and writing skills. Moreover, children’s skills grew significantly from Head Start through first grade, but, as expected, there was a wide range in growth rates. Those children who entered Head Start with the weakest skills grew at a faster rate, or in other words, had larger gains than children with strong initial skills who leveled off over time. This may indicate a “catch-up” effect for children with weaker skills; yet, for the majority, they never completely caught up to or surpassed their peers with stronger initial skills. Children who started low typically stayed low, while children who started high, stayed high, in respect to the entire group. This finding extends that of Foster and Miller (2007), who found that the achievement gap in literacy skills seen in entering kindergarteners (in the Early Childhood Longitudinal Study, Kindergarten Class of 1998-99, or ECLS-K) continued through third grade, as the children who had average and high school readiness skills outperformed children with low school readiness skills as measured by a third grade reading assessment. The strong growth rate of low achievers in the present study might be an indication of a Head Start program effect. While this study is non-experimental and causality cannot be attributed, it appears that the children most delayed and at risk, particularly English language learners and children from large families, may have benefited the most from their educational experiences during this time.

Looking specifically at the three skill domains—vocabulary, writing, and numeracy—compared to national norm age equivalents, Head Start children's writing skills at baseline were closest to the norm and their vocabulary skills were the furthest. By first grade, on average, children reached the norm ability level for numeracy skills, approached but did not reach the norm for writing skills, and scored significantly below the norm for vocabulary skills. According to standardized estimates from the latent growth model, which placed scores on an equivalent scale, thus allowing for the direct comparison across skills, on average, children's initial numeracy skills were the strongest and their numeracy skills grew at a faster rate than did their other skills. Conversely, their vocabulary skills were extremely delayed and grew at a slower rate. This finding supports previous research that has shown vocabulary as being one of the skills most sensitive to children's experiences, particularly the experience of poverty and poor quality verbal interactions (Hart & Risley, 1995; Noble, Tottenham, & Casey, 2005; Noble, Norman, & Farah, 2005).

This difference in ability across skills may be explained by the characteristics or features of the assessments used. Specifically, the PPVT required children to point to pictures that matched the words they were verbally presented. Head Start children had a great deal of difficulty with this task perhaps because their vocabulary knowledge depended heavily on their previous experience with the words they were given. Children who had not heard the words before, or did not know the meaning of the words if they had previously heard them, were unable to solve the task accurately. Since many children had parents with low levels of education and were not read to often, their early exposure to advanced vocabulary in the home may have been limited. However, from Head Start through first grade, Head Start children gained skills at a faster rate than the norm, indicating that children were learning many new words and catching up to the expected level of vocabulary for their age. Although by first grade, children continued to perform significantly lower than the norm in vocabulary, which signifies that even after being in Head Start and kindergarten, children failed to acquire the same level of vocabulary skills as the norm.

The Dictation subtest required children to copy and draw simple lines and letters, and later to write words, phases, and punctuation. In addition, the test demanded a great deal of fine motor skills to hold and manipulate a pencil. Because it is a test of multiple sub-skills—cognitive ability to copy letters, general knowledge to know about letters and punctuation, as well as physical ability (to grasp a pencil properly)—some children had difficulty, which led to an average trajectory lower than the norm through first grade. However, since the assessment relied heavily on fine motor skills, which developmentally, can be challenging for all younger children, the norms are relatively low and Head Start children demonstrated an age equivalent closer to their own age.

The Applied Problems subtest required children to conduct simple mathematical computations, such as counting, adding, and subtracting. Early on, these tasks were difficult for many Head Start children as they had little previous experience with mathematics beyond counting to small numbers. However, by first grade, they had achieved these basic mathematics skills and reached the norm ability level. This achievement is most likely a result of their daily practice with mathematics in kindergarten and first grade. As mathematics instruction is typically emphasized in the elementary school classroom (more so than vocabulary building), with addition and subtraction as major components of the curriculum, children's numeracy skills increased in strength over time. In addition, the national norm for Applied Problems represents what the average child is capable of calculating at a given age and, accordingly, corresponds to the general curriculum of that particular grade level. Therefore, Head Start children performed at the average expected level of a first grader in basic mathematics by the end of first grade. Nevertheless, these data do not show how children performed on more complicated problem solving tasks and whether their level of mathematics achievement was sustained throughout school as the curriculum became more difficult.

Influence of Family Income on Children's Development of School Readiness Skills

In various studies, researchers have used Head Start or low-income samples to address research questions related to the effects of family income on children's experiences and development (e.g., Beasley, 2002; Parker et al., 1999; Qi, Kaiser, Milan, & Hancock, 2006). Nevertheless, many researchers categorize low-income families into one group and do not control for income in their analyses (e.g., Farver, Xu, Eppe, & Lonigan, 2006), or compare families below the federal poverty level to families living above poverty (e.g., Jiang, Mok, & Weaver, 2003; NICHD, 2005), while disregarding the heterogeneity in the sample; specifically, the large variance in income levels.

In my study, I decided to explore the socioeconomic diversity in Head Start families. Although the majority of families lived near or below the poverty level, there was still a significant range in family income level. Additionally, income was treated as a continuous variable and measured in terms of income-to-needs, or household income divided by the federal poverty threshold for the corresponding family size. Accounting for the number of individuals in the home and the ages of those individuals (i.e., children under 18 years or adults 18 years and older), contextualized the economic situation in the home and allowed for a more meaningful comparison across families. In other words, knowing that a household income is $15,000, for example, does not tell us much about how that money needs to be spent. It may be enough money for a family of two to live fairly sufficiently, but for a family of six, it would not cover the costs of basic necessities. Since income-to-needs reflects the amount of income a family has compared to their federal poverty threshold, a family who has equal to their poverty threshold will have an income-to-needs of 1, while a family who has less than their poverty threshold will have a ratio less than 1 (and more than their poverty threshold, greater than 1). Scaling the income variable in this manner assists with determining if a family is living above or below the poverty line. Income-to-needs serves to be more powerful predictor in statistical modeling than household income alone.

I found that, within a low-income Head Start sample, the income that families do have plays a considerable role. Family income-to-needs was positively associated with children's initial skills, such that the children who experienced relatively higher family income in relation to their family size possessed better school readiness skills, whereas children with lower income (i.e., in more severe poverty) performed at a significantly lower ability level. Income-to-needs was also negatively associated with growth in numeracy and writing skills. Children with lower family income-to-needs and weaker skills during Head Start developed their skills at a faster rate in comparison to higher-income children whose skills leveled off over time. However, these same children who experienced severe poverty during Head Start were, on average, still performing below their higher-income peers at first grade. Their large growth slopes for numeracy and writing indicate that the range in skill levels narrowed over time, so that while an achievement gap still existed, the variance in children's abilities was smaller in first grade than the variance seen early in preschool. On the other hand, the growth slope for vocabulary was not significant, meaning that children of all income levels grew at the same rate. Therefore, children with lower income-to-needs consistently demonstrated significantly weaker vocabulary skills than children with higher income-to-needs and never caught up in the same way as they did in their numeracy and writing skills.

These findings vary somewhat from those of Jiang et al. (2003) who, using data from the ECLS-K, found that former Head Start participants living in poverty at the beginning of kindergarten demonstrated lower average cognitive skills (i.e., reading, mathematics, general knowledge) but also lower average growth rates through the end of first grade, compared to former Head Start participants living at or above the poverty level in kindergarten (Jiang et al., 2003). This difference could be due to variations in the timing of the two studies, the scales of the income variables, or the samples themselves (a nationally representative sample of Head Start children versus Head Start children from a nationally representative sample of kindergarteners in the larger ECLS-K study). Specifically, Jiang used ECLS-K data from kindergarten and first grade, whereas I examined children's skills during Head Start in addition to kindergarten and first grade. Having additional waves of data in my study allowed for a more accurate estimation of children's growth trajectories. During the Head Start year(s), children—particularly children in poverty—developed their numeracy and writing skills at a high rate, adding to the size of their growth slopes. The difference in timing may have contributed to the negative direction of the relationship between family income and children's growth rates in my study. Additionally, I used a continuous income-to-needs variable in my study taken from the beginning of Head Start when family income was at its lowest (with an average income-to-needs well below poverty) while Jiang and colleagues measured income at the beginning of kindergarten and as a dichotomous variable (i.e., above or below the poverty level). Both the timing of the measurement of income and the scaling of the variable could have influenced the differences in growth rates across the two studies.

Family income-to-needs was most strongly associated with children's initial vocabulary skills and least associated (yet still significantly) with children's writing skills, thus further supporting research that indicates the relationship between low family income (or low socioeconomic status) and poor language skills (e.g., Hart & Risley, 1995; Noble, Tottenham, & Casey, 2005). The variance in vocabulary skills was the largest among the three measured skills, and children in more severe poverty exhibited the weakest vocabulary skills. Additionally, income-to-needs was most strongly yet negatively related to growth in numeracy skill and not associated with growth in vocabulary. Thus, children in more severe poverty possess much weaker vocabulary skills and gain vocabulary skills at a slower rate than numeracy skills.

Variations in Cognitive Readiness Skills across Child and Family Characteristics

Children's early cognitive readiness skills were expected to vary significantly by sociodemographic characteristics; however, it was found that some characteristics had a much greater relationship with certain outcomes than others, with income-to-needs, primary home language, number of children in the home, and gender proving to be the strongest predictors of children's school readiness. Additionally, it was expected that children with at least one risk factor (e.g., non-English home language), would start Head Start at a lower skill level and grow at a lower rate than other children without that risk factor. Instead, across almost all covariates and outcomes, when children started with weaker skills, they grew at a faster rate over time (with the exception of Black children's negative slope for writing).

After controlling for all other covariates in the model, the effect of income was reduced—particularly for vocabulary skills—but income still demonstrated to be a significant predictor of early vocabulary, numeracy, and writing performance. As the effects of income are often confounded by race or ethnic group, the addition of child race and ethnicity in the model accounted for part of the variance in children's skills that was previously attributed to income.

As hypothesized, child race and ethnicity variables were highly related to children's vocabulary skills. In contrast to the comparison group of White children in Head Start, Black and Hispanic children possessed significantly weaker vocabulary skills during Head Start. I had expected that White children would also develop their skills at a faster rate over time, but I found that, when adding covariates to my model to explain child outcomes, racial minority children had larger growth rates in vocabulary skills than did White children. Even so, when taking the analysis a step further and also accounting for children's early experiences in the home, I found that Black and Hispanic children did not differ from White children in their growth slopes for vocabulary, but Asian children did. Black and Hispanic children developed at the same rate as White children, meaning they persisted to perform at a significantly lower level. Asian children, on the other hand, had a significantly larger growth rate in vocabulary than White children, and by first grade, surpassed their skill level.

Black and Hispanic children also demonstrated weaker numeracy skills than White children; however, after adding the latent activity factors in the model, the associations between being Black or Hispanic and early numeracy skills became non-significant. This indicated that White children's stronger numeracy skills was not explained by race alone but in part by their higher engagement in academically stimulating home learning activities, which were related to stronger numeracy skills. Controlling for the variance explained by home learning activities caused any previous racial differences in numeracy skills to be nonsignificant. Similarly, there were no racial differences in rates of growth in numeracy skills, indicating that child race and ethnicity did not play a significant role in the acquisition of numeracy skills. In addition, according to the final model results, Black children had a smaller growth slope in writing skills compared to White children. There was no significant difference in their initial writing skills, but over time Black children demonstrated lower performance on writing tasks than White children. As White children acquired more advanced writing skills at a faster rate, Black children appeared to have more difficulty and developed at a slower rate over time.

Controlling for child race and ethnicity, as well as other covariates, English language learners exhibited significantly weaker English vocabulary and numeracy skills during Head Start in comparison to native English speakers, as was expected.[7]

[7] Language minority children consisted of 77% Hispanic children, 8.1% White, 5.9% Black children, and 4.8% Asian or Pacific Islander children.

Interestingly, because they were so behind in these skills, they demonstrated stronger growth rates than native English speakers through first grade, thus narrowing the variance in skills over time. While English language learners caught up to their peers on numeracy skills, as indicated by a non-significant difference in their first grade scores, their vocabulary skills remained significantly weaker. These findings suggest that vocabulary skills are the most variable skills across racial, ethnic, and language groups, and that Black, Hispanic, and language minority children are at a great risk of poor English language skills.

In earlier studies examining young children's development, high-density households and crowding in the home were linked to negative child outcomes, particularly vocabulary skills and cognitive abilities (Evans, Maxwell, & Hart, 1999; Hart & Risley, 1995; Wachs & Camli, 1991). It has been argued that living in such unfavorable conditions can cause a great deal of stress to both parents and children, and affect the frequency and quality of the attention children receive. Some subsequent studies of the experiences in the home for families with young children account for family size and other indicators of crowding (Farver et al., 2006; Qi et al., 2006); however, others still disregard this important feature of the home. For example, in Barbarin, McCandies, Early, Pianta, and Howes (2006), risk factors, such as family income, parent education, marital status, parent health, family functioning, and neighborhood quality, predicted low-income preschool children's PPVT scores and Woodcock-Johnson Applied Problems scores (two of the assessments used in my study); however, family size was not included in the analyses. Although these other factors are all important to consider, family size and number of children in the home also play a significant role in children's early experiences.

In my study, I added a covariate that represented not just the number of children in the home, but the number of children who were specifically age five or younger. I chose age five because I hypothesized that having additional children in the home who are not yet of school age would be a potential risk factor for the developing target child. It can be argued that older siblings may assist the family by caring for and teaching a younger sibling, but in low-income families with several young children—who may not necessarily be siblings but live together—the children must compete for adult attention, physical space, and material resources. Such a challenging environment can cause stress to the child and negatively impact his or her cognitive growth. No known studies have specifically considered this variable of household density or shared resources in the home with this particular age restriction, yet the results indicate that the number of young children in the home has a significant negative association with children's vocabulary, numeracy, and writing skills.

Gender was added into the model as a covariate to control for any variance in skills that could be attributed to developmental gender differences. Although gender is not considered a traditional risk factor, some research suggests that girls develop at a faster rate in the areas of language and reading, which has caused the practice of "redshirting," or delaying children's enrollment in kindergarten, to be more common in families with boys than in families with girls (Oshima & Domaleski, 2006). I hypothesized that if boys demonstrated weaker school readiness skills, they would continue to perform at a lower level than girls and be at a higher risk for problems in school. However, I found that when controlling for other characteristics in the model, girls did not differ significantly than boys on vocabulary skills in Head Start or growth in vocabulary skills. Girls did demonstrate greater numeracy skills and writing skills than did boys early on, but boys later showed larger gains in these skills and by first grade there was no statistically significant difference. The gender differences during Head Start were most likely due to girls' greater developmental maturity. Even though boys showed early signs of delayed skills, they caught up in numeracy skills by kindergarten and in writing skills by first grade, displaying comparable skills as girls.

About 17 percent of the FACES sample had a parent-reported disability or special need, with the majority being speech or language impairments and emotional or behavioral disorders. I included a covariate in my model to control for any variance in child outcomes associated with a disability or special need, which may have negatively influenced children's learning. Even so, there was no significant difference in vocabulary skills between children with and without special needs. It is important to note that the PPVT measures receptive language, not verbal language, and does not require children to speak (only to point to pictures that match the spoken words provided by the assessor). Therefore, this test did not have a bias against children with a documented speech impairment. The main differences found were with numeracy and writing skills. Children with disabilities or special needs demonstrated weaker numeracy skills during Head Start, but developed their numeracy skills at the same rate as other children, meaning they continued to underperform over time. They also demonstrated weaker writing skills during Head Start, but by first grade they caught up to their peers and showed no significant difference. Since the Applied Problems test of numeracy skills involved problem solving, calculating, and a deeper level of thinking than the vocabulary knowledge and writing tasks, this area of school readiness may have been more challenging for children with disabilities and special needs.

Low parent education is often viewed as a risk factor in research, as parents' level of knowledge and academic attainment is thought to influence children's development—as both a genetic factor for intelligence and an environmental factor, with the assumption that parent education level influences children's experiences in the home. Surprisingly, in my study, parent education did not relate as strongly to vocabulary as did child race and ethnicity. Yet when controlling for home learning activities, parent education positively influenced numeracy skills whereas the effects of race and ethnicity were reduced. These results indicate that parents with a greater number of years of school possibly have a more extensive vocabulary themselves from which their children learn and more familiarity and comfort with mathematics to teach their children fundamental skills. Unlike gender and disabilities/special needs, parent education did not relate to writing skills, indicating that perhaps writing skills are less susceptible to socioeconomic risk factors and more a result of physical maturation combined with practice.

Conversely, parents' age did not seem to matter for vocabulary, but had an influence on numeracy and writing skills, but in the opposite direction of what was expected. It was thought that children with younger parents would have weaker skills, considering that younger Head Start parents may be in their teens and lack the experience and resources that older parents have. Instead, children of older parents appeared to fare worse (with "older" being relative to the mean of 30 years). This could in part be due to the fact that 5% of respondents to the parent interview were actually grandmothers or older foster mothers who took on the position of primary caregiver when biological parents were not capable of doing so. Therefore, the skills that these children have may be a consequence of their previous home experiences and the stress occurred from dealing with an unstable family situation, and not a direct result of their relationship with their current primary caregiver.

In addition to sociodemographic characteristics, I used the number of years children were in Head Start and the hours per week they attended the program as covariates of children's growth rates in my model. Although the focus of the study was not on the effects of the Head Start program, it was expected that children who were in Head Start for two years would have larger growth rates than children who were in Head Start for one year, due to the "double dose" of the intervention period, but no significant differences were found. This finding supports previous research that found no differences in children's developmental outcomes as a function of length of participation in Head Start (Ritblatt, Brassert, Johnson, & Gomez, 2001). I did find, however, that the number of hours per week in Head Start was positively related to growth in numeracy skills, so that children who attended Head Start programs that were full-day and full-time (5 days a week) gained numeracy skills more quickly than did children who attended half-day or part-time programs. The lack of differences found as a result of the number of years in Head Start could be due to the fact that many of the children who were in Head Start for only one year were in some other early education or child care program prior to their entrance into Head Start, which contributed to the growth of their skills. Additionally, the actual number of years spent in the program was not precise, as some children dropped out of the Head Start program during the study, but were still followed longitudinally.

Measurement issues aside, the important point to draw from these findings is that the intensity of the program, meaning the amount of time spent in the program each week, may matter more than the length of participation in the program. Nevertheless, no actual program effects can be concluded without randomizing children to 1 or 2 years of the program and controlling for factors such as classroom quality, curriculum, and teacher characteristics.

Variations in Engagement across Child and Family Characteristics

The main objective of my study was to examine Head Start children's engagement in home learning activities with their families. From an ecological systems perspective, the family is the most influential context in which early development takes place (Bronfenbrenner, 1986). Within the microsystem of the home, parents choose the types of activities in which their children are engaged and foster their children's early learning and development through engagement in these activities. Previous research indicates that children who live in high quality home learning environments, characterized in part by engagement in learning activities, demonstrate greater cognitive readiness skills than their peers living in low quality home environments who are not engaged in learning activities (Beasley, 2002; D'Elio et al., 2003; Fantuzzo et al., 2004; Parker et al., 1999; NICHD, 2003).

The quality of the home has been measured in various ways. Some global measures, such as the HOME (Caldwell & Bradley, 1984), take into account different aspects of the environment, such as the physical environment (e.g., cleanliness; safety; presence of books and toys), as well as parent-child interactions and learning activities. Other measures, such as the Family Involvement Questionnaire (Fantuzzo, Tighe, &

Childs, 2000) and the Home-Learning Environment Profile (Heath, Levin, & Tibbetts, 1993) capture the frequency with which parents support their children's learning in the home. Moreover, the family activities scales used in longitudinal survey studies (e.g., FACES and ECLS-K) measure engagement in learning activities that foster family-child interactions both in the home and in the community.

For the purposes of this study, the focus was on the learning activities that family members do with their children when they first enter Head Start. As the context of the family extends beyond the physical walls of the home and into neighborhood and community settings that the family visits, I included activities both inside and outside the home in my analyses. Specifically, the interactions, or proximal processes, between children and their families occur in various settings, but all have the potential to support children's development. Bronfenbrenner explained that these proximal processes have a more powerful effect on children's development than the environment itself in which the processes occur (Bronfenbrenner & Ceci, 1994). Therefore, activities were included in the model regardless of whether they took place in the physical home or in another location, as long as they involved both a family member and the child.

As a result of my analyses, I found that children engaged in different types of learning activities and in some activities more than others. Instead of home and community activities forming two separate factors, the items actually loaded on three factors, one of which had both in-home and community-based activities. The activity factors were referred to as Academic Stimulation, Community Enrichment, and Family Entertainment, given the characteristics of the items that loaded on each.

The types of activities that children engaged in varied by their sociodemographic characteristics; however, opposite of what was expected, gender, parent age, and disabilities/special needs status did not play a role in the type of or level of engagement. Variation in the type of engagement depended primarily on family income-to-needs, parent education level, number of young children in the home, child race/ethnicity, home language, and child age.

Children from families with higher income-to-needs and higher parent education level were more highly engaged in all three types of activities. Previous research has shown that children in poverty or from low socioeconomic status (with low family income and low parent education) have poorer quality home learning environments and are less likely to be engaged in home learning activities than their more economically advantaged peers (Bradley, Corwyn, McAdoo, & Garcia Coll, 2001; Brooks-Gunn, Klebanov, & Liaw, 1995). The results of my study provide further evidence of the relationship between family income and engagement in home learning by revealing just how sensitive children's experiences are in relation to their family income. No high-income or middle-class comparison group was included in the study, yet it was found that even families who live just above the poverty level, who are considered "low-income," generally engage in more home learning activities than families in more severe poverty.

The more years of education parents had, the more children were engaged in home learning activities. The parents who were more educated may have placed a greater emphasis on education and had a better understanding of the importance of early learning experiences, such as reading to their children and teaching them new skills and knowledge. Consequently, more educated parents spent more time with their children engaging them in learning activities. Parent education level was also positively correlated with income-to-needs; parents with more education generally earned a larger income that could meet the needs of their families. The extra spending money may have afforded greater opportunities for participation in enrichment and entertainment activities in the community, such as going to a children's theater performance or to a movie, respectively, which both can be very costly for a whole family.

I also found that families with a greater number of young children were less engaged in family entertainment activities than were families with fewer young children. In addition to the added expense, it may have been challenging for families to arrange outings in the community (e.g., movies, sports game; exercising or outdoor game) when they had several children under the age of five, particularly infants and toddlers who require constant care and supervision. These settings also may not have been suitable for very young children. The number of children in the home did not matter for community enrichment activities, which means that perhaps these settings are more family-friendly and suitable for children of various ages.

It was expected that White children and children whose primary home language was English would be more engaged in home learning activities than their racial and language minority peers, as minority race/ethnicity and language are potential risk factors that influence children's early experiences; however, race/ethnicity and language are often confounded by income and parent education. When controlling for the latter variables, it was found that White children were more engaged only in academically focused activities, in comparison to Black and Hispanic children. Black children were more engaged than White children in enrichment activities in the community and family entertainment activities, and Asian children were more engaged than White children in family entertainment activities. Similarly, English language learners were more engaged in community enrichment activities than were native English speaking children. These differences could be due to the fact that the majority of White children in my sample (approximately 59 percent) lived in rural areas, while the majority of Black children (approximately 77 percent), Asian children (99%), and English language learners (approximately 81 percent) lived in urban areas. One main difference between rural and urban poverty, while both detrimental to children's development, is that families in urban areas often have greater accessibility to resources in the community that rural families lack—including art, sports, and community events, libraries and museums, zoos and aquariums, and theaters. Therefore, in this study, Black children, Asian children, and English language learners may have been exposed to more community-based activities as a result of their proximity to larger cities that offered a variety of activities for the family. Noting the items that loaded on the family entertainment factor, specifically discussing family heritage, attending religious events, and participating in community or cultural events, clarifies why perhaps families of minority descent—Black and Asian—engaged their children in these types of activities more so than White families. Interestingly, Hispanic children did not vary from White children in their level of engagement in community enrichment or family entertainment activities, even though approximately 88% of Hispanic families spoke a non-English home language and 80% lived in urban areas. Although Hispanic families may have had closer access to community settings than White families, they engaged in these activities at the same rate. It is possible that some other factor may have hindered Hispanic families' participation in activities outside the home, such as their lower income-to-needs as compared to White families or a lack of cultural understanding of the communities where they lived.

Lastly, child age at the beginning of Head Start was highly negatively associated with Academic Stimulation activities, but not related to Community Enrichment or Family Entertainment activities. Younger children (i.e., three-year-olds) were more likely than older children (i.e., four-year-olds) to be engaged in academic activities in the home, such as learning the alphabet and how to count, but children of all ages were equally engaged in other activities. A possible explanation is that these activities may be viewed by parents as more appropriate to teach to younger children, such that by the time children are four or five years old, they have already learned their alphabet, numbers, shapes, and colors, and so there is not as much direct instruction of these specific skills. However, because reading and telling stories—two important literacy building activities—are included as part of this factor of Academic Stimulation, these results suggest that parents of older children who are soon entering kindergarten may not be spending as much time as they could be strengthening these skills. Future research should address the factors that influence parents' decisions in regards to selecting activities for their children to determine whether child age and developmental appropriateness play a role in their decisions.

Engagement in Home Learning Activities on Children's School Readiness Skills

Head Start children were engaged in a variety of home learning activities with family members before they entered kindergarten. Some activities were more focused on building academic skills through direct teaching and practicing (e.g., counting; singing songs); others exposed children to cultural and educational settings outside the home (e.g., museums; libraries), while still other activities were more social in nature and united the family in the traditional sense of "family fun" (e.g., attending a sporting event; exercising or playing an outdoor game). Foster and colleagues (2005) found that when Head Start families engaged in home learning (measured by reading to their children, exposing them to books and reading materials in the home, engaging them in learning and play activities in the home, and taking them to educational settings outside the home), children demonstrated stronger emergent literacy as well as more positive social functioning than their peers who were not engaged in home learning. However, in that study, because all of the variables were indicators of one latent factor of "Home Learning" and not factored out into separate latent factors, as I did in my study, it is difficult to know whether one type of activity was more beneficial than another (home literacy versus enrichment activities outside the home) for one domain of development over another (literacy versus social skills).

As a result of my latent modeling, I found that this overarching latent factor of "Engagement in Home Learning" did not exist, or rather was not supported by the data. The three activity factors produced by the factor analysis were best treated as separate, yet covarying, latent factors and direct predictors of children's skills instead of components of one larger latent variable. Eliminating the higher order factor of overall engagement actually allowed for a comparison across activities. It was hypothesized that family activities as a whole would contribute to children's cognitive readiness skills, but when running the model with the three activity factors as separate predictors instead of one predictor of engagement in activities, it was found that there was not a consistent pattern of relationships across activities and outcomes. The degree and directionality of the associations among the activity factors and the different child outcomes varied significantly. Academic Stimulation was highly associated with strong vocabulary, numeracy, and writing skills at baseline, with the greatest effect on numeracy and writing skills. Community Enrichment was not significantly related to any of the measured skills. Family Entertainment was not related to early vocabulary, but was negatively associated with numeracy and writing skills at baseline, and positively related to growth in writing skills.

Academic Stimulation was also negatively associated with the growth in all three skills, such that children who were highly engaged at the beginning of Head Start grew at a slower rate over time, and children who were not highly engaged grew at a faster rate. Early engagement in academically-stimulating activities enhanced children's skills early on, giving them an advantage over their peers, but over time, the disparity between highly engaged and low engaged children was reduced. By the end of first grade, low engaged children caught up on basic skills; however, they still lagged slightly behind their high engaged peers. One explanation for the fade-out effect of engagement is that families who were not engaging in activities at baseline may have become more engaged in activities later on as a result of participation in Head Start, which benefited their children's skills. Conversely, families were reported high engagement in activities may not have continued to be as involved later on as their children entered kindergarten. However, since I only looked at the effects of early engagement in my study and not the effects of changes in or stability of engagement over time, I can only speculate as to the reason why the effects of engagement are not stable through first grade. Overall, the results demonstrate a small lasting effect of academic stimulation activities on children's school readiness skills.

As far as the lack of significance for Community Enrichment and the negative influence of Family Entertainment, my findings support previous research findings. Researchers have found that of the two types of family learning activities, those occurring in the actual home environment and those occurring in the community, learning activities in the home tend to have the greatest positive association with children's cognitive readiness skills (Beasley, 2002; Klebanov et al., 1998). Beasley (2000) had found that engagement in cultural-related activities in the community had a more significant influence on high-risk children than low-risk children, over and above learning activities in the home, but risk was defined as having an unmarried mother and not attending a center-based preschool program. In my sample, children displayed a variety of risk factors, but they all attended Head Start, which served as a protective factor. Moreover, Beasley used data from the National Household Longitudinal Survey, which included parent report of children's skills (e.g., counting, naming letters and colors) and not direct child assessments. The skills included were not representative of a broader range of school readiness skills, as I found that performance on norm referenced tests of vocabulary, numeracy, and writing skills was most associated with academically-focused activities in the home.

The most noticeable distinction among engagement in activities was the lack of participation in enrichment experiences outside the home. While the majority of parents reported taking their children to the mall, to run errands, or to the park, resulting in significant skewness of these items (and causing them to be dropped from the analyses), few parents reported taking their children to educational sites in their community, such as zoos, museums, or libraries, or to a live musical or theatrical performance. This finding is quite significant given the importance of exposing children to new and stimulating environments early in life; however, since many of these activities require money and leisure time, they are often difficult for low-income parents to manage. I found that families with lower income-to-needs were significantly less engaged in all three types of learning activities, but particularly so for community enrichment activities. With the financial, emotional, and sometimes physical stress with which low-income families must cope, family outings may become more of a burden than an enjoyable activity. Similarly, Bradley (1994) found that poverty had a great effect on the variety of enriching places and events that children experienced.

Even so, it was surprising to find that engagement in community enrichment activities did not relate to children's initial readiness skills or to the growth in their skills. It could be argued that parents or family members who provided their children with these early experiences may simply have brought their children to community settings without actively engaging their learning. For instance, a mother may have brought her three-year-old son to an art museum that was not child-friendly, where the child was told to stay quiet in his stroller and not touch anything. While the child may have been exposed to a variety of interesting objects and media, the child may not have gained anything positive from the experience—in the form of new vocabulary or conceptual knowledge—if his mother did not take advantage of the opportunity as a teachable moment. According to the ecological systems theory, it is the proximal processes that occur within a microsystem that matter most for the child and not the setting itself (Bronfenbrenner & Ceci, 1994). Therefore, exposing children to new settings will only influence their learning if they are engaged in meaningful interactions and activities within those settings.

The nonsignificance found in the relationships between community enrichment activities and cognitive readiness skills may be explained by various reasons and does not discount the value of these types of activities. First, the results suggest that perhaps low-income parents lack the knowledge and skills to effectively facilitate learning in community settings. Second, researchers may not be effectively measuring engagement in learning outside in the home, as I will discuss later in further detail. Third, community enrichment activities may not be directly related to children's cognitive skills but rather influence other types of skills that were not addressed in this study, such as social skills and approaches to learning. For example, families who engage their children in early learning experiences outside the home may be providing their children with more positive attention and teaching them how to behave in social settings. If children do not experience trips into the community on a regular basis, they may lack the knowledge of how to self-regulate in those environments and, therefore, become more easily overwhelmed, aggravated, or restless when in a new setting. In previous exploratory research, I found that Head Start children's engagement in activities in community-based settings (e.g., museum, theater performance) was related to parent report of positive social skills and approaches to learning as well as teacher report of cooperative behavior during Head Start (See & West, 2007). Additionally, in that study, involvement in church and community events was related to lower negative social behaviors, specifically teacher- and parent-reported hyperactivity, aggression, and withdrawal. In the current study, I only focused on cognitive skills since the social skills measures varied over time and could not be modeled longitudinally; however, future research should address social skills as well.

While community enrichment activities showed no significant associations with child outcomes, family entertainment demonstrated to be a negative predictor of numeracy and writing. Children who were not engaged in activities focused on literacy and early learning concepts, but who frequently participated in activities centered on social activities, such as attending a sports game or church event, showed very poor numeracy and writing skills. These activities, as mentioned above, may relate to other domains of development, such as positive social and emotional skills and low behavioral problems, but as far as cognitive skills are concerned, these activities do not appear to have any beneficial qualities.

The results of my analyses also showed that there was not a significant interaction between engagement in home learning activities and income-to-needs, contrary to what I had hypothesized. The associations between income-to-needs and the three types of activities were so strong that families with the lowest income-to-needs engaged in very few activities. Since this study was not a controlled intervention, it is difficult to conclude whether children with the lowest income-to-needs would have had stronger skills if they had been engaged in activities. Instead, the results support previous research that has found the home learning environment to be a mediator between family income and child outcomes (Duncan, Brooks-Gunn, & Klebanov, 1994; Klebanov et al., 1998; Yeung, Linver, Brooks-Gunn, 2002). Low family income-to-needs negatively influences children's experiences in the home, which in turn causes lower cognitive skills. In an extension of the present study, I examined only the latent factor of Academic Stimulation and found that it did partially mediate the effect of income-to-needs on children's writing skills, but the mediating effects on vocabulary and numeracy were smaller and did not reach a level of significance (See, 2008).

These results suggest that there may be other more significant variables within the context of the family that act as mediators or mechanisms through which income affects children's acquisition of other skills, such as parental mental health, parental self-efficacy, the quality of parent-child interactions, and language modeling in the home, to name a few. When low-income parents are stressed and depressed, and lack motivation and self-confidence in their parenting abilities, they are less positive in their interactions with their children, which affect their children's own well-being and opportunities for learning (Brooks-Gunn, Klebanov, & Liaw, 1995; Gershoff et al., 2007; Watson, Kirby, Kelleher, & Bradley, 1996). Researchers have addressed many of these potential mediators (e.g., maternal distress [Linares, Heeren, Bronfman, Zuckerman, Augustyn, & Tronick, 2001]; parent-child interactions [Dodici, Draper, & Peterson, 2003]; quantity and quality of language [Hart & Risley, 1992]), but risk factors are often examined independently. Few research models incorporate multiple risk factors to complete a fuller picture of children's experiences in the home. In future studies, researchers should examine these mechanisms in more depth to determine how family income indirectly affects child development and how interventions can moderate these effects.

The underlying evidence highlights that low-income children who are exposed to educational activities in the home prior to kindergarten have significantly better vocabulary, numeracy, and writing skills than their low-income peers who are not engaged in such activities. With the growing need for children to have emergent literacy and numeracy skills before they begin kindergarten, it is important to recognize how these skills can be taught and reinforced in the home in conjunction with children's experiences in preschool. Parents who reported engaging their children in academically stimulating activities had children who displayed the strongest skills during Head Start. These children could match spoken words with pictures, calculate simple mathematical computations, and recognize and draw letters. While a direct causation cannot be made, it can be concluded that engagement in these types of activities that emphasize one-on-one verbal interaction and hands-on, structured learning may contribute to children's acquisition of early cognitive and language skills. By regularly observing print in the home as they were read to and taught letters and numbers, these children learned concepts such as letter names and shapes, and how letters form words that represent things we see in pictures and in our environment. Similarly, when they were told stories, taught songs, and engaged in arts and crafts activities children were exposed to new words that may have influenced their vocabulary knowledge. Through active learning and engaging conversations with family members, these children had developed higher level problem-solving and analytical thinking skills as well as more extensive vocabulary knowledge. These early experiences have the potential to be extremely beneficial to children's acquisition of cognitive school readiness skills and may compensate for the social and environmental risks associated with poverty.

Implications

Research

In the present study, I have uncovered some very interesting relationships among variables that give cause for future research efforts. One area in particular is testing whether an increase in engagement in home learning activities, as a result of an increase in household income for families in poverty, would stimulate an improvement in children's school readiness skills. Dearing, McCartney, and Taylor (2001) found that, in the NICHD SECCYD, increases in family income-to-needs were positively associated with children's cognitive and social outcomes. Dearing and Taylor (2007) subsequently reported that increases in family income related to improvements in the physical and psychosocial qualities of the home environment, particularly for low-income families. As parents gained more income, they provided their children with more learning materials, such as books and toys, and were more likely to engage them in stimulating activities and express warmth in their interactions with their children. Yet these studies did not examine all three constructs simultaneously to test the change in income on the change in home learning environments on the growth in school readiness over time. This could not be done in my study as home learning activities were not measured at each time point and were not developmentally appropriate for children of all ages (e.g., teaching the alphabet is appropriate during Head Start but not in first grade). Since home learning activities and educational materials in the home change as a function of child age, researchers conducting longitudinal studies must create and use measures that not only account for these developmental changes but that are psychometrically comparable at each time point.

Moreover, the previously mentioned studies examining change in family income are non-experimental, such that income changes over time without intervention, as a natural consequence of parents' educational attainment and job advancement. The additional financial resources help parents ostensibly improve the quality of their home learning environments, not only because they can afford to live in more adequate housing in cleaner and safer areas, and buy their children more learning materials, but also because it reduces their stress levels, which affect their interactions with their children. Machida, Taylor, and Kim (2002) found that family stress indirectly influenced the quality of the home learning environment through parental self-efficacy. Parents who experienced a great deal of stress reported less efficacy in their skills as a parent (such as teaching their child and providing toys and experiences that will help their child be successful), which in turn influenced the frequency in engagement in home learning activities. An experimental study could test whether a family intervention program that focuses on reducing parental stress levels, increasing parental self-efficacy, promoting parent-child engagement in home learning activities, and improving children's access to learning materials would serve to enhance children's school readiness outcomes. Given that family income has such a dramatic influence on child outcomes, it is important for researchers as well as policymakers to identify the mechanisms by which family income influences the home environment. Further development of evidence-based interventions must target these mechanisms as a means to reduce the disparities in school readiness skills and close the academic achievement gap.

Examining methods to improve the effectiveness of existing intervention programs for low-income families that focus on engagement in home learning activities would also contribute valuable information to the field. Home-based intervention programs, such as the Parent-Child Home Program (The Parent-Child Home Program, n.d.) and Parents as Teachers (PAT; Pfannenstiel, Lambson, & Yarnell, 1991), guide parents in fostering their children's learning; however, they have demonstrated limited evidence of effectiveness in changing parents' behaviors and improving child outcomes (Levenstein & O'Hara, 1993; Levenstein, Levenstein, & Oliver, 2002; Drazen & Haust, 1994). Researchers should not give up on these programs, which have potential for positive results, but instead should address the reasons why the programs have not been successful. The family unit is complex, particularly in low-income families who face a variety of risk factors. It is possible these programs focus more on children as the target of the intervention, and not parents and their needs as well. Participating parents who are suffering from stress and poor mental health may be unable to effectively implement the activities or parenting skills are they taught. Before researchers can target the parent-child relationship and the home environment, they must first address other issues in the home underlying these factors, such as parent mental health and self-efficacy. Likewise, researchers must be aware of cultural differences in families and sensitive to parents' individual needs. With these issues in mind, researchers should develop new approaches to coach parents in how to engage their children in learning activities both in the home and in educational settings in the community, while simultaneously supporting parents in achieving their own personal goals. These approaches must respect parents' role as their children's first teachers and include a coaching model that focuses on enhancing the positive things parents do, rather than a direct instruction or training model that may not be individualized and may diminish the efforts parents are already making.

In order to create evidenced-based intervention programs that encourage engagement in learning activities outside the home, we need more thorough descriptive studies of parent-child interactions in community-based settings, such as museums and libraries. These learning environments are not always designed for a preschool audience and, as a result, may not provide familiar concepts or experiences to which children can relate, making it somewhat difficult for them to comprehend and connect to previous knowledge (Anderson, Piscitelli, Weier, Everett, & Taylor, 2002). However, when parents facilitate positive interactions with their children to engage their attention and scaffold their learning at an appropriate level, activities in these community settings have the potential to be very beneficial to children's learning and development.

There is a growing body of literature on young children's learning in museum settings, which has revealed the powerful impacts of museum experiences on children's understanding of more abstract ideas (e.g.., concept of dinosaurs) as well as the mediating role families play in children's interactions with museum exhibitions (e.g., Piscitelli, 2002; Piscitelli & Anderson, 2001). Falk, Balling, and Liversidge (1985) highlighted the need for museums to recognize and accommodate the skills, background knowledge, and culture that families bring to the museum, or the "family agenda," in addition to the "museum agenda." Rather than investigating *what* families learn from museums, the focus should be *how* and *why* families are engaged in learning, and the *ways* in which their engagement occurs (Ellenbogen, Luke, & Dierking, 2007). Researchers argue that a museum is a context for learning and one of many learning resources that the family uses. Therefore, instead of the content of museum exhibits as the focal point of evaluation, research must begin with the family learning context and subsequently examine the interactions, discussions, and underlying motivations of family practices in this "meaning-making process" (Ellenbogen et al., 2007, p .24).

In Borun, Chambers, Dritsas, and Johnson's (1997) multi-city, multi-museum study, they found a correlation between families' physical and verbal interactions and their learning. Families engaged in three types of discourse: identifying, describing, and interpreting and applying. They concluded that families are learning in museums, but parents' teaching strategies were not always the most effective. Most research in this area targets elementary and secondary school students; however, the findings establish a foundation upon which further research may be conducted with a preschool sample. In future studies, researchers should investigate: how parents engage their children's learning in such settings; the interactions and dialogues that take place and the quality and effectiveness of those interactions; the themes in conversations; children's level of engagement across various settings; the type of information children learn; and the school readiness skills that are promoted.

Measurement

Existing measures of the preschool home learning environment (e.g., the HOME Caldwell & Bradley, 1979), family involvement in preschool children's learning (e.g., the Family Involvement Questionnaire; Fantuzzo, Tighe, & Childs, 2000), and engagement in family learning activities (e.g., scales from longitudinal survey studies, i.e., NHES, FACES, and ECLS-K), all acknowledge activities outside the home and in community settings in addition to learning activities in the home. For example, the HOME assesses whether the child has visited a library or has gone on a trip more than 50 miles from home. The Family Involvement Questionnaire includes the item: "I take my child places in the community to learn special things (i.e., zoo, museum)," while NHES, FACES, and ECLS-K have similar items, such as visits to the library, attending a sporting event, or visiting a zoo or museum. These measures account for activities in multiple settings with the purpose of connecting exposure to and engagement in activities in these settings to children's learning and skill development.

For the purposes of my study, it was essential to include items referring to activities across multiple settings. Unfortunately, some items were measured on an ordinal scale ranging from “never” to “three or more times a week” and others were measured on a dichotomous scale of “yes” or ”no” “within the past month.” The difference in measurement scaling and time frame thus made it difficult to compare the frequency of engagement across activities. SEM techniques are most suitable for use with continuous variables; therefore, a measure that assesses engagement in activities on a frequency scale is needed for this type of research. Researchers should focus on developing reliable and valid instruments that measure all learning activities on the same psychometric scale.

In my study, I relied on parent report of engagement in home learning activities, and while informative, the high skewness of many items suggests that certain activities are very common among families and that perhaps there are other types of activities that foster children’s learning that are not being measured, such as playing computer games with children or engaging children in shopping at the grocery store. The items from FACES were taken from the NHES 1993 parent questionnaire on parent and family involvement in education. With advances in technology and changes in family lifestyle since the early 1990s, the activities that families engage in with their children at the present time may be somewhat different. Certain items should be added, removed, or reworded in order to capture when is actually occurring in the home and to enhance the construct validity of the measure. When designing a new measure, research with parent focus groups should be conducted during the development phase to brainstorm the various types of activities families engage in with their children. Moreover, particular attention should be given to the wording of items to specify the learning component of the activities more carefully; for example, instead of "Went to library," the item could be split into two distinct learning activities and read "Went to a story time or other organized children's activity at a library" and "Went to library to look for and borrow children's books." In addition to "Read to <child>," the measure should include "Listen to <child> read or pretend to read a story" to capture the distinct action of the child practicing his or her storytelling skills with the parent. Also, vague items such as "Talk about TV programs or videos with <child>" can be reworded as "Talked about a children's television program you watched with <child> that taught academic and social skills, such as *Sesame Street*."

Given the limitations when using parent-report measures, which I will address in a later section, it is important for researchers to gather data from multiple sources or through multiple methods to validate the findings. Is it difficult to know if parents are reporting their involvement accurately or if they over-report to serve the needs of the interviewer. Also, as I found in this study, the actual frequency of the occurrence of the activity and the quality of interaction during the activity are often not captured in existing measures. One possible method of improving the validity of the results and accounting for the quality of the learning experience is to gather observational data of parent-child interactions. Classroom-based observational measurements, such as the Classroom Assessment Scoring System (CLASS; Pianta, La Paro, & Hamre, 2008), measure the quality of teacher-child interactions and may provide insight into the ways researchers can measure parent-child interactions in learning activities. For example, one of the CLASS domains is instructional support which includes dimensions such as language modeling, conceptual development, and quality of feedback. Scores on these dimensions have demonstrated high predictive validity with preschool children's language and cognitive development skills. Using such an assessment tool as a model for future measurement design in the area of home learning would be advantageous, as it is grounded in best teaching practices and developmental appropriateness, assesses quality on a frequency scale, and addresses specific ways adults scaffold children's learning to advance their level of understanding.

Policy

The findings from this research are closely tied to early childhood policy and have several implications for future policy initiatives. First of all, it is evident that there are a significant number of families with young children who are living in severe poverty. Many of the families in this study were struggling financially and had needs greater than their income. However, to aid them with their economic challenges, they were receiving educational and compensatory support services from Head Start. As a two-generational federally-funded program, Head Start has the capacity to improve the lives of young children and their families by providing them with a supportive environment, in which they can learn, and the medical, nutritional, and mental health services that they may need. However, it was also found that a substantial number—almost 30 percent of the sample—had an income-to-needs ratio over the federal poverty threshold.[8] A percentage of those children became eligible due to a disability or special need, as Head Start

[8] The present study examines poverty in terms of the poverty thresholds established by the U.S. Census Bureau, which are used for national statistics. The U.S. Department of Health and Human Services, which houses Head Start, uses its own poverty guidelines for program eligibility, which accounts for family size, but not the number of children in the home, as do the poverty thresholds. The values vary slightly, with the federal poverty thresholds being lower, since they account for resident age, and cost of living is lower for children. Thus, a small percentage of Head Start participants may meet the HHS poverty guidelines but not the federal poverty thresholds.

programs are required to reserve at least 10 percent of their enrollment slots for children with disabilities or special needs (Code of Federal Regulations 45CFR1305.6c); yet there still remains a substantial number of participants who appear to not meet the eligibility requirements of Head Start.

One explanation is that the total household income reported during data collection was not the same as the family income level reported during the Head Start application process, since total household income may include the income of other adults living in the home and other income benefits, such as Temporary Assistance to Needy Families (TANF) and Supplemental Security Income (SSI). Another explanation is that, in some areas, Head Start programs may have been located within local public schools or community settings, which contributed local funding to the programs to raise the income eligibility requirements and increase enrollment. Additionally, some Head Start programs may have had difficulty reaching their enrollment capacity and allowed families who did not qualify (but who were near poverty or who displayed some risks) to enroll in the program. However, since baseline data were collected in 1997, it is difficult to know if this situation still occurs today. According to a recent survey from the National Head Start Association (2008), 48% of Head Start programs reported that their waiting lists of children in need of services have increased over the past year due to cuts in Head Start funding. Head Start appropriations for FY2008 are over $10 million less than spending in 2007 (HHS, 2008). It begs the questions: are Head Start income eligibility restrictions too low, should eligibility levels be raised to meet the needs of more low-income children, and how can the needs of more children be met if current funding does not reach all those children who are currently eligible?

Other programs for low-income children have higher eligibility restrictions. For example, the USDA Child Nutrition Programs (i.e., Child and Adult Care Food Program, National School Lunch Program, School Breakfast Program) provide free meals to children from families at or below 133 percent of the federal poverty line and reduced price meals to children from families at or below 185 percent of the federal poverty line (U.S. Department of Agriculture, 2008a). Similarly, the Special Supplemental Program for Women, Infants, and Children Program (WIC), which provides supplemental food and nutritional services to low-income pregnant and postpartum women and their infants and children up to age five who are at nutritional risk, has an eligibility requirement of 185 percent of the federal poverty threshold (U.S. Department of Agriculture, 2008b). The State Children's Health Insurance Program (SCHIP), which provides free or low-cost health insurance for children not covered by Medicaid (Centers for Medicare and Medicaid Services, 2008), and the Purchase of Child Care Subsidy Program, which provides child care vouchers to low-income parents who are working, in an approved training program, or enrolled in public school (HHS, 2006a; Maryland State Department of Education, 2003), also have higher income eligibility limits.

Since the creation of Head Start in 1965 as a social program to combat the effects of poverty, standards of living and social norms have dramatically changed. Poverty thresholds are based on a formula developed in 1963 by Mollie Orshansky of the Social Security Administration, who calculated poverty thresholds to be three times the cost of the Department of Agriculture's economy food plan for a given family size (HHS Assistant Secretary for Planning and Evaluation, 2008). The "economy" food plan was the cheapest of the plans and was designed for "temporary or emergency use when funds are low" (Fisher, 1992). The factor of three was derived from the Department of Agriculture's 1955 Household Food Consumption Survey that determined that families were spending about one-third of their total household income on food (U.S. Department of Health and Human Services, 2008). Although the poverty thresholds are regularly updated using the Consumer Price Index to adjust for inflation in costs of goods and services, this formula does not account for any expenses other than food.

Almost 50 years later, family expenditures are very different. The U.S. Bureau of Labor Statistics Consumer Expenditure Survey of 1997 (when the data for FACES were first collected) found that Americans in the lowest 20% of the income bracket, who earn an annual salary of less than $11,944, have average annual expenditures of over twice their salaries, with food accounting for only 17 percent of expenditures (including groceries and prepared food eaten outside the home) (U.S. Department of Labor, 1997). Many families spend a significant amount more than they earn and rely on credit in order to make ends meet, which places them in further debt. Yet poverty thresholds account for income only and not the true amount families are spending to provide for their children. When poverty thresholds were created, it was assumed that when families lacked financial resources, they would be spending a minimal amount on non-food purchases and the majority of their money on basic necessities, such as housing, food, utilities, and clothing. With the changes in social norms, there are expenses today that were not accounted for years ago, such as communications expenses (e.g., television, computer, Internet, and cell phone), commuter transportation and vehicle costs, health care, educational expenses for parents, and child care costs. The Consumer Expenditure Survey of 1997 shows that families are spending a significant amount of money on these items and services, even when “funds are low.” This information combined with the results of my study indicate the need to reevaluate the eligibility restrictions for Head Start, which may be too rigid and based on outdated statistics and not the true expenses that low-income families in today’s society face. Raising the income eligibility requirements would allow more children, who are low-income but who miss the income eligibility cut-off, to benefit from Head Start services. However, to do this effectively, there needs to be a significant increase in the amount of program funding.

Due to the fact that Head Start serves a limited population of poor and at-risk children, over the past decade state prekindergarten programs have been developed in 38 of the 50 states in order to provide early educational services to low-income children. Prekindergarten programs vary in eligibility criteria (e.g., in Maryland’s prekindergarten program the eligibility cut-off is 185% of the federal poverty level); however, they typically enroll children who either do not meet eligibility criteria for Head Start, who are on a waitlist for Head Start due to full enrollment, or who do not have access to the full-day care they need through Head Start (Maryland State Department of Education, 2008). Some prekindergarten programs have partnered with Head Start grantees to deliver a combined, full-day program—half funded by Head Start and half funded by public prekindergarten, whereas in some areas, there is competition between programs for eligible children. Because of Head Start’s long history and tradition, Head Start supporters do not want to eliminate the program; however, policymakers need to address the insufficient amount of funding designated to Head Start, and recognize the demand for high-quality early education services for all young children, particularly children near poverty or in lower middle-class working families who cannot afford the high costs associated with early care and education. State prekindergarten programs may meet the needs of some of these families, but funding and availability are still limited in most states (Doctors, 2008).

The results of my study also show that Head Start children who were most at risk demonstrated the highest gains over time and, in a sense, benefited the most from the program. This finding provides support for additional or expanded service programs for children most in need. It also has implications for spending the limited amount of Head Start program resources on targeting a smaller number of children who are most at risk. In addition, the findings suggest that increasing the intensity of Head Start, so that children receive full-day, full-week, and year-round services, would significantly benefit children's cognitive development. Since Head Start children's skills were considerably delayed by the time they entered the program, there is also evidence for increased funding for programs targeting the earliest years of development, such as Early Head Start. If low-income children receive high-quality early care and education services from birth through age three, they may develop the fundamental learning skills they need at the expected rate and be at less risk of delay when they enter preschool. The results show that it is important to prevent delays early on during these formative years rather than intervening later when children have a more difficult time catching up to the norm, particularly in the area of language development. Thus, as funding for state prekindergarten programs is expanded, Head Start funding should be reserved for providing services at a more intense level to a small number of high-risk children with the greater portion of funding designated for Early Head Start.

The findings of my study also highlight the potential need for culturally specific intervention programs that target identified risk groups. In particular, African American males who came from large families in severe poverty and low parent education were at a high risk of cognitive delays and weaker school readiness skills. In the State of Maryland, the Task Force on the Education of Maryland's African American Males was recently created to address the documented underachievement of African American males and create recommendations to improve their success (Maryland State Department of Education, 2007). Recommendations include providing subsidized early child and education centers (known as Judy P. Hoyer Early Child Care and Family Education Centers) in every elementary school where there is a documented gap between African American and White achievement and ensuring that all early childhood programs—including Head Start, child care, and prekindergarten programs—provide a strong focus on emergent literacy. The results of my study support the efforts of this task force and provide further evidence of the need for providing targeted services to those children at most risk, including African American males.

The findings of my research also shed light on the importance of families and engagement in family activities in the home for children's development of fundamental school readiness skills. Children from families most in need were engaged in significantly fewer learning activities in the home than were their peers from families in the low-income range above poverty. Experiencing such low family income has dramatic influences on children's early experiences and their development and well-being. There is a need to educate parents about the importance of home learning activities and how to engage their children in meaningful interactions—in other words, how to identify and take advantage of everyday learning moments. There are many possible approaches to connecting with families and providing them with this information, but I have listed a few suggested methods.

Family resource centers, pediatrician offices, and other community service providers (e.g., Early Head Start and Head Start centers) should be better equipped with resources for families on providing a positive home learning environment and staff should verbally discuss this information with parents. Every parent seeking social services, whether it be WIC, food stamps, child care vouchers, or SCHIP, should be given easy-to-read information about everyday activities they can do with their children to stimulate their learning. Family service programs should also provide learning kits with children's books, puzzles, and other educational materials (e.g., crayons, pencils, paper) to low-income families to help increase the physical quality of the home learning environment and promote engagement in learning activities. Additionally, high school child development or home economics courses should integrate parenting skills into their curriculum to teach young adults before they are parents about how to foster the early learning of young children.

Since many low-income parents have weak literacy and numeracy skills themselves, which make it challenging for them to effectively teach their children, it is also important to target parents' own learning in the context of family interventions. One such program, the Even Start Family Literacy Program, was first authorized in 1988 to "help break the cycle of poverty and illiteracy by integrating early childhood education, adult literacy or adult basic education, and parenting education into a unified family literacy program" (National Even Start Association, 2008). Even Start helps parents improve their literacy or basic educational skills, become full partners in educating their children, and assist children in reaching their full potential as learners (U.S. Department of Education, 2008). However, while the goals and components of this program are notable, the most recent evaluation of this program found no significant differences between the literacy skills of participating families and control families (U.S. Department of Education, 2003). Future policy research needs to address why the program is not effective in improving family literacy and document ways to improve the delivery of the intervention in order to attain more positive outcomes. Otherwise, new models of family education programs should be created that demonstrate greater effectiveness. There also needs to be a stronger focus on developing and expanding family service centers in low-income communities that offer programs that address low-income parents' basic educational needs. Helping parents with practical life skills, such as reading and following a recipe, balancing a checkbook, writing a resume, and operating a computer, would build their confidence as learners and as parents, and make them more comfortable with teaching their children the skills they need for school.

Lastly, parent involvement has been the cornerstone of the Head Start program model since it first began as a two-generational social service program for both parents and their young children, but slowly over time, due to federal mandates, it has become more focused on early education than on the needs of families. Policymakers must reevaluate the goals of Head Start as a program for families, not just children, and recognize the importance of early home learning environments on children's readiness for school. Center-based early education experiences are important, but are most effective when learning is reinforced in the home and when parents are involved in the learning process. Head Start services for families need to be expanded to address with greater emphasis the importance of building skills in the home through family activities. Family specialists must be assigned to all center-based children and have reduced caseloads so that they can provide more individualized services to each family, conduct regular home visits with the child's teacher, and coach parents in engaging their children's learning in the home. Given that there are many more full-time working mothers today than there were when Head Start was first developed, programs must work to reach out to working parents to involve them in center-based activities and accommodate their schedules and personal needs.

In sum, improving policies at the level of the macrosystem regarding early education and family service programs will positively affect all other systems that directly or indirectly affect a child's development. Communities and schools will be better able to serve the needs of low-income families; parents will be able to reach their full potential as parents and as learners and workers; and children will have more high-quality home learning environments and receive the comprehensive services they need to succeed in school and in life.

Contributions

In this study, I analyzed an underused yet well respected national dataset to examine the home learning experiences of children enrolled in the federal Head Start program. The sample consisted of primarily low-income children with various risk factors and diverse family histories. One of the major strengths of the FACES methodology is that a stratified random sampling procedure was implemented, which reduced the amount of confounding variability among participants and increased the internal validity of the results. For example, some of the Head Start parents who participated in the study may have been more involved in their children's educational experiences than the average Head Start parent, but if those very involved parents were over-represented in the sample, the outcomes could have been skewed. In such a case, there is a threat to the external validity of the findings, signifying that the results of the study might not generalize to the Head Start population. Therefore, having a randomized, nationally representative sample of Head Start children eliminated such biases.

Another strength of this study is that I did not focus on engagement in activities with just one parent, such as the child's biological mother, but rather engagement in activities with any member of the family, thus, providing a more global understanding of children's home learning experiences. The home learning activities scale took into consideration multigenerational households and the presence of resident extended family and older siblings in the home who may have participated in activities with the target child. Whether it was the grandmother who read to the child every night, the uncle who brought the child to the movies, or the older brother who colored and drew with the child, the target child was experiencing those activities within the context of the family.

Most importantly, the longitudinal design of FACES offered the opportunity to track children's academic growth over time, which, compared to a cross-sectional analysis, provides a more accurate estimation of the causal relationships among home learning activities and children's academic skills. Whereas previous research has established the positive associations between home learning activities and school readiness skills, I took this research a step further by using latent growth modeling to examine the contribution of engagement in home learning activities to the development of school readiness skills over time. Latent growth modeling advances our current knowledge of these relations, as it permits the analysis of *individual* growth rates of participants at multiple times points as opposed to *group* mean comparisons as used in repeated measures analyses. This structural equation modeling technique has proven to be a useful tool for examining the process of change over time and individual growth trajectories (Vernon-Feagans, Odom, Pancsofar, & Kainz, 2008). Specifically, latent growth modeling provides more reliable estimates, since the model accounts of changes in variance over time unlike repeated measures or correlational analyses which assume homogeneity of variance. Additionally, latent growth modeling provides detailed statistical information such as the average growth rates over time and variance in growth rates across participants, the relationship between initial skills and growth in skills, and the linearity of the growth curve. The variation around the mean intercept and slope factors represent individual differences in growth trajectories within the sample. These individual differences can subsequently be examined for latent classes, or groups of participants who have similar growth patterns, to distinguish between the different types of trajectories that children have. According to Vernon-Feagans and colleagues (2008):

> We believe a more transactional and process-oriented definition of 'readiness' helps place 'readiness' where it should be—at the intersection of important individual and contextual systems—and helps us to understand not just children's initial skills but also their growth in that skill, which we can call their learning or readiness trajectory…the confounds of race, poverty and the myriad of other factors that co-occur may have the most profound effects on 'readiness' for children and have the

greatest policy implications if we take these constraints on families and children seriously. (p. 74)

In my study, I found a significant amount of variance in Head Start children's readiness trajectories. The average trajectory across all Head Start children showed that, by first grade, they progressed towards the national norms for basic skills in numeracy and writing, but persisted to show vocabulary skills well below the norm. Yet because there was considerable variance, some children continually underperformed in all three skills, particularly children living in severe poverty, English language learners, children living with siblings or other children who were under school age, and children who were not engaged in academic stimulation activities.

My study demonstrates the utility of latent growth modeling with longitudinal data to track children's performance over time. Modeling children's trajectories can assist in the identification of individual or groups of children at risk of problems in school. Moreover, model covariates and predictors can address which sociodemographic characteristics or other meaningful factors in children's lives, such as engagement in home learning, have the strongest effect on children's acquisition of school readiness skills. At an individual level, this valuable information can be applied to the design of intervention services that target the whole child based on his or her individual needs, characteristics, and experiences. At a program level, the information can be used to identify areas in need of improvement, such as language and vocabulary development, to guide program enhancement and teacher/trainer professional development. At a systems level, mean trajectory data across all children as well as developmental trends for subgroups of children, programs (e.g., Head Start, state prekindergarten, private child care), and schools (e.g., Title I) can inform state accountability. As Love (2006) stated:

> Systematic data on program characteristics, processes, and child outcome measures allow states to examine in detail the operations and outcomes of their programs. [When using data for accountability], children will develop more fully along the dimensions the program seeks to enhance, and they will be launched on learning trajectories enabling them to succeed in their next school experience. (p. 6)

Limitations

Although the results of my study shed light on the early experiences and abilities of this targeted population, they do not necessarily generalize to the entire low-income preschool population, or even to the entire Head Start population, as migrant and American Indian programs were not included in the larger FACES study. Moreover, the results of my study are not generalizable to all Spanish speaking children in the Head Start program, since I only examined children's performance on English language assessments. The investigators in charge of FACES 1997 were interested in English language learners' English literacy and language skills after completing Head Start (HHS, 2001). Consequently, Spanish-speaking children were assessed in their home language at baseline (Fall 1997) and in English at each of the follow-up waves. Because it was my intention to examine children's readiness for kindergarten in the United States, it was important to analyze English language skills, which it can be argued, are necessary for academic success. However, some Spanish speaking children may have possessed greater proficiency in their home language than in English, which is not revealed in the findings. Additionally, some children were from predominantly Spanish-speaking classrooms (e.g., in Puerto Rico) and were assessed in Spanish throughout the study. My analyses did not include child outcome data for these participants. If these children, who had very few English skills, had been assessed in English, their scores would have been significantly low. Therefore, if their scores were included in the analyses, the means for the total sample would have been lowered and the effect of home language would have been even greater than what was estimated. Nevertheless, the results of my study are not generalizable to this subsample of Head Start participants.

Since Head Start's primary goal is school readiness, the families in the FACES sample may have engaged in more family activities with their children than non-Head Start families due to their involvement in the program and their access to program resources and parent training opportunities. Findings from the Head Start Impact Study (HHS, 2005b), which compared Head Start and non-Head Start families matched on various demographic characteristics, indicated that after one year of Head Start, participating parents engaged their children in more cultural enrichment activities and read more to their children than non-Head Start families. However, this was not something that could be analyzed in this study given that there was no comparison group of non-Head Start families.

I selected the FACES dataset for this study in order to explore the variability in home learning activities, family characteristics, and children's skills within the Head Start population. However, due to the selection of this dataset, there was no comparison group of middle- or high-income families. Consequently, I was unable to compare engagement in home learning activities across different socioeconomic levels. In a future study, I plan to look more carefully at the types and frequency of activities in which higher-income families engage compared to low-income families and test if engagement in home learning activities has a more significant contribution to the skills of low-income children, or if learning activities are equally as important for all children regardless of income level.

Similar to many studies of young children, there is the limitation of parental report measures. Parents reported the types of activities they performed with their children; however, there was no independent source of data to validate the occurrence of the described activities. In future studies, researchers should use multiple methods to collect data, such as an observational measure of family activities or a time diary method in which parents report on daily activities with their children—which have demonstrated effectiveness in other studies (e.g., Keller, Neese, & Hofferth, 2001; Yeung, Sandberg, Davis-Kean, & Hofferth, 2001).

The scaling of the items on the Activities with Your Child scale also presented some limitations. While weekly activities were measured on a 3-point ordinal scale, the monthly activities were measured on a dichotomous scale (i.e., “yes”/”no” response); therefore, although some conclusions could be drawn in regards to frequency of engagement in weekly home activities, I could not address the issue of intensity of engagement in community-based activities. Accordingly, when it comes to data analysis, there are some limitations to doing a factor analysis with dichotomous variables. Since a factor analysis is based on the correlations among related variables and assumes a normal distribution of variance, having dichotomous variables can make it difficult to create reliable factors. However, with those limitations in mind, an exploratory principal components analysis was attempted with both dichotomous and 3-point ordinal variables to test for underlying factors in the activities that children engage in with their families. The resulting factors were conceptually valid (e.g., “academic” activities grouped together) and followed a pattern that supported previous research examining in-home and out-of-home activities (Klebanov et al., 1998); therefore, the factors were used as predictors in the larger latent growth model.

An additional limitation to the research methodology is the large sample size. Although a large sample size is helpful in controlling for the effects of attrition in longitudinal studies and allows for more powerful statistical analyses, such as latent growth modeling, a sample that is too large can lead to Type II error. In other words, the power becomes so large, that it becomes difficult to reject the hypothesized model. In addition to the large sample size, there were also many variables in the model, which led to large degrees of freedom. With a sample size of 1,930 and degrees of freedom over 100 (as was the case with the final structural model), power was equal to .99; that is, there was a .99 probability of rejecting the null model (using $\alpha = .05$), in favor of acceptable data-model fit for the hypothesized model (Hancock, 2006). In order to account for the complexity of the data due to sampling design, including stratification and clustering, and eliminate selection bias, I implemented the complex survey option in Mplus, which adjusted the standards errors for parameter estimates. The model fit indices remained very high, partly as a result of the large sample size and strong power; however, the model fit for the final structural model was not statistically significantly better than the comparison model (without covariates for home learning activities). This indicated that the hypothesized model was able to be rejected and there was not Type II error due to extreme power. Hence, the large sample size did not appear to present any statistical challenges.

In addition to generalizability, measurement, and sample size limitations, the varying number of years in Head Start and corresponding waves of child assessment data posed a limitation for my latent growth model. The FACES sample contains both three- and four-year-olds, some of whom attended Head Start for one year and some of whom attended for two years. Children subsequently enrolled in kindergarten and then first grade in different years. This "cohort effect" combined with the fact that younger children were not age eligible for the Woodcock-Johnson subtests when they began Head Start in the fall of 1997, presented some methodological constraints. In particular, I was unable to capture younger children's numeracy and writing skills at the beginning of the Head Start program. While my research questions and hypothesized model were designed to address children's growth from entry into Head Start through the end of first grade, the available baseline data for younger children was from the spring of 1998—half a year after they began Head Start. As a result, these children's skills could have been influenced by their participation in the program during those months. For older children, I used data from the fall of 1997, although a substantial percentage of those children participated in Head Start the year before and were included in the pilot study in the spring of 1997. Therefore, their skills in the fall of 1997 did not necessarily represent the skills they possessed at the beginning of their Head Start experience. Although there was a difference in timing of the baseline assessment depending on child age, and the "Baseline: Head Start" wave did not represent the beginning of participation in Head Start for all participants, this wave did capture children's skills at the beginning of, or just prior to, their four-year-old Head Start experience. Since preschool is generally conceptualized as a program for four-year-olds the year prior to kindergarten, the limitation to four-year-old preschool data (as opposed to Head Start data across two full years) fit the goals of this study.

Conclusion

The findings from my study illustrate the utility of latent growth modeling in estimating Head Start children's school readiness trajectories through first grade. I found that, on average, Head Start children perform significantly below national norms for receptive vocabulary, numeracy, and writing, but also that they possess a wide range of individual differences in their developmental trajectories. The achievement gap for numeracy and writing skills slowly decreased from Head Start through first grade; however, children's vocabulary skills persisted to be significantly lower than the norm, which highlights early vocabulary skills as an area in need of intervention. Income-to-needs, parent education, non-English home language, and number of young children in the home demonstrated to be the strongest risk factors.

I also found that the home learning environment played an essential role in Head Start children's development of school readiness skills. Activities that took place within the home had the most significant association with children's skills, whereas activities in community settings were less beneficial. Moreover, academically-stimulating activities that focused on literacy and numeracy skills were associated with greater readiness skills. However, engagement in home learning activities was highly influenced by family income-to-needs.

In addition to advancing our basic knowledge, the results of this study also have potential to contribute to practice in the field of early childhood education. The hypothesized model was accepted as a tenable representation of the underlying relations in the data, thus supporting the theory that home learning activities influence school readiness skills. These findings further substantiate the need for early intervention programs designed to educate low-income families about the importance of engaging in home learning activities with their young children. The developmental risks associated with poverty may be prevented or improved with educational interventions beginning in early childhood that focus on strengthening the cognitive and language abilities shown to be most at risk. Furthermore, early childhood educators can promote the success of young children at risk of academic failure by making parents part of the learning process and increasing awareness of the importance of extending learning into the home. This research can also be used to define approaches to enhance parent involvement with young children of all levels of socioeconomic status. Through this process we can better understand how to serve their educational needs and prepare them for school.

In order to achieve cognitive school readiness skills, children must be engaged in cognitively stimulating home learning activities within the context of the family. To ease the transition into kindergarten and prevent grade retention and academic failure, it is critical to intervene early and engage children in enriching learning activities that will enhance their readiness skills, as well as their motivation to learn. In future studies examining school readiness, researchers should expand their concept of school readiness beyond the beginning of kindergarten and examine the transactional process of developing and promoting school readiness skills over time. Finally, researchers are encouraged to utilize advanced statistical modeling techniques that are capable of estimating children's readiness trajectories. This information can help to inform individualized interventions, program improvement, and systems level (e.g., school district, State Department of Education) accountability, so that all children have the opportunity for academic success.

Appendices

Appendix A. *Instruments to Assess Child*
(adapted from the FACES website http://www.acf.hhs.gov/programs/opre/hs/faces)

Name of the Instrument	Fall 1997	Spring 1998	Spring 1999	Spring 2000/2001
COGNITIVE OUTCOMES				
1. Social Awareness Tasks	HS	HS	HS, K	K, 1st
2. Peabody Picture Vocabulary Test III (PPVT)/Test de Vocabulario en Imágenes Peabody (TVIP)*[1]	**HS**	**HS**	**HS, K**	**K, 1st**
3. McCarthy Draw-A-Design	HS	HS	HS	-
4. Color Names and Counting	HS	HS	HS	-
5. Woodcock-Johnson Letter-Word Identification*[2] / Woodcock-Muñoz Identificación de letras y palabras*[1]	HS	HS	HS	-
6. Woodcock-Johnson Applied Problems*[2] **/ Woodcock-Muñoz Problemas aplicados***[3]	**HS**	**HS**	**HS, K**	**K, 1st**
7. Woodcock-Johnson Dictation*[2] **/ Woodcock-Muñoz Problemas aplicados***[3]	**HS**	**HS**	**HS, K**	**K, 1st**
8. Story and Print Concepts • 1997: Goodnight Moon/Buenas noches luna • 1998, 1999: Where's My Teddy/¿Dónde está mi osito?	HS	HS	HS	-
9. The Phonemic Analysis Task from the Test of Language Development, Third Version (TOLD-III)	-	-	K	K, 1st
10. Name Writing Task	-	-	K	K, 1st
11. Early Childhood Longitudinal Study-Kindergarten Cohort (ECLS-K) Reading	-	-	K	K, 1st
12. Early Childhood Longitudinal Study-Kindergarten Cohort (ECLS-K) General Knowledge	-	-	K	K, 1st
13. Developmental Accomplishments	HS	HS	HS, K	K, 1st *[4]

SOCIO-EMOTIONAL OUTCOMES				
1. Social Skills (completed by teacher)	HS	HS	HS, K	K
2. Classroom Conduct Problems (completed by teacher)	HS	HS	HS, K	K
3. Your Child's Behavior (completed by parent)	HS	HS	HS, K*5	K*[5]
4. Peer Play Observation Scale	HS	HS	HS*[6]	-
5. Assessment Behavior Scale (completed by interviewer)	HS	HS	HS, K	K, 1st
6. Teacher Feedback on Child's School Performance and Behavior (completed by parent)	-	-	K	K, 1st
7. Child Observation Record (COR)	HS	HS	HS	-

*[1] TVIP and Letter-Word ID were administered in Fall 1997 and Spring 1998 to Spanish-speaking/limited English proficient children. Thereafter, they were administered only to children in Spanish-speaking classrooms (i.e., in Puerto Rico).
*[2] Woodcock-Johnson Scales were only administered to children who were four years old and older.
*[3] Spanish versions of Woodcock Johnson Dictation and Applied Problems were administered only in Fall 1997 to Spanish-speaking/limited English proficient children. Thereafter, they were administered only to children in Spanish-speaking classrooms (i.e., in Puerto Rico).
*[4] Parents were asked only questions about their child reading storybooks on own.
*[5] This version of the scale is different from the one used with HS children and the scale used with KG children in Spring 1998.
*[6] Used only for a small subsample of children observed by the Quality Check Visitors.

Citations for Child Instruments

COGNITIVE OUTCOMES

1. Social Awareness Tasks - Child is asked to tell his/her full name, age, birthday and address. (Instructions were also translated into Spanish by the FACES Research Team.)

   Authors: FACES Research Team, modified from the Social and Communicative Competence tasks in: Jana M. Mason and Janice Stewart (1989), *The CAP Early Childhood Diagnostic Instrument* (prepublication edition), American Testronics.

2. Peabody Picture Vocabulary Test - III Performance Record, Form A (PPVT)/Test de Vocabulario en Imágenes Peabody (TVIP)

   Authors of PPVT: Dunn, L. M., Dunn, L. L., & Dunn, D. M. (1997) *Peabody Picture and Vocabulary Test, Third Edition. Examiner's Manual and Norms Booklet.* Circle Pines, MN: American Guidance Service.

   Authors of TVIP: Dunn, L.M., Padilla, E.R., Lugo, D.E., & Dunn, L.M. (1986). *Test de Vocabulario en Imágenes Peabody*. Circle Pines, MN: American Guidance Service.

3. McCarthy Draw-A-Design Task from the McCarthy Scales of Children's Abilities. (Instructions were also translated into Spanish by the FACES Research Team.)

   Author: McCarthy, D. (1970, 1972). *McCarthy Scales of Children's Abilities*. San Antonio, TX: The Psychological Corporation.

4. Color Names and Counting - Child is shown a page of ten colored bears and asked to name all the colors he or she can. For those colors that the child cannot name, assessor asks, "Can you find the...(color)...bear?" Then the child is asked to count the bears. (Instructions were also translated into Spanish by the FACES Research Team.)

   Authors: FACES Research Team, modified from the Color Concepts and Number Concepts tasks in: Jana M. Mason and Janice Stewart (1989), *The CAP Early Childhood Diagnostic Instrument* (prepublication edition), American Testronics.

5. Letter-Word Identification Test, Applied Problems Test, and Dictation Test from Woodcock-Johnson, Revised Tests of Achievement, Standard Battery / Batería Woodcock-Muñoz Pruebas de Aprovechamiento-Revisada.

   Authors of English version: Woodcock, R. W., & Mather, N. (1989, 1990). WJ-R test of achievement: Examiner's manual. In R.W. Woodcock & M.B. Johnson, *Woodcock-Johnson Psycho-Educational Battery - Revised*. Chicago: Riverside.

   Authors of Spanish version: Woodcock, R.W., & Muñoz-Sandoval, A.F. (1996). *Batería Woodcock-Muñoz Pruebas de Aprovechamiento-Revisada*. Chicago: Riverside.

6. Story and Print Concepts - Child is asked to show the front of the book, open it for reading, point to where the assessor can start reading, point to things on the page that are requested by the assessor, explain why certain things are happening in the story, point to the title of the book, explain what the author does when author's name is pointed to, and recall certain content from the book. (Instructions were also translated into Spanish by the FACES Research Team.)

Authors: FACES Research Team, modified from Story and Print Concepts tasks in: Jana M. Mason and Janice Stewart (1989), *The CAP Early Childhood Diagnostic Instrument* (prepublication edition), American Testronics.

The books used to assess child's story and print concepts are as follows:

Author for English version: Brown, M. W. (1947). *Goodnight Moon*. New York, NY: Harper Collins [ISBN 0-06020-705-1]
Author for Spanish version: Brown, M. W. (1947). *Buenas noches luna* (T.M. Lawer, Trans.). New York, NY: Harper Collins [ISBN 0-06026-214-1]

Author for English version: Alborough, J. (1992). *Where's My Teddy?* Cambridge, MA: Candlewick Press [ISBN 1-56402-048-7]
Author for Spanish version: Alborough, J. (1992). *¿Dónde está mi osito?* (M. Castro, Trans.). Compton, CA: Santillana. [ISBN 1-56014-582-X]

7. The Phonemic Analysis Task from the Test of Language Development, Third Version (TOLD-III)

   Authors: Newcomer, P.L., & Hamill, D.D. (1997). *Test of Language Development, Second Edition.* Austin, TX: Pro-Ed.

   Name Writing Task. (Instructions were also translated into Spanish by the FACES Research Team.)
   Authors: FACES Research Team, modified from the Name Writing tasks in: Jana M. Mason and Janice Stewart (1989), *The CAP Early Childhood Diagnostic Instrument* (prepublication edition), American Testronics, and Writing Samples test in Woodcock-Johnson, Revised Achievement Battery.

   Early Childhood Longitudinal Study - Kindergarten Cohort (ECLS-K) - Reading assessment and General Knowledge assessment. These assessment instruments are not available for use by other investigators without special arrangements with the National Center for Education Statistics (NCES).

8. Developmental Accomplishments Scale ("Your Child's Activities") - Parents report on their children's accomplishments and difficulties in 17 specific areas, including cognitive skills, fine motor skills, speech, and gross motor coordination. Thirteen of the items are from the 1993 National Health Interview Survey on School Readiness, which can provide comparative data on a national sample of preschool children. Four additional items on number recognition, name recognition, counting, and liking to write were added by members of the Head Start Quality Research Consortium.

   Authors: Zill, N., Collins, M., & West, J. (1995). *Approaching kindergarten: A look at preschoolers in the United States. NCES Statistical Analysis Report 95-280*. Washington, DC: U.S. Department of Education, Office of Educational Research and Improvement.

SOCIO-EMOTIONAL OUTCOMES

1. Social Skills (Rating scale completed by Head Start and kindergarten teachers) - Twelve-item scale assessing frequency with which child engaged in friendly, cooperative, and compliant behavior in class during past month.

   Authors: FACES Research Team. Modified from Elliot, S. N., Gresham, F. M., Freeman, R. & McCloskey, G. (1988). Teacher and observer ratings of children's social skills: Validation of the social skills rating scales. *Journal of Psychoeducational Assessment, 6*, 152–161.

2. Classroom Conduct Problems (Rating scale completed by Head Start and kindergarten teachers) - Fourteen-item scale assessing frequency with which child engaged in aggressive, hyperactive, or depressed-withdrawn behavior in class during past month.

   Authors: FACES Research Team. Modified from: Achenbach, T. M. (1992). *Teacher/Caregiver Report Form for Ages 2-5*. Burlington, VT: Center for Children, Youth, and Families, University of Vermont; and, Zill, N. (1976). *Child Behavior Rating Scale for Teachers (Personal Maturity Scale)*, *National Survey of Children*. New York: Foundation for Child Development.

   See also:
   Alexander, K. L., & Entwisle, D. R. (1988). Achievement in the first two years of school: Patterns and processes. *Monographs of the Society for Research in Child Development, 53(2)*, Serial No. 218.

3. Your Child's Behavior

   Rating scale completed by Head Start parents - Seven items assess frequency with which child engaged in prosocial behavior and positive approaches to learning during past month. Twelve items assess frequency with which child engaged in aggressive, hyperactive, anxious or depressed behavior during past month.

   Authors: FACES Research Team and Head Start Quality Research Consortium. Positive items modified from Elliot, S. N., Gresham, F. M., Freeman, R., & McCloskey, G. (1988). Teacher and observer ratings of children's social skills: Validation of the social skills rating scales. *Journal of Psychoeducational Assessment, 6,* 152–161.

   Selection of problem behavior items based in part on unpublished discriminant analyses of Child Behavior Check List done for National Center for Health Statistics by Thomas Achenbach (1996), Burlington, VT: Center for Children, Youth, and Families, University of Vermont. Selected items were among those found to be most discriminating of children receiving clinical mental health services.

Rating scale completed by kindergarten parents - Twenty-six item child behavior rating scale used in parent interview of Early Childhood Longitudinal Study of a kindergarten cohort (ECLS-K). Thirteen items assess frequency with which child engaged in cooperative social behavior and positive approaches to learning. Thirteen items assess frequency with which child engaged in aggressive, hyperactive, anxious or depressed behavior.

Authors: Samuel J. Meisels and Sally Atkins-Burnett, University of Michigan School of Education, and Jerry West and Elvira Germino Hausken, National Center for Education Statistics. Items modified from Elliot, S. N., Gresham, F. M., Freeman, R., & McCloskey, G. (1988). Teacher and observer ratings of children's social skills: Validation of the social skills rating scales. *Journal of Psychoeducational Assessment, 6*, 152–161.

4. Peer Play Observation Scale - Time-sampling observational measure of extent and nature of child's interaction with other children and teachers or other adults during free-play periods.

   Authors: FACES Research Team. Adapted from Howes Peer Play Scale with permission from Carollee Howes.

   Howes, C., & Matheson, C.C. (1992). Sequences in the development of competent play with peers: Social and social pretend play. *Developmental Psychology, 23*, 961–974.

   Howes, C., & Stewart, P. (1987). Child's play with adults, toys and peers: An examination of family and child care influences. *Developmental Psychology, 23,* 423–430.

5. Assessment Behavior Scale (Interviewer's rating of child's behavior during cognitive assessment) - Upon completion of assessment battery, interviewer rates child's attitude and behavior during assessment. Eight items cover task persistence, attention span, body movement, attention to directions, comprehension of directions, verbalization, ease of relationship, and confidence. Interviewer also completes seven-item check list of special conditions that may have applied, such as nonverbal responses, nonstandard English, English as second language, limited English proficiency, child had difficulty hearing or seeing, and child's speech was difficult to understand.

   Authors: FACES Research Team.

6. Teacher Feedback on Child's School Performance and Behavior (Checklist completed by kindergarten parents) - Fourteen-item checklist of types of feedback parent has received from child's teacher about the child's academic performance and classroom behavior during the current school year. Similar reports on teacher feedback were

obtained for a national sample of kindergarten children in the 1993 National Household Education Survey.

Authors: Zill, N., Loomis, L. S., & West, J. (1997). *The elementary school performance and adjustment of children who enter kindergarten late or repeat kindergarten: Findings from national surveys. NCES Statistical Analysis report 98-097*. Washington, DC: U.S. Department of Education, Office of Educational Research and Improvement.

7. Child Observation Record (COR) - Criterion-referenced ratings by teacher of child's problem solving and initiative, social relationships, creative representations, musical skills and fine and gross motor coordination, and language and mathematics skills.

   Author: High/Scope Educational Research Foundation. (1992). *Child Observation Record-Manual.* Ypsilanti, MI: High/Scope Educational Research Foundation.

Appendix B. *Sources of Items in FACES Parent Interview*

(adapted from the FACES website http://www.acf.hhs.gov/programs/opre/hs/faces)

Question Domain	Source
Family Demographics	FACES Research Team
Activities with your Child	National Household Education Survey (NHES) & FACES Research Team
Disabilities	National Household Education Survey (NHES), Head Start Program Information Report (PIR), A Descriptive Study of the Head Start Health Component (HSHealth), & Head Start Quality Research Consortium (QRC)
Your Activities in Head Start	Head Start Quality Research Consortium (QRC)
Satisfaction with Head Start	Head Start Quality Research Consortium (QRC)
Your Child's Activities	National Household Education Survey (NHES)
Your Child's Behavior	FACES Research Team and Head Start Quality Research Consortium (QRC). Selection of behavior problem items based on unpublished discriminant analysis of Child Behavior Check List by Thomas Achenbach (1996), Center for Children, Youth, and Families, University of Vermont.
Household Rules	National Longitudinal Study of Youth (NLSY), Early Head Start Evaluation (EHS), Head Start Quality Research Consortium (QRC)
Employment and Income	Head Start Quality Research Consortium (QRC), University of Maryland Department of Family Studies (UMD)
Community services	Head Start Quality Research Consortium (QRC), FACES Research Team
Child Care	The NICHD Study of Early Child Care (NICHD), Emlen, A. (1998). From a parent's point of view: Flexibility, income, and quality of child care. Background paper for New Perspectives on Child Care Quality Conference, SEED 2000 Consortium of Federal Agencies, Bethesda, MD.
Family Health Care	Head Start Quality Research Consortium (QRC), A Descriptive Study of the Head Start Health Component (HSHealth), National Health Interview Survey (NHIS)
Home Safety	University of North Carolina, Frank Porter Graham Center (UNC)

Home and Neighborhood Characteristics	FACES Research Team, Department of Labor (DOL), National Household Education Survey (NHES)
Your Feelings	• Center for Epidemiology Studies Depression Scale (Radloff, 1977). Abbreviated version as used in Ross, Mirowsky, & Huber (1983). o Radloff, L. S. (1977). The CES-D: A self-report depression scale for research in the general population. *Applied Psychological Measurement, 1*, 385–401. o Ross, C.E., Mirowsky, J., & Huber, J. (1983). Dividing work, sharing work, and in-between: Marriage patterns and depression. *American Sociological Review, 48*, 809–823. • Pearlin Mastery Scale (Locus of Control) (Pearlin & Schooler, 1978). o Pearlin, L.I., & Schooler, C. (1978). The structure of coping. *Journal of Health and Social Behavior, 22*, 337–356. • Family Support Scale - Adapted from Dunst, C. J., Jenkins, V., & Trivette, C.M. (1984). o Dunst, C.J., Jenkins, V., and Trivette, C.M. (1984). Family Support Scale: Reliability and validity. *Journal of Individual, Family and Community Wellness, 1(4)*, 45–52.
Getting Ready for Kindergarten	Head Start Quality Research Consortium (QRC)
About your Child and Family	Head Start Quality Research Consortium (QRC), FACES Research Team

Appendix C. *Activities with Your Child Scale from FACES Parent Interview in Fall 1997*

(retrieved from FACES website http://www.acf.hhs.gov/programs/opre/hs/faces)

BATCH# 8-10/
CARD# 11-12/05

OMB Approval Number: 0970-0151 Exp 06/2000 **RESPONDENT ID** __ __ __ __ __ __ __

B. ACTIVITIES WITH YOUR CHILD

Now I have some questions about you and CHILD at home.

B1. How many times have you or someone in your family ***read*** to CHILD in the past ***week***? Would you say...

READ LIST. CIRCLE ONE RESPONSE

Not at all	01	SKIP TO B2	
Once or twice	02		
Three or more times	03		
Every day	04		13-14/

B1a. Who read to CHILD in the past week?

DO NOT READ LIST. CIRCLE ALL THAT APPLY

Mother/Mother-figure	01	15-16/
Father/Father-figure	02	17-18/
Other household member	03	19-20/
Non-household member	04	21-22/

B2. For about how long does CHILD enjoy being read to at a sitting? **PROBE:** About how many minutes?

CODE 000 IF CHILD DOESN'T LIKE TO BE READ TO AT ALL.

___ ___ ___ minutes 23-25/

Head Start Family and Child Experiences Survey
Page 8 -- Fall 1997 Parent Interview

B3. *In the past week*, have you or someone in your family done the following things with CHILD? (READ LIST BELOW)

B4. **IF YES:** How many times have you done this in the past week? Would you say one or two times, or three or more?

B5. **AFTER COMPLETING ALL OF B3 AND B4(a-k), ASK THE FOLLOWING FOR EACH ACTIVITY CODED "YES" IN B3**: Who (Read Item)?

B3. In the past week, have you or someone in your family ...			B4 How many times?		B5 Who (READ ITEM)? **DO NOT READ CHOICES. CIRCLE ALL THAT APPLY.**			
			1-2	3+	Mother / Mother Figure	Father/ Father Figure	Other Household Member	Non-Household Member
	NO	YES						
a. Told (him/her) a story? 26-27/	01	02	1-2	3+ 28/	01 29-30/	02 143-144/	03 145-146/	04 147-148/
b. Taught (him/her) letters, words, or numbers? 31-32/	01	02	1-2	3+ 33/	01 34-35/	02 140-150/	03 151-152/	04 153-154/
c. Taught (him/her)songs or music? 36-37/	01	02	1-2	3+ 38/	01 39-40/	02 155-156/	03 157-158/	04 159-160/
d. Worked on arts and crafts with (him/her)? 41-42/	01	02	1-2	3+ 43/	01 44-45/	02 161-162/	03 163-164/	04 165-166/
e. Played with toys or games indoors? 46-47/	01	02	1-2	3+ 48/	01 49-50/	02 167-168/	03 169-174/	04 171-172/
f. Played a game, sport, or exercised together? 51-52/	01	02	1-2	3+ 53/	01 54-55/	02 173-174/	03 175-176/	04 177-178/
g. Took (him/her) along while doing errands like going to the post office, the bank, or the store? 56-57/	01	02	1-2	3+ 58/	01 59-60/	02 179-180/	03 181-182/	04 183/184/
h. Involved (him/her) in household chores like cooking, cleaning, setting the table, or caring for pets? 61-62/	01	02	1-2	3+ 63/	01 64-65/	02 185-186/	03 187-188/	04 189-190/
i. Talked about what happened in Head Start? 66-67/	01	02	1-2	3+ 68/	01 69-70/	02 191-192/	03 193-194/	04 195-196/
j.Talked about TV programs or videos? 71-72/	01		1-2	3+ 73/	01 74-75/	02 197-198/	03 199-200/	04 201-202/

B3. In the past week, have you or someone in your family ...			B4 How many times?		B5 Who (READ ITEM)? **DO NOT READ CHOICES. CIRCLE ALL THAT APPLY.**			
			1-2	3+	Mother / Mother Figure	Father/ Father Figure	Other Household Member	Non-Household Member
k. Played counting games like singing songs with numbers or reading books with numbers? 76-77/	01	02	1-2	3+ 78/	01 79-80/	02 203-204/	03 205-206/	04 207-208/

B6. *In the past month,* that is since (MONTH)(DAY), has anyone in your family done the following things with CHILD?

B7. **AFTER COMPLETING ALL OF B6(a-k), ASK THE FOLLOWING FOR EACH ACTIVITY CODED "YES":** Who has (READ ITEM) with CHILD?

B6. *In the past month,* that is since (MONTH)(DAY), has anyone in your family done the following things with CHILD?	NO	YES	B7. **[ASK ONLY AFTER COMPLETING ALL OF B6]** Who has (READ ITEM) with CHILD? **[DO NOT READ CHOICES. CIRCLE ALL THAT APPLY. IF NOT MOTHER/ OR FATHER/, CLARIFY IF HOUSEHOLD OR NON-HOUSEHOLD MEMBER]** Mother/ Mother Figure	Father/ Father Figure	Other Household Member	Non-Household Member
a. Visited a library? 81-82/	01	02	01 83-84/	02 209-210/	03 211-212/	04 213-214/
b. Gone to a movie? 85-86/	01	02	01 87-88/	02 215-216/	03 217-218/	04 219-220/
c. Gone to a play, concert, or other live show? 89-90/	01	02	01 91-92/	02 221-222/	03 223-224/	04 225-226/
d. Gone to a mall? 93-94/	01	02	01 95-96/	02 227-228/	03 229-230/	04 231-232/
e. Visited an art gallery, museum, or historical site? 97-98/	01	02	01 99-100/	02 233-234/	03 235-23/	04 237-238/

B6. *In the past month,* that is since (MONTH)(DAY), has anyone in your family done the following things with CHILD?			B7. [ASK ONLY AFTER COMPLETING ALL OF B6] Who has (READ ITEM) with CHILD? [DO NOT READ CHOICES. CIRCLE ALL THAT APPLY. IF NOT MOTHER/ OR FATHER/, CLARIFY IF HOUSEHOLD OR NON-HOUSEHOLD MEMBER]			
	NO	YES	Mother/ Mother Figure	Father/ Father Figure	Other Household Member	Non-Household Member
f. Visited a playground, park, or gone on a picnic? 101-102/	01	02	01 103-104/	02 239-240/	03 241-242/	04 243-244/
g. Visited a zoo or aquarium? 105-106/	01	02	01 107-108/	02 245-246/	03 247-248/	04 249-250/
h. Talked with CHILD about (his/her) family history or ethnic heritage? 109-110/	01	02	01 111-112/	02 251-252/	03 253-254/	04 255-256/
i. Attended an event sponsored by a community, ethnic, or religous group. 113-114/	01	02	01 115-116/	02 257-258/	03 259-260/	04 261-262/
j. Attended an athletic or sporting event in which CHILD was not a player? 117-118/	01	02	01 119-120/	02 263-264/	03 265-266/	04 267-268/

121-124/B
269-274/B

Appendix D. *National Poverty Thresholds from 1997*

(retrieved from U.S. Census Bureau, http://www.census.gov/hhes/www/poverty/threshld.html)

Poverty Thresholds in 1997, by Size of Family and Number of Related Children Under 18 Years
(DOLLARS)

Size of family unit	Weighted average thresholds	Related children under 18 years								
		None	One	Two	Three	Four	Five	Six	Seven	Eight or more
One person (unrelated indiv	8,183									
Under 65 years	8,350	8,350								
65 years and over	7,698	7,698								
Two people	10,473									
Householder under 65 year	10,805	10,748	11,063							
Householder 65 years and	9,712	9,701	11,021							
Three people	12,802	12,554	12,919	12,931						
Four people	16,400	16,555	16,825	16,276	16,333					
Five people	19,380	19,964	20,255	19,634	19,154	18,861				
Six people	21,886	22,962	23,053	22,578	22,123	21,446	21,045			
Seven people	24,802	26,421	26,586	26,017	25,621	24,882	24,021	23,076		
Eight people	27,593	29,550	29,811	29,274	28,804	28,137	27,290	26,409	26,185	
Nine people or more	32,566	35,546	35,719	35,244	34,845	34,190	33,289	32,474	32,272	31,029

Appendix E. *Mplus Syntax for Full Structural Model*

```
TITLE:
  Latent Growth Model with Covariates and 3 Activity Factors

  DATA:
  File is 'C:\Documents and Settings\Heather\My Documents\
  Dissertation\DISSERTATION_MODEL_DATA_mplus.dat';

  VARIABLE:
  Names are
  weight
  PRGRID
  CNTRID
  CLASID
  CHILDID
  GENDER
  AGEAUG
  NumYrsHS
  HSHRWK
  LANGMI
  ASIAN
  BLACK
  WHITE
  HISP
  DISABL
  URBAN
  NumCh5
  RESAGE
  YrsEd
  EMPLOY
  AcaStm
  ComEnr
  FamEnt
  AGE_B
  AGE_HS
  AGE_K
  AGE_FG
  PPVTWB
  PPVTWH
  PPVTWK
  PPVTWF
  WJMWB
  WJMWH
  WJMWK
  WJMWF
  WJDWB
```

WJDWH
WJDWK
WJDWF
ITN_B
ITN_HS
ITN_K
ITN_FG
FL_F01
FL_F00
FL_K00
FL_K99
FL_H99
FL_H98
STRAT
INC_B
INC_HS
INC_K
INC_FG
NumRead
NumStory
NumLettr
NumSong
NumArts
NumGame
NumTV
NumCount
Library
Movie
Play
Museum
Zoo
FamHist
ComRel
SportEv
IncGr
yrenths;

Usevariables are
numYrsHS
HSHRWK
GENDER
LANGMI
ASIAN
BLACK
HISP
DISABL
NumCh5
RESAGE
YrsEd

```
ITN_B
AGE_B
AGE_HS
AGE_K
AGE_FG
PPVTWB
PPVTWH
PPVTWK
PPVTWF
WJMWB
WJMWH
WJMWK
WJMWF
WJDWB
WJDWH
WJDWK
WJDWF
NumRead
NumStory
NumLettr
NumSong
NumArts
NumGame
NumTV
NumCount
Library
Movie
Play
Museum
Zoo
FamHist
ComRel
SportEv
AGEYR;

Missing are all(-9);
Idvariable is CHILDID;
WEIGHT is weight;
STRATIFICATION is STRAT;
CLUSTER is PRGRID;

DEFINE: AGEYR = AGEAUG/12;

ANALYSIS:
TYPE IS COMPLEX;
ESTIMATOR = MLR;
ITERATIONS = 4000;
H1ITERATIONS = 5000;
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MODEL:
i1 s1 | PPVTWB@0 PPVTWH@1 PPVTWK@2 PPVTWF@3;
i2 s2 | WJMWB@0 WJMWH@1 WJMWK@2 WJMWF@3;
i3 s3 | WJDWB@0 WJDWH@1 WJDWK@2 WJDWF@3;
i1 with i2;
i1 with i3;
i2 with i3;
s1 with s2;
s1 with s3;
s2 with s3;
PPVTWB ON AGE_B;
PPVTWH ON AGE_HS;
PPVTWK ON AGE_K;
PPVTWF ON AGE_FG;
WJMWB ON AGE_B;
WJMWH ON AGE_HS;
WJMWK ON AGE_K;
WJMWF ON AGE_FG;
WJDWB ON AGE_B;
WJDWH ON AGE_HS;
WJDWK ON AGE_K;
WJDWF ON AGE_FG;
AGE_B WITH AGE_HS;
AGE_B WITH AGE_K;
AGE_B WITH AGE_FG;
AGE_HS WITH AGE_K;
AGE_HS WITH AGE_FG;
AGE_K WITH AGE_FG;
I1 ON GENDER;
I1 ON LANGMI;
I1 ON ASIAN;
I1 ON BLACK;
I1 ON HISP;
I1 ON DISABL;
I1 ON NumCh5;
I1 ON RESAGE;
I1 ON YrsEd;
I1 ON ITN_B;
I2 ON GENDER;
I2 ON LANGMI;
I2 ON ASIAN;
I2 ON BLACK;
I2 ON HISP;
I2 ON DISABL;
I2 ON NumCh5;
I2 ON RESAGE;
I2 ON YrsEd;
I2 ON ITN_B;
I3 ON GENDER;
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I3 ON LANGMI;
I3 ON ASIAN;
I3 ON BLACK;
I3 ON HISP;
I3 ON DISABL;
I3 ON NumCh5;
I3 ON RESAGE;
I3 ON YrsEd;
I3 ON ITN_B;
S1 ON NumYrsHS;
S1 ON HSHRWK;
S1 ON GENDER;
S1 ON LANGMI;
S1 ON ASIAN;
S1 ON BLACK;
S1 ON HISP;
S1 ON DISABL;
S1 ON NumCh5;
S1 ON RESAGE;
S1 ON YrsEd;
S1 ON ITN_B;
S2 ON NumYrsHS;
S2 ON HSHRWK;
S2 ON GENDER;
S2 ON LANGMI;
S2 ON ASIAN;
S2 ON BLACK;
S2 ON HISP;
S2 ON DISABL;
S2 ON NumCh5;
S2 ON RESAGE;
S2 ON YrsEd;
S2 ON ITN_B;
S3 ON NumYrsHS;
S3 ON HSHRWK;
S3 ON GENDER;
S3 ON LANGMI;
S3 ON ASIAN;
S3 ON BLACK;
S3 ON HISP;
S3 ON DISABL;
S3 ON NumCh5;
S3 ON RESAGE;
S3 ON YrsEd;
S3 ON ITN_B;
f2 by NumRead@1 NumStory* NumLettr* NumSong* NumArts* NumCount*;
f3 by Library@1 Play* Museum* Zoo*;
f4 by NumGame@1 NumTV* Movie* FamHist* ComRel* SportEv*;
I1 ON F2;
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I2 ON F2;
I3 ON F2;
s1 on f2;
s2 on f2;
s3 on f2;
I1 ON F3;
I2 ON F3;
I3 ON F3;
s1 on f3;
s2 on f3;
s3 on f3;
I1 ON F4;
I2 ON F4;
I3 ON F4;
s1 on f4;
s2 on f4;
s3 on f4;
f2 on AGEYR;
f2 ON ITN_B;
f3 ON ITN_B;
f4 ON ITN_B;
f2 on black;
f3 on black;
f4 on black;
f2 on hisp;
f3 on langmi;
f4 on asian;
f3 on yrsed;
f4 on yrsed;
f4 on numch5;
f2 with f3;
f2 with f4;
f3 with f4;

OUTPUT:
STAND;
TECH4;
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